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Non-Linearity in Determinants of Corporate Effective Tax Rate: Further Evidence from Nigeria

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Abstract

This study employs quantile regression analysis to examine possible non-linearity in the determinants of corporate effective tax rate (ETR). The results generally indicate that the examined determinants have significant impact on ETR along the decides and confirm non-linearity in the distribution of ETR. Firm size, firm leverage and inventory intensity are most influential variables while capital intensity and profitability are fairly influential across the ETR of firms. However, tax expert, firm size and inventory intensity are the most influential for firms with lower ETR. The study also confirms that large firms enjoy political clout but smaller firms are also able to reduce their fiscal pressure. The influence of human controllable factors is also evident in the study.

Keywords: Quartile regression; Non-linearity; Effective tax rate, Nigeria.
JEL Classification: H2: H22: H220.

1. Introduction

Studies in Effective Tax Rate (ETR) can be classified into three: the determination, the determinants and the segmentation studies. Earlier studies in ETR concentrate on defining, explaining, determining and comparing the ETR inherent in investments, sectors, economies and regional blocks. These studies can be grouped as determination studies. Substantial amount of literature has emerged on this including Harris and Fenny (2000) which describes ETR as a tax rate that provides summary statistics depicting the actual tax paid relative to profit made and ETR can also be described as a tax rate that considers other aspects of a tax system that affect the actual amount of tax paid apart from the Statutory Tax Rate (STR). Weiss (1979) suggests that ETR can be used to measure the equity and efficiency of a tax system. Others have said that it can be used to measure actual tax burden (Nicodeme, 2001), as a basis for tax reform (Gupta and Newberry, 1997), used in investment decisions and determining investment behaviour (Devereux and Griffith, 1998) and in determining management compensation (Ronen and Aharoni, 1989) amongst other uses. A review of studies in this class suggests that there are two types of ETR, the Marginal Effective Tax Rate (METR) and the Average Effective Tax Rate (AETR). Spooner (1986) opines that METR can be used to capture the amount of tax incentives to invest in new projects and AETR to measure the distribution of tax burden in past in projects.

Two approaches to measuring ETR are encountered in literature, the Forward Looking Approach and the Backward Looking Approach, with the level of data used to describe each as either micro or macro approach (Weiss, 1979). Micro-forward looking approach uses company level data to predict the rate of tax inherent in a project to be undertaken and, therefore, captures the net effect of tax provisions in the project (Bradford and Stuart, 1986). ETR in this respect is measured as METR, which Fullerton (1984) defines as the proportionate change in the pre and post tax rate of return of a particular project. Micro-forward approach has been used in studies like Devereux and Griffith (1998); Jacobs and Spengel (1999) and Alworth and Arachi (2003). Micro-backward looking approach also uses company level data to determine the amount of tax burden a company, sector or past project, bears. It is usually measured as the ratio of tax expenses to the profit. Keifer (1980) and Hulten and Robertson (1984) use this approach to study the level of tax burden experienced in the public utility sector and the manufacturing sector of the US economy respectively. Chowdhury (1998) uses it to the find the effective indirect tax rate in Bangladesh. The approach has also been employed in sector by sector ETR comparison studies (Derashid and Zhang, 2003; Rohaya *et al.*, 2008; Salaudeen, 2017a) and country by country ETR comparison studies (Buijink *et al.*, 1999; Nicodeme, 2001). These studies have found ETR to be different from sector to sector and from country to country. Macro backward approach uses aggregate national data to estimate the average tax burden of an economic system and it is measured as tax paid by all companies over a measure of tax base (Nicodeme, 2001). (Martinez- Mongay, 1998; Martinez-Mongay, 1997) and Gordon and Tchilinquircan (1998) are some of the studies that have used this approach to ETR.

The determinants studies attempt to answer the question of what factors drive the ETR away from STR and what factors determine the variability in ETR. This class of ETR studies has also enjoyed considerable attention from researchers. Siegfried (1972), Stickney and McGee (1982) and Zimmerman (1983) are some of the earlier studies in the respect. They examine the association between ETR and firm size in order to find support for either of

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the two contending theories relating firm size with ETR; the Political Cost Theory (PCT) and the Political Clout/Power Theory (PPT). The PPT suggests that large firms have political clout to get government attention and waivers and resources at their disposal to pursue tax management and, therefore, the larger a firm is the lower will be its ETR. Results of studies like Porcano (1986), and Kim and Limpaphayom (1998) support this theory. On the other hand, PCT suggests that large firms are well known and therefore are open to greater public scrutiny, hence, may not engage in aggressive tax planning. They, therefore, pay a price for being large in the amount of tax they bear, thence; the larger a firm is the higher is its tax burden. Kern and Morris (1992), Holland (1998) and Olhoft (1999) provide evidence in support of this theory. Yet other studies like Shevlin and Porter (1992), Fenny *et al.* (2002) and Liu and Cao (2007) have found no significant relationship between ETR and firm size.

Other commonly examined determinants in relation to ETR include capital intensity, inventory intensity, profitability, firm leverage and research and development expenditure. These could be found in studies like Gupta and Newberry (1997), Richardson and Lanis (2007), Kim and Limpaphayom (1998), Kraft (2014), Ribeiro (2015), Mourikis (2016), Rohaya *et al.* (2008), Harris and Fenny (2000) and a host of other studies. These studies have proved that the size and direction of the association of these determinants with ETR have not been consistent. However, Rohaya *et al.* (2008) observe that capital intensity, and firm leverage, to a large extent have consistent negative relationship with ETR while profitability and inventory intensity appear consistently positively related to ETR. Other ETR determinants investigated include auditor/tax experts, state ownership, ownership structure, corporate governance, foreign operations and industrial sectors with varying results in studies including Wang *et al.* (2014), Derashid and Zhang (2003), McGuire *et al.* (2012).

The third category of studies in ETR focuses on finding differences in the determinants along different divides. This group of studies can be referred to as segmentation studies. Literature within this group is relatively small, because, according to Richardson and Lanis (2007), events leading to segmentation infrequently occur. Some notable studies in this category include Gupta and Newberry (1997). Gupta and Newberry investigate the differences in determinants before and after the 1986 Tax Reform in the US using longititudinal data. The result of the association of the two variants of ETR and the explanatory variables chosen were missed pre and post reform. In the same vein Richardson and Lanis (2007) and Kraft (2014) investigate the possible variation in determinants of ETR before and after the Raph Review of Business Taxation Reform in Australia and the German Corporate Tax Reform of 2008 respectively. The results of both studies show that the tax reforms negatively affect the ETR and caused changes in the association between ETR and the determinants examined. After the Self Assessment System of taxation was introduced in Malaysia in 2001, Rohaya *et al.* (2010) compare the determinants of ETR before and after the introduction and find that similar factors affect ETR of both regimes, however, change was noticed in the sign and significance of inventory intensity. Salaudeen (2017a) examines the determinants of ETR along the different industrial sectors of the Nigerian economy and concludes that different factors affect ETR differently depending on the sector. This result confirms the earlier study of Derashid and Zhang (2003) in Malaysia.

Hsieh (2012) introduces the use of quantile regression analysis into determining differences in determinants along high and low (deciles) ETR using data obtained from China. Similarly, Delgado *et al.* (2014) use data obtained from the EU to investigate variability in determinants along different deciles and percentiles and claim the rarity of such studies using quantile regression. This current study is in line with the studies of Hsieh and Delgado et al. It examines the heterogeneity that may subsist in determinants of ETR distributions using quantile regression analysis with data obtained from Nigeria. Furthermore, the study also investigates determinants of ETRs for quantiles below 0.1(10%), to characterise the effects of the determinants on smaller firms when ETR is considered low. Gupta and Newberry (1997) classify ETR as low if it is below 10% normal/moderate if it is between 10% and the Statutory Rate, and high if it is above the Statutory Rate. This study contributes to the scarce literature on the use of quantile regression in ETR studies and exposes the different factors affecting ETR at high, and low levels. This is of great value to managers of firms in deciding which factors to concentrate on in their tax planning activities.

Overall result of this study indicates that the determinants have significant impact on ETR and confirms the non linearity of the determinants in the distribution of ETR of firms. Further discussions in this study proceed as follows; the next section presents the research methodology adopted. Section three presents and discusses the empirical results while the last section contains concluding remarks.

2. Methodology

2.1. Sample Selection and Data

An average of 177 firms was listed on the Nigerian Stock Exchange (NSE) during the period of the study. This study excludes the 55 firms in the Financial Services Sector from the sample because of their reporting requirement that is different from those of other firms (Buijink *et al.*, 1999). However, firms with operating losses, during the period of the study, have been included despite the conclusion in Kim and Limpaphayom (1998) that ETR has no meaning in loss making situation. This is because procedures have been established in Gupta and Newberry (1997) on how to handle such a situation. Therefore, the balance of 122 firms constitutes the sample of this study.

Panel data was obtained from the annual reports of the sampled firms for a period of four years (2012 – 2015). The study period commences from 2012 because the adoption of International Financial Reporting Standards (IFRSs) in Nigeria started in that year. IFRS brings in new measurement requirements for items in the financial statement different from the local GAAP hitherto applied. This may result into lack of comparability of figures before and after the adoption.

2.2. Variables Specification and Measurement

2.2.1. Dependent Variable

The dependent variable of this study is Corporate Effective Tax Rate (ETR). ETR suffers from the challenge of definition. As a ratio both the numerator (tax expenses) and denominator (profit) are capable of many definitions. The numerator options encountered in literature include current year tax only (Gupta and Newberry, 1997; Kim and Limpaphayom, 1998; Rego, 2003) and current year tax plus current year provision for deferred tax (IAS 12.5; (Armstrong *et al.*, 2012). Nicodeme (2001), Buijink *et al.* (1999) suggest the actual tax paid in respect of the year as the numerator. This study adopts the definition of tax expenses provided by IAS 12.5 as current year tax plus current year deferred tax obtainable from the income statement as the numerator of its ETR. Ribeiro (2015) believes that the inclusion of deferred tax shows the effect of firms' characteristics on firms' tax burden and therefore provides a more accurate result.

The dominator has also been variously measured. Zimmerman (1983), Omer *et al.* (1993) measure it as the operating cash flow; Porcano (1986), Kim and Limpaphayom (1998) and Liu and Cao (2007) measure it as profit before interest and tax while it was measured as profit before interest and tax in Rego (2003); Armstrong *et al.* (2012) and Delgado *et al.* (2014). If the ETR is a measure of the proportion of profit paid as tax, the stand of this study as to the choice of a denominator is a denominator (profit) of which tax is part after deducting all other expenses before deducting tax itself. Therefore, profit after tax may not be appropriate. Additionally, when tax expenses is estimated by the firm or determined by the tax authority, it is based on profit after all expenses/allowable expenses have been deducted before the tax itself, therefore, profit before interest and tax may also not be appropriate. Hence, this study adopts profit before tax as the denominator. (Other arguments in favour of this type of denominator can be found in for example Gupta and Newberry (1997). This measure of the denominator has also been used in Kern and Morris (1992) and Shevlin and Porter (1992). Combined with the numerator adopted, the ETR used in this study is in line with the definition of ETR provided in IAS 12.86. Hence, ETR used in this study can be represented by the formulae:

$$\mathbf{ETR}_{it} = \frac{\mathbf{CTE}_{it} + \mathbf{CDP}_{it}}{\mathbf{PBT}_{it}}$$

Where ETR is the Corporate Effective Tax Rate; CTE is the current tax expenses; CDP is current year deferred tax provision; PBT is the profit before tax; *i* for company; and *t* for the period.

In order to measure the ETR, the measurement system established in Gupta and Newberry (1997) was adopted as has been adopted in many studies thereafter including Rohaya *et al.* (2008); Rohaya *et al.* (2010); Kraft (2014) and Ribeiro (2015). Therefore, ETR is set between 0% and 100%. Firms with negative numerator (either because of tax refund or deferred tax credit being higher than current tax expenses) and positive denominator were scored zero; firms with positive numerator but negative denominator were scored 100%; and firms with larger numerator (may be because of deferred tax inclusion) than the denominator, in which case the ETR will be in excess of 100%, were scored 100%. A scenario not captured in the Gupta and Newberry (1997) study is where the numerator is zero and the denominator positive or negative. In both cases, we scored the ETR zero because, mathematically, the 0% of any number, positive or negative is zero.

2.2.2. Explanatory Variables

Firm Size

Firm size is a common explanatory variable of studies of this nature. Previous studies have measured firm size as natural logarithm of sales (Salaudeen, 2017b; Sebastian, 2011) or as natural logarithms of total assests (Porcano, 1986) or total number of employees (Buijink *et al.*, 1999). In this study, firm size is measured as natural logarithm of total assets (Minnick and Noga, 2010; Richardson and Lanis, 2007; Viera, 2013). Firm size is denoted by FSIZ.

Tax Consultant or Expert

Tax expert is represented in this study by the type of auditor engaged by a firm and it is measured as a dichotomous variable by assigning 1 to any firm being audited by the major four audit firms and 0 for others. The relationship of auditor with ETR has been examined in the various studies including Campbell and Wang (n.d), McGuire *et al.* (2012), Wang *et al.* (2014). Tax consultant/expert is denoted by AUD.

Firm Leverage

Firm leverage is measured in this study as total liabilities scale down by total assets. This appears to be the most common measure of leverage and has been so measured in various studies including Richardson and Lanis (2007); Rohaya *et al.* (2008) and Salaudeen (2017b). Firm leverage is represented with FLEV.

Profitability

Profitability is here represented by return on asset which is expressed as profit before tax divided by total assets (Plesko, 2003; Richardson and Lanis, 2007; Stickney and McGee, 1982). PROF is used to denote profitability in this study.

Capital Intensity

Capital intensity is measured here as the ratio of property, plant and equipment to total assets as found in Harris and Fenny (2000); Derashid and Zhang (2003) and Liu and Cao (2007). Capital intensity is denoted by CAPINT.

Inventory Intensity

Inventory intensity is the proportion of total inventory in total assets. It is used in this study as in Gupta and Newberry (1997). INVINT represents inventory intensity.

2.3. Econometric Framework

The linear regression model (LRM) provides a means of describing the relationship between a set of covariates by establishing the conditional mean function for the response variable. One problem with this is that it is a one-model assumption, i.e. it is assumed to be appropriate for all data which may not be true in many practical situations. Also LRM function may not be appropriate in situation when the underlying assumptions fail and focus only on the conditional mean of the response variable without accounting for the full conditional distributional properties of the response variable. Quantile regression model (QRM), apart from being robust to the usual standard regression assumptions and presence of outliers, facilitates the analysis of full conditional properties of the response variable, and, therefore provides a detail and clearer picture of how the covariates account for variation at different points of the distribution of the response variable and helps trace how the effects of covariates vary from the beginning to the end of the conditional of the response variable. QRM also allows the detection of nonlinear relationship between the response variable and the covariates if any (Buchinsky, 1998).

Let y be a response variable and $x_i, i = 1,2,3,...,k$ be k covariates: and $0 < p < 1$ indicates the proportion of the population of the response variable having values below the quantile at p. Following Koenker (2005) the relationship between y and x_i's can be stated as

$$y = \beta_0^{(p)} + \beta_1^{(p)} x_1 + ... + \beta_k^{(p)} x_k + \varepsilon^{(p)} \quad (1)$$

and the p-th quantile estimate is

$$\hat{y} = Q^{(p)}(y / x_i) = \hat{\beta}_0^{(p)} + \hat{\beta}_1^{(p)} x_1 + ... + \hat{\beta}_k^{(p)} \quad (2)$$

The estimation procedure which is iterative in nature estimates the conditional quantiles for different p and requires that the p-th quantile of the error term be equal to zero. i.e $Q^{(p)}(\varepsilon) = 0$.

The QRM estimates $\beta_0^{(p)}, \beta_1^{(p)}, ..., \beta_k^{(p)}$ by minimizing the weighted sum of absolute distances between fitted values $\hat{y}$ and observed value y,

$$\sum_{i=1}^{n} d_p(y, \hat{y}) = p \sum_{y \geq \hat{y}} \left| y - \hat{\beta}_0^{(p)} - \hat{\beta}_1^{(p)} x_1 - ... \hat{\beta}_k^{(p)} x_k \right| + (1-p) \sum_{y \prec \hat{y}} \left| y - \hat{\beta}_0^{(p)} - \hat{\beta}_1^{(p)} x_1 - ... \hat{\beta}_k^{(p)} x_k \right| \quad (3)$$

p is the proportion of observed data points lying below the estimated line while $1-p$ is the proportion lying above the line. The distance between the quantiles does not necessarily have to be equal however; equal intervals make interpretation to be easier. In this research we estimate (2) for p = 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, and 0.9. Estimation was also considered for quantiles below 0.1(10%), corresponding to values below 10% ETR to characterize the effects of the covariates on smaller firms.

3. Empirical Results and Discussion

3.1. Descriptive and Distributional Statistics

Table 1 presents the descriptive and distributional statistics of the dependent variable (ETR). The mean of the dependent variable stands at 42.03% which is higher than the Statutory Tax Rate (ETR) of 30%. The reason for is that majority (49.69%) of firms in the sample have ETR of above the statutory rate of corporate tax in Nigeria of 30%. The table also shows there is moderate variability.

Table-1. Descriptive and Distributional Statistics of Dependent Variable

Distribution (%)	
Mean	42.0328
Standard deviation	36.8816
Median	30.9298
Skewdness	0.6373
Kurtosis	-1.1198
Jarque-Bera	58.4103***
P-value	<0.0001
Frequency (% of n)	
ETR < 10%	103 (21.15%)
ETR between 10% and 30%)	142 (29.15%)
ETR > 30%	242 (49.69%)

*****,**** and * indicates significance at 1%, 5% and 10% respectively.

Table-2. Descriptive and Distributional Statistics of Explanatory Variables

Statistic	**FSIZ**	**FLEV**	**CAPINT**	**INVINT**	**PROF**	**AUD**
Mean	9.9782	0.7512	0.5141	0.1900	-0.3164	0.5072
Standard deviation	0.782	1.8212	0.8767	0.7600	7.7674	0.5005
Median	9.9995	0.4965	0.3344	0.0800	0.0390	1.0000
Skewness	-0.0128	10.4078	6.0154	14.4100	-21.6888	-0.0288
Kurtosis	-0.4085	126.0110	41.3453	227.8800	472.3951	-1.9992
Jarque-Bera	3.4002	330998.6575***	37624.1691***	1070606.0186***	6411.3077***	81.1667***
P-value	>0.1	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001

Where FSIZ is firm size; FLEV is firm leverage; CAPINT is capital intensity; INVINT is inventory intensity; PROF is profitability; AUD represents tax expertise.
***, ** and * indicates significance at 1%, 5% and 10% respectively.

Table 2 shows the descriptive and distributional statistics of the explanatory variables. The table reflects that an only firm size is normally distributed; however, AUD is just slightly skewed.

Table-3. Correlation Matrix of Variables

	FSIZ	**FLEV**	**CAPINT**	**INVINT**	**PROF**	**AUD**	**ETR**
FSIZ	1						
FLEV	-0.0265	1					
CAPINT	-0.1232	0.0287***	1				
INVINT	-0.0026	0.8258***	-0.0388	1			
PROF	0.1011	0.012	-0.0199	0.0217	1		
AUD	0.2864	0.0671	-0.0825	0.0637	0.05	1	
ETR	-0.1795	0.0322	-0.0105	-0.0033	0.09	-0.1034	1

*****, **** and * indicates significance at 1%, 5% and 10% respectively.

3.2. Regression Results

Table-4. Marginal Effects for the OLS and Quantile Regression Models

Variable	**OLS Estimate**	**Quantile Regression Estimate**								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Intercept	118.7427***	-3.8255***	6.3723	54.9859***	83.9044***	74.6462***	109.0074***	202.8390***	178.8944	100.0000***
	(21.96)	(0.092)	(3.842)	(4.179)	(3.807)	(1.456)	(1.485)	(2.544)	(1.69)	(0.246)
FSIZ	-7.4639***	0.3760***	-0.33940	-4.1424***	-5.9475***	-4.4094***	-6.9824***	-12.3084***	-8.4448***	0.0000
	(2.22)	(0.009)	(0.388)	(0.422)'	(0.385)	(0.147)	(0.15)	(0.257)	(0.171)	(0.025)
FLEV	2.17	0.9417***	1.6702***	0.1156	-0.1893	0.2450**	4.3628***	3.0085***	7.6858***	0.0000
	(1.614)	(0.007)	(0.282)'	(0.307)	(0.28)	(0.107)	(0.109)	(0.187)	(0.124)	(0.018)
CAPTINT	-1.7996	1.9062***	1.6991***	-0.0323	-1.0557***	-1.3667***	-2.0281***	-1.0668***	-4.7727***	0.0000
	(1.905)	(0.008)	(0.333)	(0.363)	(0.33)	(0.126)	(0.129)	(0.221)	(0.147)	(0.021)
INVINT	-4.3019	-1.6563***	-3.6059***	-1.5822**	-1.4904**	-0.5375**	-4.2943***	-1.6209***	-17.6509***	0.0000
	(3.867)	(0.016)	(0.676)	(0.736)	(0.67)	(0.256)	(0.261)	(0.448)	(0.298)	(0.043)
PROF	-0.3224	-0.5769***	-0.5511***	-0.4684***	-0.3945***	-0.3725***	-0.2858***	0.0022	0.0467***	0.0000
	(0.213)	(0.001)	(0.037)	(0.041)	(0.037)	(0.014)	(0.014)	(0.025)	(0.016)	(0.002)
AUD	-4.3845	0.4764***	5.3353***	7.5208***	3.4226***	0.2735	-4.3801***	-35.6219***	-18.8173***	0.0000
	(3.448)	(0.014)	(0.603)	(0.656)	(0.598)	(0.229)	(0.233)	(0.399)	(0.265)	(0.039)
Adj. R^2	0.0327***	0.0930***	0.0103***	0.4750***	0.5537***	0.3639***	0.4320***	0.7022***	0.5817***	0.0000
P-value	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	>0.1000

*****, **** and * indicates significance at 1%, 5% and 10% respectively.

Table-5. Marginal Effect for Quantiles below 10%

Variable				Quantile Regression Estimate					
	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
Intercept	-1.3483***	-3.7180***	-5.5208***	-7.8016***	-8.9920***	-9.4480***	-8.6112***	-7.1892***	-4.730***
	(0.009)	(0.038)	(0.052)	(0.07)	(0.085)	(0.083)	(0.07)	(0.063)	(0.072)
FSIZ	0.0987***	0.2967***	0.4603***	0.6524***	0.7603***	0.8809***	0.8105***	0.6772***	0.4576***
	(0.001)	(0.004)	(0.005)	(0.007)	(0.009)	(0.008)	(0.007)	(0.006)	(0.007)
FLEV	0.0719***	0.4121***	0.6557***	0.9112***	1.0240***	0.9989***	0.9935***	0.9881***	0.9810***
	(0.001)	(0.003)	(0.004)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
CAPTINT	0.3802***	0.8729***	1.1042***	1.5654***	1.7684***	1.6691***	1.6424***	1.6159***	1.5546***
	(0.001)	(0.003)	(0.005)	(0.006)	(0.007)	(0.007)	(0.006)	(0.005)	(0.006)
INVINT	0.0450***	-0.5934***	-1.0515***	-1.5317***	-1.7443***	-1.7052***	-1.7037***	-1.7066***	-1.7142***
	(0.002)	(0.007)	(0.009)	(0.012)	(0.015)	(0.015)	(0.012)	(0.011)	(0.013)
PROF	-0.5872***	-0.5875***	-0.5879***	-0.5885***	-0.5887***	-0.5860***	-0.5848***	-0.5832***	-0.5799***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
AUD	0.3063***	0.5382***	0.6358***	0.8612***	0.9212***	0.2819***	0.2773***	0.3817***	0.4369***
	(0.001)	(0.006)	(0.008)	(0.011)	(0.013)	(0.013)	(0.011)	(0.01)	(0.011)
Adj. R^2	0.0353**	0.0866**	0.1222***	0.1634***	0.1839***	0.1925***	0.1807***	0.1510***	0.1090***
P-value	<0.05	<0 .05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

***, ** and * indicates significance at 1%, 5% and 10% respectively.

The term results of the quantile regression are summarised in Table 4 for 10th, 20th, 30th, 40th, 50th, 60th, 70th, 80th, and 90th quantiles while Table 5 presents the results for quantiles below the 10th quantile. From Table 4, the results show that Ordinary Least Square (OLS) equation, even though significant (p< 0.0001), captured only about 3% of variation in ETR with only constant and FSIZ making significant (p< 0.0001) contributions suggesting only firm size and deterministic factors likened to human and or controllable factors influence ETR. Except for FLEV, all coefficients in the OLS are negative and insignificant. The quantile regression estimates show wide variation in the quantity of variation explained by the explanatory variables across the quantiles judging by the values of adjusted R-squares. The probabilities corresponding to the Chi-square statistic values are all lower than 0.0001and hence we would be taking a lesser than 0.01% risk in assuming that the explanatory variables have effects on ETR of the firms.

For quantiles below the 10% rate, all intercepts are negatively significant (p< 0.0001). Their significance is an evidence of the possible role of deterministic or controllable human factors in variation exhibited by ETR. The amount of variation explained is lowest, 3% for the 1st quantile and increased sharply from 9% at the second quantile to 19% at the 6th and started decreasing from the 7th quantile (18%) to 12% at the 9th quantile. All coefficients except INVINT and PROF are positive, showing direct relationship with ETR.

Intercepts are all significant (p< 0.0001) for 10th, 30th, 40th , 50th , 60th , 70th , 80th , and 90th but not significant for the 20th quantile. R-square adjusted shows disparity in the quantity of variation explained in ETR for quantiles between the 10% and 30% statutory rates and quantiles above 30% statutory rate. All these point to the fact that the effects of explanatory variables differ at different point of the ETR distribution and are pointers to the possibility of nonlinearity in the relationship. The results of OLS and QRM justify the validity of quantile regression to describe variation in the whole population of ETR and show that the explanatory variables do bring a significant amount of information about ETR in this case. It clearly invalidates the appropriateness of OLS in discerning the variation in the effects of the covariates on ETR for the companies considered in this study.

The amount of variation captured at each quantile varies between 0% and 70% with 70th quantile capturing the highest, 70% and 90th quantile capturing none. The intercept at the 10th quantile is negatively significant (p< 0.0001) portraying the influence of deterministic factors and the smallness of the firms at the lower part of the ETR distribution. This result is partly corroborated by the OLS and clearly described and supported by the analysis for quantiles below the 10% statutory rate in Table 5.The effects of deterministic factors persisted all through except for the 20th quantile and completely dominated at the 90th quantile.

The coefficients of the proxy variable for size are negative and significant (p< 0.0001) except for the 10th quantile for which it is positive and 20th quantile at which it is non-significant (p > 0.10). This result is contrary to the results for the quantiles below 10% where all coefficients are positive and significant (p < 0.0001). The former did not support the political costs hypothesis but are similar with that of Hsieh (2012) and opposite to that of Delgado *et al.* (2014) for the EU. The effect changes with mixed pattern along the distribution, highest at the 70th quantile and totally absent at the end of the distribution.

For the proxy variable FLEV, all the coefficients are positively significant (p< 0.0001) except for the 40th quantile which is negative and 30th quantile which is positive and are not significant (p>0.1000). This is similar to the result found by Hsieh (2012). The pattern of impact varies from the beginning to the end of the distribution with higher impact towards the end but none at the end of the distribution. This result is also partly in agreement with that of Delgado *et al.* (2014).

Most coefficients for CAPINT are negative and significant (p < 0.0001) except at the lower tail of the distribution, 10th and 20th quantiles which are positively significant (p < 0.0001) and 30th quantile which is negative but not significant (p > 0.1000). This is contrary to the results of Delgado *et al.* (2014) who found all coefficients to be positively significant (p < 0.0100) though in a more global analysis. The effect of capital investment is also totally absent at the end of the ETR distribution with the impact more visible from the middle and towards the end.

In the results for INVINT and PROF most coefficient are negatively significant (p < 0.0001) except for PROF which is positive and insignificant (p > 0.1000) at the 70th quantile and positive and significant (p < 0.0001) at the

80th quantile. The inverse relation established between ETR and INVINT is in contrast with the direct relation found by Delgado *et al.* (2014). Their effects also vanish at the 90th quantile just like other covariates. The effects of INVINT vary considerably along the distribution with the highest impact near the tail end at 80th quantile. The effect of PROF was almost constant from the beginning to a little beyond the middle and drastically reduces thence to zero at the end of the ETR distribution.

Coefficients on the proxy variable AUD are positively significant ($p < 0.0001$) at the beginning to the middle of the distribution and negatively significant ($p < 0.0001$) afterwards except for the median quantile at which it is positive and not significant ($p > 0.1000$).Signifying audit status directly impact on the smaller to medium firms while maintaining its indirect influence on the larger firms.

4. Conclusion

The outcome of this study portends that covariates in this study do have influence on the ETR of the firm with varying pattern of sensitivity and that the magnitude of their influence change from one level of corporate tax rate to another through the entire ETR distribution. The result also confirms the quantile regression model as the best model for describing the relation between ETR and the covariates considered in this study and suggest the existence of some amount of nonlinearity in the relations. Our findings also establish firm size, inventory intensity and firm leverage to be the most influential while profitability and capital intensity are fairly influential across the ETR distribution. The most influential for companies with lower ETR are tax expertise, firm size and inventory intensity while tax expertise, inventory intensity, firm size and firm leverge are most influential for companies with the highest fiscal pressure in the order mentioned. The empirical results also confirm that all large firms do enjoy the political power even though smaller firms are also able to reduce their fiscal burden. The influence of deterministic and or controllable factor is overwhelming all through the ETR distribution. This should be worrisome to administrators of tax policy as it suggests there are likely gaps in the implementations of tax directives to operators in the companies in Nigeria.

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