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Empirical Insight into Solvency Constraint and Tax Planning Dynamics in Ghanaian Banking Sector: A Non-Linearity Approach

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Abstract. This paper examines the relationship between tax planning activity dynamics and solvency constraints within the Ghanaian banking sector. This is conceived on the premise that banks are likely to change their tax planning dynamics in the midst of solvency challenges to boost their after-tax capital position to minimize the exposure to the going concern problem. The study employs the quantile regression estimation to draw time-varying constraint scenarios to measure solvency constraint proxies: WW index, HP index, and Z-score. Tax planning activity is also measured through cash effective tax rate. Annual data from 2008 to 2022 are used for the investigation with the unit of analysis expanding to cover all licensed banks which have been in operation within the study span. The study employed a quantile estimation approach to conduct the analysis. It is observed that the nature and trend in tax aggressiveness of the banks under a solvency-constraint scenario is dependent on the measurement of the constraints. Nevertheless, the study found non-linearity in the solvency-constraint and tax planning nexus. The banks do not generally alter their tax planning behaviour at the initial stage of the constrained scenario, however, turn to be relatively aggressive when the solvency constraint amplifies. The government is advised to protect the banks not to fall into any solvency constraint situation since that could change their tax planning activities.

Keywords: Banking sector, Ghana, Panel quantile regression, Solvency constraint, Tax planning activity.

1. INTRODUCTION

Tax revenues are the mainstay of economies across the globe. Since time immemorial, taxation has often been the medium through which governments finance their projects, and ideologies, and implement their plans (Boateng et al., 2022; Queku et al., 2024). Taxes, however, are not a straightforward issue especially when it comes to the administration and collection of tax revenues. Many governments fail to achieve their tax revenue targets during their tenure. If they do achieve their tax revenue targets, it is woefully inadequate when compared to the overall GDP in the same year. Tax revenues across economies, states, countries, counties, ministries, departments, and agencies continue to see a decline in meeting their tax revenue targets.

Comparatively, governments in less developed countries collect less tax revenues than their counterparts in developed economies. Tax revenue mobilization often receives setbacks due to tax complexity (Bayar et al., 2018; Slemrod, 2019; Wencel, 2022). Despite the universality of challenges in meeting tax revenue targets (Lee & Yoon, 2020; Razali et al., 2018; World Bank, 2015), it appears countries in the developed world continue to sail through these challenges to boost their tax revenue than counterparts in other regions such as Africa (see Figure 1 showcasing the pictorial comparison). For instance, the average tax revenue to gross domestic product (GDP) is about 41.1% in Europe (with France: 47.4% and Denmark: 46.9% being the highest), in the Americas: Cuba: 40.6% and Brazil: 32.3% and the Organisation for Economic Co-operation and Development (OECD) average of 34.3% while the average in the Sub-Sahara Africa is about 16.1% in 2019 (Kalaš et al., 2020; OECD, 2020; World Bank, 2020). Figure 1 shows that almost all African countries fall short of the OECD average tax performance.

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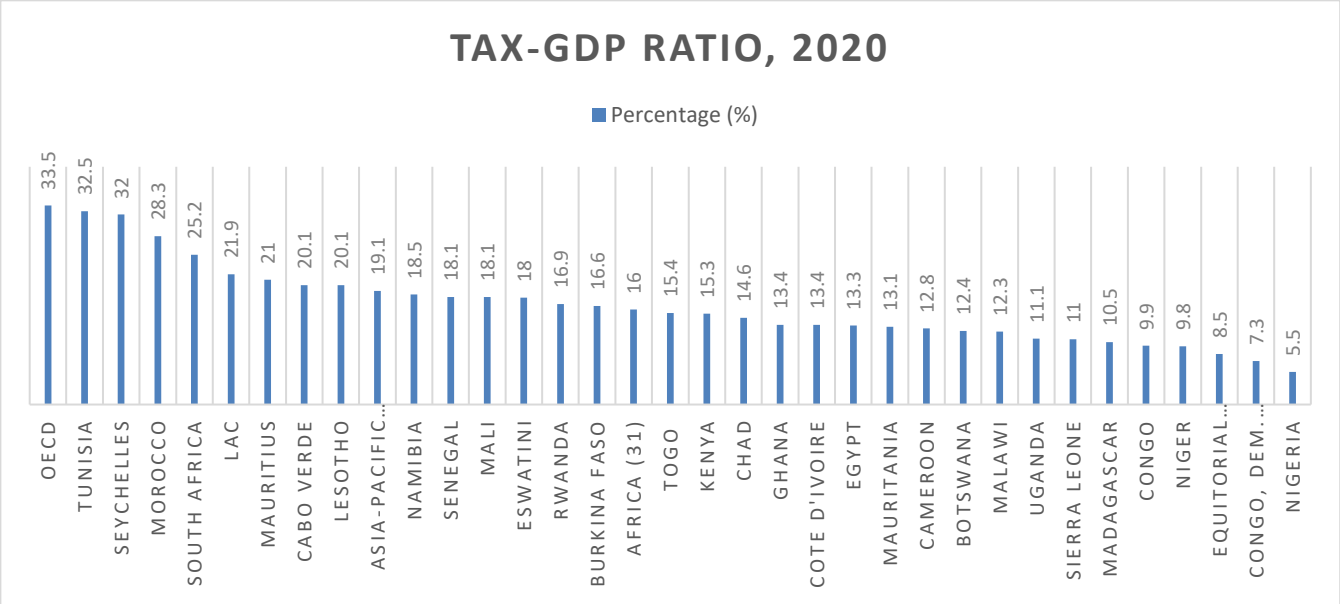

Figure 1: Tax Performance in Africa in Relation to OECD Average.

One likely reason that contributes to the difference in the tax revenue gap between developed and developing countries is the poor tax compliance behaviour of individuals and firms domiciled in less developed countries. Tax compliance reforms have generally failed in the developing world due to little empirical evidence (Anaman, 2024; Carsamer & Abbam, 2020; Devos, 2014; Dowling, 2014; Keen & Slemrod, 2017; Ogbonna & Appah, 2016). While many empirical studies have been conducted on tax complexity and tax revenue such as tax compliance, tax evasion, tax operating cost, avoidance, and tax efficiency with the causes often being contested, most empirical studies about tax regulatory enforcement and tax evasion have been the preoccupation of developed countries with Africa providing a "distorted and partial view of questions about low tax revenue, poor enforcement of tax law, and policy" (Carsamer, Abbam, & Queku, 2021; Queku et al., 2023; World Bank, 2015). Another emerging antecedent of tax revenue mobilisation is the firm-level financial constraints (Seidu, Queku & Carsamer, 2021). The literature is stocks with evidence on the implications of financial frictions on economic outcomes (Buera & Karmaker, 2022; Cevik & Miryugin, 2022; Constantinescu & Proskute, 2019; Seidu, Queku, Tackie, & Mensah, 2022). In recent times, and with the growing availability of micro-data, research investigations have taken a firm-level approach to answer this question. Thus, although financial constraint-tax revenue nexus is emerging, the new direction focuses on firm-level and often industry-specific.

Within the African sub-region, an industry that cushions the financing needs is the banking sector due to the fact that capital market is less developed (Carsamer et al, 2021; Queku, 2017; Seidu, et al., 2022). Thus, due to the less development of equity markets in the developing economies of the Ghanaian economy, as in other developing countries, the banking sector is the main supplier of external financing for firms and individuals (Mahmutovic & Coskun, 2016; Mateev et al., 2013). The irony is that while the banking sector is the financing hub for almost all firms, banks themselves become helpless under financial constraint scenarios. This makes an extension of financial constraint-tax compliance literature to the banking sector quite critical. This study, therefore, seeks to contribute to the body of knowledge on financial constraints and tax compliance in the banking sector by zeroing the constraint into solvency. A bank's continuity is dependent primarily on the solvency position, a solvency-constrained bank is not likely to survive.

While the implications of TPA on tax revenue targets have been well documented in advanced-country literature, it has been a neglected focus of tax reforms in the developing world until recently (Yimbila, 2017) especially exploring the dynamics in relation to financial constraints in the financial sector. Thus, there is a visible scarcity of studies pertaining to the financial sector (Alm, Liu, & Zhang, 2019; Edwards, Schwab, & Shevlin, 2016). The findings emanating from investigations in advanced economies and cross-border contexts may not be applicable to developing nations, such as Ghana, due to differences in developmental stages, tax administration practices, and compliance environments. Additionally, differences in tax administration practices—such as the efficiency of tax collection, the clarity of tax regulations, and the level of taxpayer education—can significantly impact how tax avoidance strategies are employed. Compliance environments also vary widely; in some countries, there may be a stronger culture of compliance and enforcement, while in others, tax evasion may be more prevalent due to weaker institutional frameworks.

These differential implications suggest that the characteristics of taxation, including the motivations behind tax avoidance behaviour, are likely to differ significantly across countries and economic sectors. For instance, what drives a non-financial firm in a developed economy to engage in tax avoidance may not hold as true for a financial institution in a developing country. The financial sector, particularly banking, plays a crucial role in the economy and is often subject to different regulatory and tax obligations, which can influence its approach to tax

planning and avoidance.

Given these considerations, it is both relevant and timely to expand the existing literature to include a focus on the financial sector, especially banking in Ghana. Moreover, Ghana's average tax revenue continues to lag far behind the average benchmark in Sub-Saharan Africa. A critical examination of Ghana's tax revenue performance in comparison to the African benchmark as depicted in Figure 2 reveals a troubling tax situation. A quick examination of tax revenue statistics in Figure 1 for the periods of 2008 to 2020 reveals that Ghana's tax revenue to GDP in 2014 was 12.2 percent, compared to the African average of 18.89 percent; 13.1 percent in 2015, compared to the African average of 18.6 percent; 13.7 percent in 2016 compared to the African average of 18.16 percent; 14.1 percent in 2017 compared to the African average of 18.58 percent; 12.57 percent in 2018 compared to the African average of 18.6 percent; and 13.4 percent in 2020 compared to the African average of 16.0 percent (OECD, 2022; Queku et al., 2024; World Bank annual report, 2022).

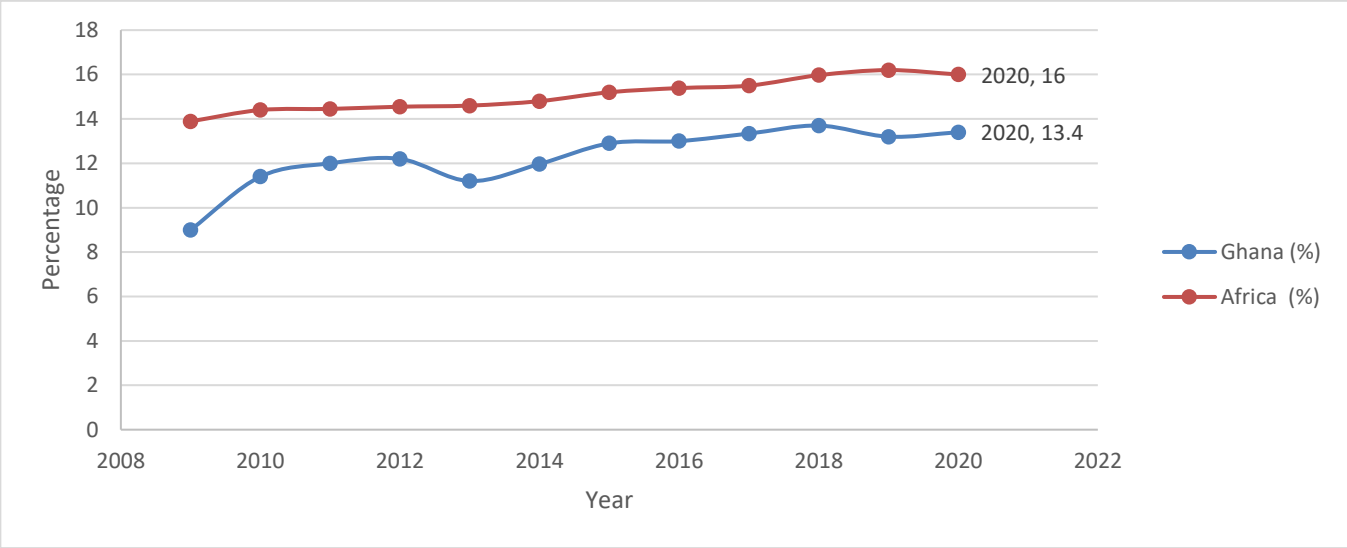

Figure 2: Tax Revenue Trend: Comparative Pattern of Ghana and Africa.

These statistical messages from the tax data show the pattern of deleterious tax revenue performance. Therefore, as the nation (i.e. Ghana) grapples with persistent challenges in tax revenue generation, understanding the tax behaviour of financial institutions becomes increasingly important. By investigating the specific tax avoidance strategies employed by banks in Ghana, researchers can provide valuable insights that may inform policymakers and contribute to the development of more effective tax policies. This research could ultimately aid in enhancing tax compliance and increasing revenue, thereby supporting the broader economic development goals of the country. Moreover, emerging studies such as Seidu et al (2021) viewed the relationship as largely linear, however, marrying the assumptions of the extended parallel process theory coupled with the regulatory risk in the Ghanaian banking sector, the relationship may tilt to be more non-linear, evidence which is virtually absent in the empirical literature. Therefore, in addition to the focus and contextual gaps in understanding the solvency constraint-tax planning nexus, this study also seeks to explore possible non-linearity in the relationship. Building on these lessons, the study investigates a non-linear relationship between solvency constraints and the tax planning activities of banks in Ghana.

2. LITERATURE REVIEW AND HYPOTHESIS TESTING

The fundamental theories that underpin the study is the pecking order theory (POT) and the extended parallel process model (EPPM). Pecking order theory explains the antecedents of tax planning activities of banks. The pecking order theory was first used by Donaldson (1961) that assert that the order of financing sources takes precedence over their weight (Froko, 2020; Seidu et al., 2021). POT states that firms follow a specific hierarchy of financing sources wherein they prefer internal financing, followed by debt, and lastly equity financing. According to the pecking order theory, firms prioritize using retained earnings to finance their investment projects Then, if the internal resources are insufficient, they prefer to finance the capital needed with debt, and, finally, if nothing works, they go for equity infusion. The pecking order is critical as it indicates how the firm is performing. For example, if a firm can finance its requirements internally, it is doing well. On the other hand, if a firm opts for debt financing, it indicates that management is certain of good results and can comfortably meet its obligations. Finally, if a company has to rely on equity financing, it may send a negative signal.

The pecking order theory assumes that there is no target capital structure and that companies prioritize their financing strategies based on the path of least resistance. The theory also assumes an asymmetry of information between the manager and the investors, which means the company managers have access to information that the investors don't know about. In the pecking order theory, companies determine their financial strategies based on

the seniority of claims to assets. Consequently, the sources of financing are arranged in the following sequence: retained earnings are the cheapest, followed by debt and equity. The implication of the theoretical assumption is that ceteris paribus, firms prefer cheaper sources of capital than alternative sources of capital.

The drive for cheaper sources of financing, partly explains the tax planning behaviour of firms as tax planning opportunities lead to cost savings and deepen the level of the internally generated fund. This suggests even under normal condition, firms are more likely to favour internal sources of funding. By implication when firms have limited financing options, a condition that is prevalent under solvency constraint scenarios, these firms are more likely to aggressively engage in activities to cut down costs and improve internal net cash flow. Following these theoretical extrapolations, there is a theoretical basis to assume that solvency constraints could motivate firms to actively engage in tax planning activities. The cost of external financing is considerably higher for solvency-constrained firms and as a result, are more likely to generate funds internally to finance future investment opportunities. In this setting, tax planning could be viewed as an alternative source of financing for firms. When firms are solvent, traditional financing such as debt and equity often becomes more expensive and difficult to acquire (Edward et al., 2016). Thus, by the assumption of POT, firms that are solvent could acquire funds through tax planning avoidance by reducing taxable earnings and increasing tax savings or credits.

This study, therefore, argues that solvency constraints could motivate tax planning activities. Relating to the study setting, the paper anticipates that solvency-constrained banks will engage in tax planning activities as an easy source of finance for several reasons. Firstly, an option to increase IGFs by reducing cash outflows through cost-cutting mechanisms such as reducing capital expenditure (capex), advertisement, labour cost, and research and development. However, these cost-cutting strategies could have adverse long-term effects on firms' performance; therefore, seeking tax planning opportunities becomes an obvious alternative. Unlike the cost-cutting strategies, reducing the tax burden to increase cash inflow through tax planning is unlikely to have adverse long-term consequences when operated within the framework of tax laws. Secondly, practitioners and experts have demonstrated that during tough economic times, "cash is king, and a lot of companies are receptive to focusing on opportunities in the tax area that they may not have been eager to focus on in the past" (Leone, 2008). Thus, drawing from the assumptions of POT, solvency constraints and tax planning activity could have a direct linear relationship.

However, aggressive tax planning inherently carries a degree of tax risk exposure. Borrowing from the extended parallel process model (EPPM), it becomes evident that the risk aspect, particularly in a heavily regulated environment like the banking sector, may disrupt the linearity assumption proposed by the POT. Consequently, the EPPM provides a unique foundational perspective for this study. According to the model, individuals or firms must (1) recognise a threat to their well-being stemming from specific behaviours and, concurrently, (2) have the ability to take appropriate actions to alleviate that threat while believing in the effectiveness of those actions (Witte, 1992). In this context, the EPPM posits that banks will undertake tax planning initiatives based on the nature and intensity of the threats they face. Unlike the POT, which follows a linear framework that favours low-cost, unrestricted funding sources, the EPPM adopts a non-linear approach. The responses of banks are influenced by their risk profiles, the severity of threats, and the probability of those threats occurring. This illustrates that the EPPM's assumptions extend beyond a simple linear relationship, incorporating a more complex non-linear dynamic (Elmirzaev, 2015; Neuman, 2023; Vazquez-Caro et al., 2011). Although the existing literature has largely ignored this possible non-linearity dimension, evidence within the empirical context would not only improve the understanding of the relationship but also present foundational knowledge for tax policy and practice within the Ghanaian banking sector with extended implications.

Besides these theoretical connotations, the empirical literature has captured various opportunities/incentives for firms to engage in TPAs. Some stream of studies have focused on linking tax planning to some relevant outcome variables such as a firm's value and profitability (Christina & Alexander, 2018; Lee & Yoon, 2020; Razali et al., 2018), transfer pricing (Brock & Pogge, 2014; Cristea & Nguyen, 2016; Hopland et al., 2018; Jansky, 2013), cost of equity (Goh et al., 2016), the term structure of debt (Bolton et al., 2014; Fatica et al., 2013; Platikanova, 2017). Other stream of studies focuses on incentives for tax planning such as equity compensation (Rego et al., 2017), institutional ownership (Bird and Karolyi, 2017; Cheng et al., 2012; Khan et al., 2017), board intervention (Armstrong et al., 2015) and analyst cash flow forecast (Ayers et al., 2018).

Financial constraint as motivation for tax planning is emerging as another stream of studies (Chen and Lai, 2012; Edward et al., 2016; Hanlon and Heitzman, 2010; He et al., 2020; Law and Mills, 2015). Chen and Lai (2012) found that financially constrained companies engage in more tax avoidance activities. Consistently, Law and Mills (2015) also found that financially constrained firms pursue more aggressive tax planning strategies both contemporaneously and in the future. Edwards et al. (2016) also revealed that financially constrained firms increase IGFs through tax planning. The authors further demonstrated that this relationship is greater among firms that have low cash reserves and that financially constrained firms pursue tax savings without exploiting the financial reporting benefit.

In another study, Wu (2018) examined the variation in corporate tax avoidance which is described as jointly determined by firms' incentives and opportunities to avoid taxes, and found a positive relation between financial constraints (a proxy for an incentive to avoid taxes) and tax avoidance. Wu (2018) found the relationship to be

significantly stronger for firms with high tax planning opportunities. Furthermore, Alm et al. (2019) showed that the effects of financial constraints are heterogeneous across firm ownership, firm age, and firm size. Additionally, the study provided suggestive evidence on the possible channels through which the impact of financial constraints on firm tax evasion may operate, including a reduction of information disclosure through the banking system, an increase in the use of cash for transactions and an increase in bribery activities in exchange for tax evasion opportunities.

A critical review of the literature shows that researchers are taking an interest in investigating financial constraints as an incentive for TPAs. However, most of these studies have been conducted in the advanced economies. The findings and implications from these studies may not be holistically relevant to the Ghanaian setting due to differences in stages of development. It is believed that the stage of development influences the direction of fiscal policies and strategies including tax laws and tax policy economies (Agyei et al., 2019; Queku, 2020). Thus, the heterogeneity characteristics of tax laws are likely to affect tax planning opportunities and the associated motivations, and therefore empirical evidence from data across borders and even across industries are more likely to be heterogeneous rather than homogeneous. The limited evidence on financial constraints as an incentive for tax planning in Ghana is therefore not only detrimental to the development of a body of knowledge in tax planning in Ghana but also inimical to the achievement of tax revenue targets and the development of the Ghanaian economy. It is therefore fundamental and critical to investigate how financial constraints become a motivation for tax planning to provide country-specific evidence in Ghana.

In sum, viewing TPA as a source of internally based financing (Chen and Lai, 2012; Edward et al., 2016; He et al., 2020; Law and Mills, 2015; Wu, 2018), coupled with standard theories in finance such as POT (Agyei et al., 2019; Froko, 2020; Leone, 2008; Myers, 1984), support the assertion that firms will rely heavily on generating funds/cash inflows through TPA when those tax based funds are the cheapest available source of funds to the constrained firm. Thus, financial constraints are likely to cause firms to rearrange the ranking order of their cost of capital as external funds such as equity and debt become more expensive, thereby causing these firms to reevaluate possible internal sources of funds. This implies that firms that did not access all possible tax planning opportunities during non-constrained times are more likely to access them during constrained periods.

Following the theoretical arguments from POT and the empirical evidence, the paper operationalizes its framework by predicting that financially constrained banks will take actions to increase internally generated funds through TPA due to the several lessons from the literature review. First, banks would prefer increasing tax savings or credit to boost cash inflow to cutting other operating costs which could have adverse long-term effects on the banks' operation and performance. Secondly, banks, like other firms, likely have a diverse array of untapped tax planning opportunities that can be leveraged to boost IGFs through cash tax savings and credits. Finally, anecdotal evidence suggests that constrained banks like other financially constrained firms are indeed more likely to take advantage of tax opportunities as a source of additional cash. Thus, this paper posits that solvency constrained banks will take action to reduce cash taxes paid. Nevertheless, this study does not predict that the relationship is solely a linearity drawing lesson from the EPPM. The study therefore proposes its grand null hypothesis (H0(g) as:

H1: Solvency constraints have a statistically significant influence on the tax planning activities of banks in Ghana.

2.1. Population and Sources of Data

All universal banks licensed by the Bank of Ghana are used as the study population. The sample frame covered banks that operated from 2008 to 2022. In 2008, Ghana changed its financial reporting structure for banks which is likely to affect the financial data. Consequently, 2008 is used as the starting point for data collection ending in 2022 where data is readily available. Banks without complete data within the study frame are excluded from the study investigation. In all 20 banks out of 23 are sampled based on the sampling criteria for the investigation. The study employs secondary data for the investigation. Data is collected from all banks in the sampling frame for the analysis. Audited annualized financial statements are collected from the banks' websites over a period of 14 years (from 2008 to 2022). The variables of importance are the tax planning activity and solvency constraint.

2.2. Measurement of Solvency Constraint

Solvency constraint employs three proxies: Pierce and Hadlock (HP) index, Whited and Wu (WW) index, and Z-score (ZS) to measure the variable. Hadlock and Pierce (2010) developed its index as an update of the widely used Kaplan and Zingales' (1997) proxy (Farre-Mensa and Ljungqvist, 2016). HP index is constructed based on size, size-squared, and age. It is one of the widely used proxies (Farre-Mensa & Ljungqvist, 2016). WW index is premised on the assumption that solvency-constrained firms do not have funds for lucrative projects. It is argued that solvency-constrained firms with going-concern problems would exhibit challenges such as cash flow problems, high gearing, and negative sales growth. These indicators are captured in the WW index (Whited & Wu, 2006). Z-score, according to Chijoriga (2011), is used to predict firms' potential bankruptcy. It is therefore an important proxy to measure solvency constraints (Lubawa & Louangrath, 2016).

Solvency-constrained banks may apply for voluntary liquidation else they are likely to be forced to liquidate

by the regulator similar to the recent banking crisis. During the recent banking crisis in Ghana, several banks with unredeemed solvency problems were liquidated by BOG to protect depositors' funds. Therefore, banks getting to this point through Z-score assessment are more likely to engage in rigorous activities including tax planning to strengthen to improve their solvency position.

2.3. Measurement of Tax Planning Activities

Even though there could be various proxies for measuring tax planning activities, it is important to choose proxies that are appropriate for the focus of the study investigation (Edward et al., 2016; Hanlon & Heitzman, 2010). One proxy selected for the analysis is the cash effective tax rate (CETR). This paper employs CETR because the interest of this investigation is to determine how banks respond to solvency constraints resulting in the need to generate extra cash. Another justification for the appropriateness of CETR is that CETR is the most direct measurement of banks' cash tax burden. Thus, tax planning activities that decrease banks' cash burden would have a direct effect on the banks' CETR. The CETR is measured as the ratio of the actual cash tax paid to the pre-tax income (PTY) adjusted for special items (SPI).

2.4. Control Variables

This paper uses four control variables in the analysis. They are bank size (BS), and bank leverage (BL). Bank size (BS) is measured as the natural log of total assets (Seidu et al., 2021). According to Hanlon et al. (2007), large banks may be able to structure complex and sophisticated tax planning to achieve tax savings. The true impact of solvency constraints can be determined by controlling for BS. Bank leverage (BL) is controlled because debt provides a tax shelter (Mills & Newberry, 2004). The results of the solvency constraint variables would show incremental tax avoidance triggers when BL is controlled. BL is computed as the ratio of long-term debts to total assets.

2.5. Model Specification

The focus of the study is to examine the effect of solvency constraints (SC) on the tax planning activity (TPA) of banks. The study attempts to investigate the role of solvency constraints (HP index, WW index, ZSCORE). In this regard, the empirical model expresses TC as a function of LC. Therefore, the model is expressed as follows:

$$TC = f(SC, CETR) \quad (1)$$

Where SC and CETR stand for solvency constraints, and cash effective tax rate respectively. The stochastic model of Eq. (1):

$$TC_{it} = \beta_0 + \beta_1 LC_{it} + \beta_2 CETR_{it} + \alpha_{it} + \varepsilon_{it} \quad (2)$$

where β is the model's intercept, ε is the error term, α is the sector-specific effect and i and t represent bank and year, respectively.

This paper develops a quantile regression model of the form:

$$TPA_{it} = \gamma_{it} X'_{it} + \varepsilon_{it} + \alpha_{it};\ Quant_{\theta}(TPA_{it} / X_{it}) = \gamma_{\theta} X'_{it} \quad (3)$$

where X' is a vector consisting of regressors consisting of SC and CETR; ε is a vector of residuals; α is the sector-specific effect and $Quant_{\theta}(TPA_{it} / X_{it})$ identifies the θth conditional quantile of TPA given X'.

Koenker and Bassett (1978) proposed the idea of quantile regression. While the OLS regression model determines a covariate's impact on the dependent variable's conditional average, the quantile regression model considers the whole conditional distributions of the dependent variable. According to econometric theory, outliers and non-normal distribution are the cases for most economic variables (Lin & Xu, 2021), which may yield spurious OLS estimation results. Contrary to OLS, the quantile regression estimation is not sensitive to the case of outliers and non-normal distribution (Koenker and Bassett, 1978). Notably, the residuals of the quantile regression model don't require classical OLS assumptions such as zero mean, constant variance and normally distributed errors (Lin & Xu, 2018). Moreover, the quantile regression estimation approach provides robust results in the case of monotonic transformations and follows a standard asymptotic normal distribution (Mu & He, 2007). In the context of our study, quantile regression provides an ideal tool to investigate evidence of TPA heterogeneity, departing from conditional-mean methods.

This study adopts the quantile regression model with clustered data (Akter & Nasir Uddin, 2020) and GQR (Powell, 2020) econometric techniques. First, the SQR method is utilized to obtain the estimates of the covariates for multiple quantiles simultaneously and to produce their standard errors through a bootstrapping approach. Second, we adopt robust quantile regression with clustered data in the case of intra-cluster correlation and heteroscedasticity. Intra-cluster correlation is likely the case in our study since data are sampled from different units (Akter & Nasir Uddin, 2020). Finally, we apply the GQR to overcome potential endogeneity issues. SQR does not address this problem. Moreover, the GQR methodology produces reliable estimates in small T-panels, which is the case for the current study, and is easy to implement (Powell, 2020). The study analysis uses the one-year-lagged explanatory variables as instruments in this method.

Table 1: Measurement of variables

Variable	Description	Measurement
Tax compliance	Cash effective tax rate (CETR)	$\frac{CTP}{PTP - SPI}$
Solvency constraints	HP index	$-0.737\text{xSize} + 0.043\text{x}Size^2\text{-}0.040\text{xAge}$
	WW index	$-0.091\ x\ (IB + DPAT) - 0.062\ x\ Dividend\ paying\ indicator + 0.021\ x\ DLTTAT - 0.044\ X\ Ln(AT) + 0.102\ X\ Avg\ industry\ sales\ growth - 0.035\ x\ Sales\ growth$
	Zscore	$-1\ x\ \left\{3.3\ x\ \left(\frac{PI+XINT}{AT}\right) + 1.2\ x\ \left(\frac{WCAP}{AT}\right) + \left(\frac{\text{SALE}}{\text{TA}}\right) + 1.4\ \text{x}\ \left(\frac{\text{RE}}{\text{TA}}\right) + 0.6\ \text{x}\ \left(\text{CSHO x}\frac{\text{PRCCF}}{\text{LT}}\right)\right\}$
Control variables	Bank Size (BS)	Log of total assets
	Bank Leverage (BL)	Long term liability to assets

- Cash effective tax rate is adjusted by extraordinary items

2.6. Descriptive and Pre-Diagnostic Analyses

Table 2 details the descriptive statistics of the tax planning proxy, solvency constraints of banks, and the control variables used in this study. Contrary to Seidu et al. (2021), the corporate tax rate of banks (25%) is lower than the CETR of banks (31.20%). This finding aligns with the conclusions of Agyei et al. (2019), which suggest that banks in Ghana do not engage in aggressive tax planning activities as evidenced by the high cash effective tax rate. The divergent findings of this study compared to those of Seidu et al. (2021) may be attributed to the data sources and the implementation of new tax reforms. Seidu et al. used data from 2008 to 2018, while this study employed a broader time frame that is 2008 to 2022. Solvency constraints were proxied by the HP index, WW index, and z-score. Notably, except for the z-score, all solvency constraints exhibited negative means.

The relatively high standard deviations for these variables indicate substantial variation in banks' solvency constraints during the study period. Descriptive statistics for CETR, HP, WW, and ZSCORE are presented in Table 2. The Jarque-Bera (JB) statistics for these variables yielded p-values of 0.0000, 0.0000, 0.0400, and 0.0000, respectively. These JB results indicate that HP, WW, and ZSCORE deviate from normality at a 5% level of significance.

Table 2: Descriptive statistics of the variables.

Variable	CETR	HP	WW	ZSCORE	BL	BS
Mean	0.3120	-4.3989	-0.0059	0.3020	0.0909	21.4534
Median	0.2624	-4.0634	-0.0075	0.3394	0.0581	21.5296
Maximum	10.8065	-3.1946	0.1049	2.7442	0.6289	23.9726
Minimum	-1.9508	-10.3104	-0.1270	-7.9774	0.0003	18.4679
Std. Dev.	0.7885	1.0961	0.0398	0.6597	0.0879	1.1084
Skewness	9.0841	-2.3352	0.1969	-6.3751	1.8529	-0.1886
Kurtosis	112.7636	10.17156	2.3973	85.6122	8.1468	2.5261
Jarque-Bera	153695.2	909.4575	6.435763	86759.59	499.4524	4.5552
Probability	0.0000	0.0000	0.0400	0.0000	0.0000	0.1025
Sum	92.98874	-1310.891	-1.7854	90.0109	27.0992	6393.137
Sum Sq. Dev.	184.6942	356.8831	0.4725	129.2725	2.2963	364.9371
Observations	298	298	298	298	298	298

As HP, WW, and ZSCORE are not normally distributed, the study analyses the standardized residuals to check the normality test results for the combined effect. The result of the JB normality test is illustrated in Figure 3. The p-value of the JB test in this case is 0.0000, which reveals that the residuals are normally distributed at 1% level, but not normally distributed at 5% level of significance.

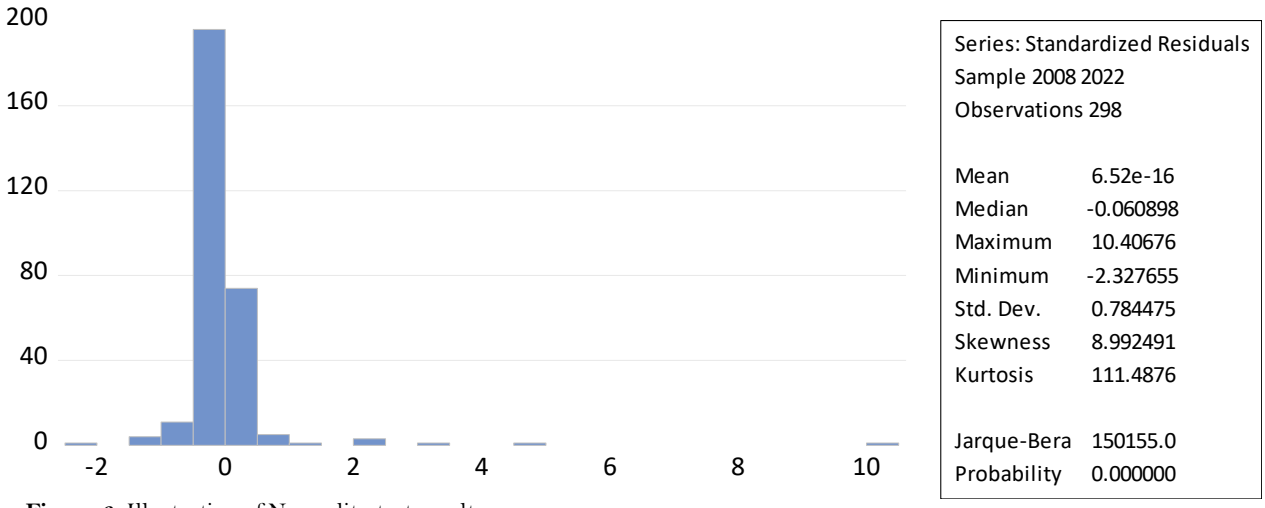

Figure 3: Illustration of Normality test results.

The results of the heteroskedasticity test for both panel cross-section and panel period are presented in Table 3, where the likelihood ratio is 531.0906 with 20 df and a p-value of 0.0000 for cross-section LR test, and the likelihood ratio is 580.2711 with 20 df and a p-value of 0.0000 for panel period heteroskedasticity LR test. Both panel cross-section and period LR test reject the null hypothesis of homoskedasticity and reveal that residuals are heteroskedastic across panel and period.

Table 3: Heteroskedasticity LR test for both Panel cross-section and Period.

Panel Cross-section Heteroskedasticity LR Test			
	Value	**df**	**Probability**
Likelihood ratio	531.0906	20	0.0000
Panel Period Heteroskedasticity LR Test			
	Value	df	Probability
Likelihood ratio	580.2711	20	0.0000

The study further tests the cross-section dependence within the estimation framework. The results of the cross-section dependence (CD) test are presented in Table 4, where the p-value of Breusch-Pagan LM, Pesaran scaled LM, and Pesarn CD test are 0.0000, 0.0000 and 0.0221, respectively, suggesting the rejection of null hypothesis and conclude that CD exists in residuals.

Table 4: Results of various CD Test.

Null hypothesis: No cross-section dependence (Correlation) in residuals			
Test	**Statistic**	**d.f.**	**Prob.**
Breusch-Pagan LM	558.3558	190	0.0000
Pesaran scaled LM	18.89625		0.0000
Pesaran CD	2.287923		0.0221

It can be observed from the diagnostic test results that the residuals are not normally distributed, there is also evidence of heteroskedasticity, and cross-sectional correlation. Therefore, estimation of fixed effect or random effect model will provide misleading results in this case. This study therefore applies the panel quantile which is nonlinear, to estimate the elasticities.

Results of the panel quantile regression are tabulated in Table 5. It can be observed that the adjusted R-square is 0.006351 indicating that about 0.6351 percent of the variation of median cash effective tax rate is expressed by these explanatory variables after taking into account the number of regressors. It is observed that HP index and ZSCORE have a positive significant impact and WW index has a negative significant impact on CETR of banks. Results indicate that one percent reduction in median WW index will improve median CETR by 0.598005 percent and vice-versa. However, a one percent increase in median HP index will increase median CETR by 0.016944 percent. Similarly, a one percent increase in ZSCORE will improve CETR by 0.004624. This breeds diversity in the findings in terms of both magnitude and direction.

Table 5: Results of Quantile Regression (Median).

Method: Quantile Regression (Median), Dependent Variable: CETR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HP_INDEX	0.016944	0.009447	1.793501	0.0739
WW_INDEX	-0.598005	0.299867	-1.994232	0.0471
Z_SCORE	0.004624	0.006831	0.677000	0.4989
LBS	0.038056	0.008436	4.511441	0.0000
BL	0.047577	0.127182	0.374085	0.7086
C	-0.501932	0.169640	-2.958811	0.0033
Pseudo R-squared	0.023079	Mean dependent var		0.312043
Adjusted R-squared	0.006351	S.D. dependent var		0.788585
S.E. of regression	0.796259	Objective		34.81636
Quantile dependent var	0.262380	Restr. objective		35.63886
Sparsity	0.273611	Quasi-LR statistic		24.04871
Prob (Quasi-LR stat)	0.000212			

2.7. Post Diagnostic of Quantile Specifications

Having specified and estimated the quantile, the study conducts further diagnostics to evaluate the appropriateness of the quantile specifications. The result of the Ramsey RESET is one of post-diagnostic tests. The test results of Ramsey RESET are tabulated in Table 6, where the p-value of QLR L-statistics is 0.2533 and QLR Lambda-statistic is 0.2535. This implies that the quantile regression (median) is correctly specified. Quantile process estimates are presented in Table 6, where the number of process quantiles is 10.

Table 6: Result of Ramsey RESET Test.

	Value	df	Probability
QLR L-statistic	1.3051	1	0.2533
QLR Lambda-statistic	1.3041	1	0.2535

The study also analyses the slope and symmetric position of the estimation. This is done through a slope equality test with the results captured in Table 7 and a symmetric test with the results in Table 8. The chi-square statistic of the Wald test of the slope equality test is 82.46890 and the respective p-value is 0.0001, which suggests the rejection of the null hypothesis. Thus, it is evident that the slope coefficients are not equal across the quantiles, they are different from each other.

Table 7: Quantile Slope Equality Test.

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Wald Test	82.4689	40	0.0001

Table 8 also reports the results of the symmetric test. The chi-square value of the Wald test of symmetric quantiles is 33.1467 and the respective p-value is 0.1010. Therefore, the null hypothesis cannot be rejected in this case and it can be concluded that there is symmetry, no asymmetry exists.

Table 8: Symmetric Quantiles Test.

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Wald Test	33.1467	24	0.1010

3. EMPIRICAL FINDINGS AND IMPLICATIONS

With both the pre and post-diagnostic tests supporting the quantile estimation structure, the study proceeds to present and discuss the implications of the empirical findings. Although the results in Table 9 provide the coefficient-based dynamics in the relationship with the median reference, the non-linearity is not observable. The study, therefore, analyses the non-linearity through process estimation with the results captured in Table 6 and Figure 4. From the results, it is evident that HP has a positive but insignificant impact on CETR up to 30th quantile, however, it gained significance from the 40th and 50th quantile. Surprisingly, when HP began its significant consequences, the value or magnitude of the elasticity began declining up to the 80th quantile. Figure 4 emphasizes the pictorial position of this relationship. This means that an HP index magnitude of less than 40th quantile would not have any significant effect or implication on tax planning dynamics, however, as the magnitude of the elasticity increases beyond the 40th quantile, the implication becomes significant eroding tax planning gains as evident in the positive coefficient. This evidence is inconsistent with the study apriori as the study expected that such constraint should rather amplify aggressive tax planning activity.

Nevertheless, the finding has strong theoretical implications reflecting the assumptions of the extended parallel process model (EPPM) or theory rather than the pecking order theory. The findings imply that although solvency-constrained banks are required to engage in aggressive cash savings to improve internal sources of funds as they become increasingly the primary source of funding as argued by the proponents of pecking order theory (POT) (Akter & Nasir Uddin, 2020; Guizani, 2020), the banks also consider further risk exposures associated with the alternative mechanisms available including risk in aggressive tax planning (Haselip et al., 2015; Olaleye, 2016; Siddiqua et al., 2019).

Following the assumption of EPPM, the management of banks would respond to threats based on the nature

and severity of the consequences of occurrence (Siddiqua et al., 2019; Witte, 1992). Since a high HP index indicates that a firm is larger and older (Amaning et al., 2021; Seidu et al., 2021), such firms may be susceptible to public scrutiny and possibly regular tax audits, thereby increasing general risk. This could exasperate the existing solvency challenge and possibly even collapse. This may make these banks cautious and charitable in engaging in further risk-induced activities such as aggressive tax planning. This might explain why the banks are exhibiting rather negative tax planning activity (i.e. increasing tax payments) in the midst of solvency constraints. This tax compliance behaviour, thus, echoes the empirical relevance of the EPPM.

A further implication of the finding is that larger and older banks are sceptical to engaging in aggressive tax planning possibly due to the fear of regular and frequent audits which may expose their aberrant activities emerging from tax planning. activities. A policy implication is that tax administrative notoriety practices and reports of such notoriety and sanctions could whip up tax compliance even under a solvency-constraint scenario through a fear-inducement and amplification of compliance sanctions on the minds of large entities such as banks.

Table 9: Quantile Process Estimates.

	Quantile	Coefficient	Std. Error	t-Statistic	Prob.
HP	0.100	0.035965	0.090061	0.399342	0.6899
	0.200	0.026048	0.025634	1.016167	0.3104
	0.300	0.016588	0.012841	1.291761	0.1975
	0.400	0.020822	0.011764	1.769881	0.0778
	0.500	0.016944	0.009447	1.793501	0.0739
	0.600	0.014973	0.009631	1.554625	0.1211
	0.700	0.004806	0.007390	0.650300	0.5160
	0.800	0.004421	0.007249	0.609852	0.5424
	0.900	0.015608	0.011633	1.341703	0.1807
WW	0.100	-2.037752	0.679899	-2.997141	0.0030
	0.200	-1.483784	0.486287	-3.051254	0.0025
	0.300	-0.854912	0.329946	-2.591066	0.0100
	0.400	-0.675084	0.298859	-2.258871	0.0246
	0.500	-0.598005	0.299867	-1.994232	0.0471
	0.600	-0.110250	0.324556	-0.339696	0.7343
	0.700	-0.015874	0.335067	-0.047374	0.9622
	0.800	0.370513	0.392323	0.944407	0.3457
	0.900	1.767179	0.569127	3.105072	0.0021
ZSCORE	0.100	0.056830	0.057996	0.979889	0.3280
	0.200	0.068153	0.026530	2.568907	0.0107
	0.300	0.047946	0.033382	1.436277	0.1520
	0.400	0.019309	0.024772	0.779469	0.4363
	0.500	0.004624	0.006831	0.677000	0.4989
	0.600	0.004278	0.006916	0.618619	0.5366
	0.700	0.005825	0.006681	0.871924	0.3840
	0.800	0.004706	0.007574	0.621381	0.5348
	0.900	-0.006350	0.092823	-0.068415	0.9455

The effect of WW index on CETR is negative from the 10th to 70th quantile, and became positive in the 80th and 90th quantiles. This is evidence of non-linearity which is a characteristic of response to risk and uncertainty (i.e. solvency). Diagrammatically, the solvency-constraints (WW index)-tax planning behaviour exhibits a zig-zag nature or an "S-shape" trend as captured in Figure 4.

The findings show that solvency-constrained banks are more likely to engage in tax planning activities with magnitude-varying coefficients significant up to 50th quantile and insignificant though still negative in the 60th and 70th quantiles. The evidence of non-linearity and changes in magnitude provides the basis to assume the application of both POT and EPPM by the Ghanaian banks in constraint scenarios. The initial negative trend suggests that these banks are more likely to engage in aggressive tax planning activities for cash savings by minimising cash payments in tax (i.e. CETR) with the understanding that internal sources of funds through tax savings are more relevant under such situations, an argument which is consistent with the POT (Akter & Nasir Uddin, 2020; Guizani, 2020). This seems to corroborate the existing empirical evidence that banks would sacrifice their tax obligation to meet their long-term financial obligations when the nature and severity of the threat it poses is high (Seidu et al., 2021; Siddiqua et al., 2019).

However, the magnitude of the elasticity decreases in absolute terms up to the 70th quantile and even assumes a positive trend in the 80th and 90th quantiles. This reflects cautiousness in further risk exposure (i.e. tax risk in aggressive tax planning) and the severity of the consequences of such risk. Thus, much as these solvency-constrained banks need respite through tax planning, they also recognise an increase in further risk through tax planning. This affirms the assumptions in EPPM (Seidu et al., 2021, 2022; Witte, 1992).

An important practical implication is that these banks are not intentional about aggressive tax planning activities. This extrapolation is drawn on the strength that banks have the resource capacity to engage in complex tax planning activities within the allowable legal tax frameworks. Therefore, the evidence of scepticism

of such practices even in the midst of survivorship risk mimics weak intentional tax planning practices. Additionally, tax authorities could continue to capitalise on this tax planning gap to deepen tax revenue mobilisation within the Ghanaian banking sector and this seems to be in force by the tax authorities given the higher positive tax gap captured in Table 2.

The effect of ZSCORE on CETR has been positive and insignificant in Table 5 and largely the same in the process estimation in Table 9. The results also reveal non-linearity in the relationship as captured in Table 9 and displayed in Figure 4. From the 10th quantile to the 80th quantile, other than the 10th quantile (i.e. which is positive and significant), there is an insignificant positive effect of ZSCORE on CETR of banks. However, at the 90th quantile, ZSCORE had an insignificant negative effect on CETR. This implies Ghanaian banks generally do not significantly alter their tax-paying behaviour under a solvency-constraint situation (i.e. Zscore).

Nevertheless, a critical analysis of the elasticity shows that the positive elasticities have a decreasing pattern and eventually cross the zero line to the negative region (see Figure 4) though still insignificant. The practical implication is that banks' tax response to a solvency-constraint is primarily dependent on the severity of the constraint. Initially, they hold on to their positive tax-paying behaviour though at a decreasing rate. However, as the constraint becomes biting, these banks are more likely to engage in aggressive tax planning activity.

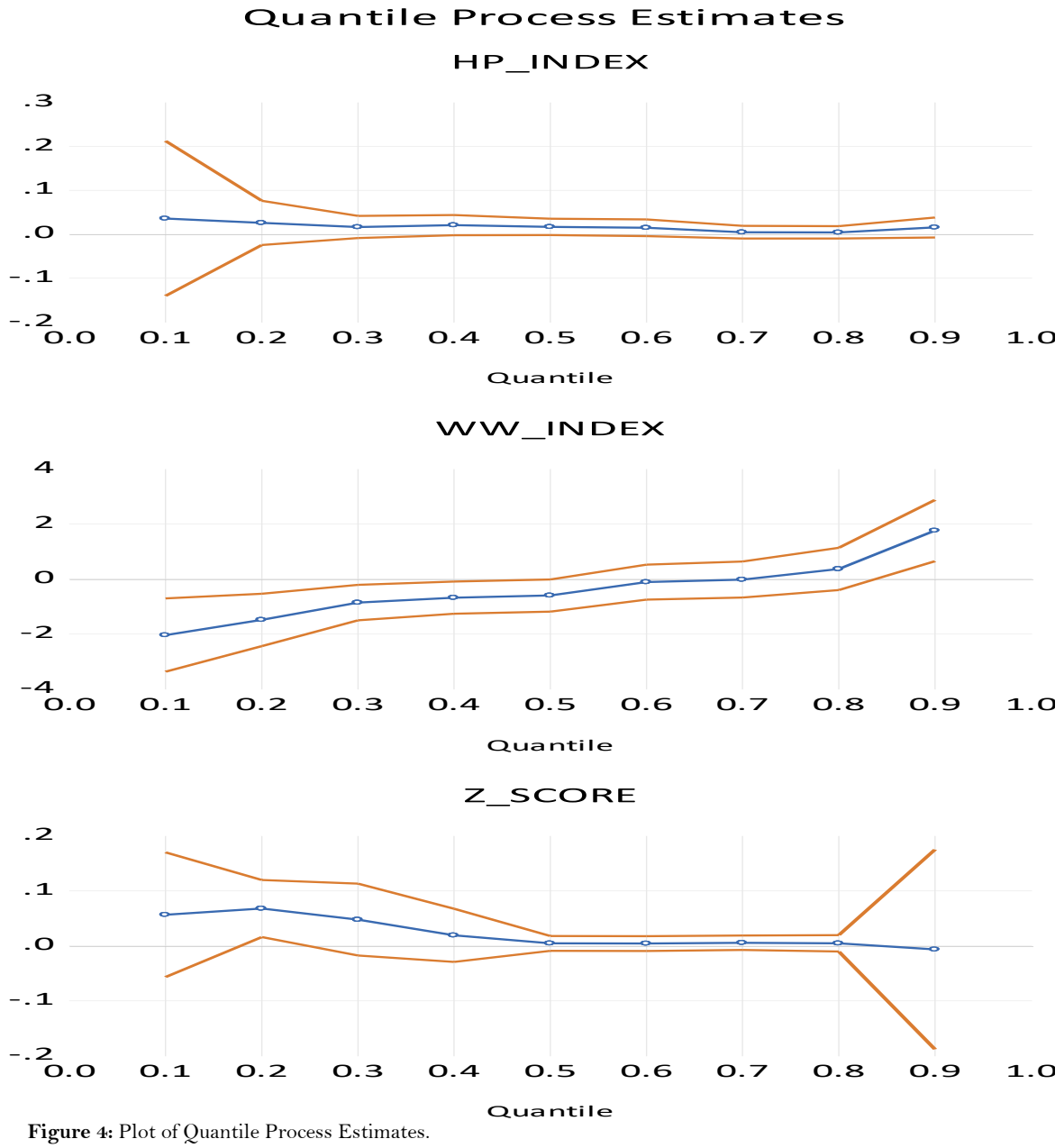

Figure 4: Plot of Quantile Process Estimates.

4. CONCLUSIONS AND RECOMMENDATIONS

The study provides contribution to empirical studies on solvency constraints tax planning activity of banks. Primarily, it explores the effects of solvency constraints on banks' tax planning activities. Data for analysis is collected from annual audited financial statements of universal banks in Ghana, ranging from 2008 to 2022. The data is segmented into monthly frequencies to estimate the dynamics. The study employed simulation approach

to determine solvency constraint scenarios using the HP index, WW index, and ZSCORE and tax planning activity (TPA) measured by the CETR. The panel quantile estimation approach is employed for the estimation.

It is observed that the nature and trend in tax aggressiveness of the banks under a solvency-constraint scenario is dependent on the measurement of the constraints. The findings demonstrate non-linearity of somewhat in the relationship between solvency constraints and tax planning activities (i.e. tax aggressiveness). Even in the case of HP index scenario where the directional effect does not change, the elasticities largely exhibit a decreasing trend. It is evident from the results that solvency constraints can lead to aggressive tax planning to minimise the negative consequences of the solvency threats. This evidence supports the assumptions of POT. The findings reveal that the magnitude of the elasticity of the relationship between some solvency constraint proxies and tax planning activities decreases in absolute terms at some level of quantile. This reflects cautiousness in further risk exposure (i.e. tax risk in aggressive tax planning) and the severity of the consequences of such risk. Thus, much as these solvency-constrained banks need respite through tax planning, they also recognise an increase in further risk through tax planning. This affirms the assumptions in EPPM.

An important practical implication of the finding is that banks in Ghana do not proactively pursue aggressive tax planning strategies, despite having the resources to do so within legal frameworks. Instead, they exhibit cautious tax planning practices, even when facing survival risks. This hesitation presents an opportunity for tax authorities to enhance tax revenue collection in the banking sector, which is already evident in the significant positive tax gap identified. It is suggested that the tax authorities should continue to capitalise on this tax planning gap to deepen tax revenue mobilisation within the Ghanaian banking sector and this seems to be in force by the tax authorities given the higher positive tax gap observed in this study. The government is advised to protect the banks not to fall into any solvency constraint situation since that could change their tax planning activities. The study found evidence of Ghanaian banks not taking significant advantage of tax planning opportunities available in the Ghanaian tax laws, management could deploy resources to improve cash inflows from tax planning.

This study has provided a comprehensive insight into non-linear relationship between solvency constraints and tax planning activity. Nevertheless, the scope was limited to the solvency constraint scenario, future studies could replicate the methodology and extend the implications of financial constraint by emphasizing liquidity constraint and tax aggressiveness of Ghanaian banks. Additionally, future researchers in this area may also explore these relationships in other sub-financial sectors such as the insurance sector. This would make the evidence and implications more conclusive not only to under the theoretical dynamics but also to inform policy and practice.

Author Contributions:

Kwakye Boateng, Kwame Bosiako Omane-Antwi, and Yaw Ndori Queku all made substantial contributions to this study. Boateng and Queku were involved in the conceptualization and design of the study, as well as the analysis and interpretation of the data. They also drafted the paper. Omane-Antwi supervised and critically revised the draft for intellectual content and final approval of the published version. All authors acknowledge their shared responsibility for all aspects of the work.

Data Availability Statement:

Raw data were generated from audited financial statements of banks. The supporting data for the findings of this study are available upon request from the corresponding author [YNQ].

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