



Research Article

Effect of Data Analytics on Tax Evasion Among Small and Medium Enterprises in Nairobi Central Business District, Kenya: The Moderating Role of Firm Size

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Abstract

Tax evasion remains a major challenge to domestic revenue mobilization despite the increasing adoption of digital technologies by tax authorities. Small and Medium Enterprises (SMEs), which constitute a significant proportion of economic activity in Kenya, continue to exhibit substantial tax compliance gaps. This study examined the effect of data analytics on tax evasion among SMEs in Nairobi Central Business District, Kenya, while assessing the moderating role of firm size in this relationship. The study was guided by Economic Deterrence Theory, Resource Dependency Theory, and Laffer Curve Theory. A cross-sectional explanatory research design was adopted and data were collected from 391 SME owners and managers using structured questionnaires. Descriptive statistics, Pearson correlation analysis, multiple regression analysis, and hierarchical moderated regression were employed, with data analysed using SPSS version 27. The findings revealed that descriptive analytics had a positive and significant effect on tax compliance ($\beta = 0.175$, $p = 0.033$), leading to the rejection of H01. Due to severe multicollinearity among diagnostic, predictive, and prescriptive analytics (correlations ranging from 0.831 to 0.862), these three variables were combined into a composite Advanced Analytics Index, which demonstrated a stronger and statistically significant effect on tax compliance ($\beta = 0.408$, $p = 0.003$), leading to the rejection of H02, H03, and H04. The results further established that firm size significantly moderated the relationship between data analytics and tax evasion, with interaction terms for descriptive analytics $\times$ firm size ($\beta = -0.198$, $p = 0.000$) and advanced analytics $\times$ firm size ($\beta = -0.229$, $p = 0.000$) being statistically significant, leading to the rejection of H05a, H05b, H05c, and H05d. These findings indicate that larger firms benefited more from analytics-based compliance strategies compared to smaller firms. The study concludes that investments in data analytics substantially strengthen tax compliance and reduce tax evasion among SMEs. It recommends that the Kenya Revenue Authority enhance the adoption of integrated analytics platforms, strengthen digital record management among SMEs, and implement firm-size-specific compliance strategies to maximize the effectiveness of data-driven tax administration.

Keywords

Data Analytics, Descriptive Analytics, Advanced Analytics, Tax Evasion, Firm Size

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1. Introduction

Tax evasion was a major challenge affecting revenue collection and economic development in many developing countries, including Kenya. Tax evasion and tax avoidance posed significant threats to economic stability and the fiscal stability of a nation, as emphasized by Pohan et al. [31]. Tax evasion denoted the deliberate and unlawful act by individuals or businesses of concealing income, falsifying financial records, underreporting sales, or failing to remit taxes in order to reduce tax liability, as noted by OECD [26], Bactalia et al. [4], and Ravenda et al. [32]. Among Small and Medium-sized Enterprises (SMEs), tax evasion was common because many firms operated informally, maintained weak accounting systems, and experienced limited regulatory monitoring. According to KRA [14], SMEs contributed significantly to tax gaps through practices such as non-filing of returns, understatement of taxable income, and manipulation of expenses. Hendriyetty et al. [9] further argued that weak digital compliance systems and poor financial reporting increased the likelihood of SMEs evading taxes.

Evidence from several studies confirmed the persistence of tax compliance challenges among SMEs. Muthoni [21] established that socio-psychological factors including tax awareness, tax morale, and national pride significantly influenced turnover tax compliance, with the study model explaining 53.8 percent of the variation in compliance behaviour. Similarly, Mwanzia et al. [22] found that tax audits, tax penalties, and the publicity of enforcement actions had a statistically significant effect on tax compliance, suggesting that stronger enforcement mechanisms were necessary to enhance compliance levels. While these studies provided valuable insights into behavioural and enforcement-related determinants of tax compliance, they largely focused on traditional approaches to addressing tax evasion and paid limited attention to the emerging role of data analytics in detecting, preventing, and reducing tax evasion.

Economic factors such as high tax rates, administrative factors such as complicated filing procedures, high evasion costs or inadequate audit systems, and behavioural or social factors such as low tax morale, lack of trust in tax authorities, or peer influence were the main determinants of tax evasion behaviour among SMEs, as observed by Maiyo et al. [19]. Research conducted in Kenya also revealed that inadequate tax education compromised tax compliance. Greater evasion costs considerably lowered tax evasion among SMEs. Additionally, Irungu and Nekesa [10] demonstrated that easier tax procedures and improved taxpayer knowledge boosted compliance, thereby reducing tax evasion. As a result, tax evasion often occurred when tax enforcement was weak or opportunities for evasion remained high. Analysing the effect of data analytics on tax evasion provided new insights into financial stability and tax administration, as noted by Ozili [29]. Ultimately, data analytics helped tax authorities identify and curb tax evasion among SMEs, according to Harelimana [8].

Data analytics has emerged as a critical tool for enhancing tax compliance, improving tax administration efficiency, and reducing tax evasion. Tuyishimire and Murorunkwere [35] reported that data analytics enabled tax authorities to process large volumes of taxpayer information and identify irregularities that may indicate tax non-compliance. Through advanced analytical techniques, tax authorities could detect inconsistencies in tax declarations, assess taxpayer risk profiles, and target enforcement efforts more effectively. In the Kenyan context, KRA [13] intended to shift from traditional audits to data-driven enforcement by utilizing artificial intelligence. This strategic move aimed to curb tax evasion by increasing the likelihood of detecting unreported income and inadequate record-keeping, as argued by Nguyen [23]. To further combat tax evasion, tax authorities would employ AI-driven tools to enhance data analytics, anomaly detection, and predictive modelling. This approach was demonstrated by the Kenya Revenue Authority through the use of behavioural data mining. However, the effectiveness of data analytics in reducing tax evasion may not be uniform across all SMEs, as firm characteristics such as firm size may influence the extent to which businesses adopt and benefit from these technologies, as noted by Irungu and Nekesa [10].

Other studies linked firm size to tax compliance behaviour and organizational performance. Larger firms generally possessed greater capacity to meet tax obligations because of their stronger financial position and availability of professional expertise [11, 24]. In contrast, smaller businesses often faced resource constraints that may limit their capacity to comply fully with tax requirements, according to Kandagor [12]. Similarly, compliance costs tended to place a heavier burden on smaller businesses, making them more vulnerable to non-compliance and tax evasion. Firm size had also been identified as an important moderating variable in organizational studies. Le et al. [18] found that the size of a business significantly moderated the relationship between tax compliance and business performance among Vietnamese enterprises. The study established that the impact of tax compliance on business performance varied across firms of different sizes, indicating that firm size could influence how organizations responded to taxation-related factors. Similarly, Kiruga et al. [16] observed that firm size significantly affected organizational outcomes by enhancing access to resources and improving operational efficiency.

Concerns were also widely reported regarding the challenges of implementing data analytics in tax administration. Scholars noted risks of data fragmentation, limited platform interoperability, and lack of skills in revenue administration for model development and validation [13]. Local studies and KRA reports highlighted several operational challenges, such as data fragmentation across multiple providers, inconsistent SME invoice and receipt practices, and limited platform interoperability, as observed by Kimani et al. [15]. KRA [13] emphasized the need for a transparent model and well-defined

guidelines for third-party data sharing to prevent abuse and maintain taxpayer confidence. The literature on mobile money and tax performance indicated that the adoption of digital payments broadened the tax base and increased the possibility of detection, as reported by Apeti [2]. However, policy design was important because taxing digital payments could affect evasion behaviours and have distributional effects, as noted by Maiyo et al. [19]. Owens and Schlenther [28] recommended that SMEs maintain interoperable digital records to minimize false tax claims and ensure that detection efforts resulted in long-term revenue gains without unduly burdening sole traders.

Further studies highlighted the potential of data analytics in transforming tax administration in developing countries. In Rwanda, the acquisition of electronic billing machines and integration of fiscal device data into tax operations demonstrated notable improvements in tax reporting metrics, including larger reported sales bases, improved filing and payment timeliness, and marked increases in tax revenues, as reported by Bellon [6]. Available data indicated that by establishing verifiable transaction trails, the process of making receipts centrally transparent and fiscal reduced the cash-only and off-books leakage channels that were typical of small businesses, according to Irungu and Nekesa [10]. In Tanzania, research on Electronic Fiscal Devices revealed that third-party enforcement through customers complemented administrative analytics because customers' awareness and readiness to demand receipts was a potent enforcement channel [6]. In Uganda, the Electronic Fiscal Receipting and Invoicing System (EFRIS) was implemented with the specific goal of enhancing tax compliance and reducing tax evasion, and evaluations indicated that tax traceability had improved, as noted by Mause [20]. Yet few of these studies directly examined the effect of data analytics on tax evasion among SMEs in Kenya.

In Kenya, tax administration has progressively transitioned from paper-based processes to digitally enabled tax administration through initiatives such as iTax, electronic filing (e-filing), electronic payment (e-payment), electronic tax registers (ETRs), and integration with third-party payment systems [13]. These digital platforms have improved the capture, storage, and analysis of taxpayer information, thereby enhanced transaction traceability and strengthening the ability of tax authorities to detect tax evasion [6, 13]. SMEs increasingly conduct transactions through mobile money, point-of-sale systems, and electronic invoicing, generating digital records that can be analysed to identify inconsistencies between reported income and actual business transactions, as demonstrated by Apeti [2]. Studies have further shown that the adoption of digital tax systems, including iTax and electronic invoicing, has improved tax filing and compliance among registered taxpayers, according to Ominde et al. [25]. Nevertheless, evidence suggests that the effectiveness of these digital systems varies across sectors and business categories, with tax evasion remaining prevalent among many SMEs despite increased digitalisation, as reported by Kandagor [12].

Although Kenya has recorded consistent growth in tax revenue collection following the implementation of digital tax administration reforms, tax evasion continues to undermine domestic revenue mobilisation, particularly among SMEs. Existing studies have primarily attributed tax compliance to behavioural factors, tax audits, penalties, and other conventional enforcement mechanisms, while providing limited attention to the role of data analytics in strengthening tax compliance. Moreover, previous empirical studies have largely focused on the adoption of digital tax systems rather than examining how descriptive, diagnostic, predictive, and prescriptive analytics influence tax evasion. In addition, little empirical evidence exists on whether firm size moderates the relationship between data analytics and tax evasion among SMEs, particularly within Nairobi Central Business District. Consequently, there remains insufficient evidence on the extent to which data analytics can be leveraged to detect, prevent, and reduce tax evasion among SMEs.

This study addressed these knowledge gaps by examining the effect of data analytics on tax evasion among Small and Medium Enterprises in Nairobi Central Business District, Kenya. Specifically, the study investigated the influence of descriptive analytics, diagnostic analytics, predictive analytics, and prescriptive analytics on tax evasion and examined the moderating role of firm size in this relationship. The study was anchored on Economic Deterrence Theory, which explains tax evasion as a rational decision based on the perceived benefits of non-compliance relative to the likelihood of detection and the associated penalties, as proposed by Allingham and Sandmo [1] and Becker [5]. Pfeffer and Salancik [30] were used to explain how organisational resources influence firms' ability to adopt data analytics and comply with regulatory requirements, while Laffer Curve Theory provided insight into how tax structures and firm characteristics influence taxpayer behaviour and compliance outcomes. By integrating these theoretical perspectives, the study sought to generate empirical evidence on how data analytics can complement conventional tax administration approaches, strengthen tax compliance, and enhance domestic revenue mobilisation among SMEs in developing economies.

2. Research Design

This study employed a quantitative research approach to provide a comprehensive understanding of the effect of data analytics on tax evasion among Small and Medium Enterprises (SMEs) in Nairobi Central Business District, Kenya. A cross-sectional explanatory research design was adopted to examine the relationships between descriptive analytics, advanced analytics, and tax evasion while assessing the moderating role of firm size. The study was guided by the positivist research philosophy, which emphasizes objective measurement and empirical testing of hypothesized relationships. This approach enabled the collection and analysis of quantitative

data from SME owners and managers, thereby providing reliable evidence on the extent to which descriptive analytics and advanced analytics influence tax compliance and tax evasion, while also examining whether firm size moderates these relationships.

2.1. Participants and Context

The participants were 391 owners and managers of Small and Medium Enterprises (SMEs) operating within Nairobi Central Business District (CBD), Kenya. The study targeted SMEs because they constitute a significant proportion of registered businesses and play a major role in employment creation, economic growth and domestic revenue generation. A stratified random sampling technique was employed to ensure adequate representation of SMEs across different business sectors, while simple random sampling was used to select the respondents. This approach enhanced the representativeness of the sample and ensured that the findings reflected the diverse characteristics of SMEs operating within Nairobi CBD.

2.2. Data Collection Tools

Data were collected using a structured questionnaire to facilitate the collection of standardized quantitative data. The questionnaire comprised items measuring descriptive analytics, diagnostic analytics, predictive analytics, prescriptive analytics, firm size and tax evasion using a five-point Likert scale. The instrument was adapted from validated measures reported in previous empirical studies and modified to suit the Kenyan SME context. Prior to the main survey, the questionnaire was pilot-tested to establish its validity and reliability. The completed questionnaires provided quantitative data that enabled the examination of the relationships between data analytics, firm size and tax evasion among SMEs.

2.3. Data Collection Procedure

The study commenced with the identification of the sampled SMEs operating in Nairobi Central Business District (CBD). Following this, the researcher obtained the necessary research authorization and sought informed consent from SME owners and managers before administering the structured questionnaires. Participants completed the questionnaires by providing information on the adoption of descriptive analytics, diagnostic analytics, predictive analytics, prescriptive analytics, firm size and tax evasion practices within their enterprises. The completed questionnaires were checked for completeness and consistency before coding and entry into the Statistical Package for the Social Sciences (SPSS), thereby ensuring that the data collected were suitable for subsequent statistical analysis.

2.4. Data Analysis

The quantitative data generated from the structured questionnaires were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 27. Descriptive statistics were used to summarize respondents' characteristics and patterns in the study variables, while Pearson correlation analysis examined the relationships among descriptive analytics, advanced analytics, firm size, and tax evasion. Multiple regression analysis was employed to determine the independent effects of descriptive analytics and advanced analytics on tax evasion, whereas hierarchical regression analysis assessed the moderating effect of firm size by introducing interaction terms in sequential models. This analytical approach enabled the study to establish the statistical significance and explanatory power of the proposed relationships while providing empirical evidence on the role of data analytics in reducing tax evasion among SMEs.

3. Results and Discussion

The study sought to examine the effect of data analytics on tax evasion among Small and Medium Enterprises (SMEs) in Nairobi Central Business District, Kenya. Specifically, the study examined the effect of descriptive analytics on tax evasion, the effect of advanced analytics on tax evasion and the moderating effect of firm size on the relationship between data analytics and tax evasion. Participants were asked to indicate the extent to which they agreed with statements relating to descriptive analytics, diagnostic analytics, predictive analytics, prescriptive analytics, firm size, and tax evasion. Responses to the Likert-scale statements were analysed using descriptive and inferential statistics to determine the relationships among the study variables and to test the proposed hypotheses. The findings are presented according to the three study objectives, beginning with descriptive statistics and followed by regression analyses, as illustrated in the subsequent tables.

3.1. Effect of Descriptive Analytics on Tax Evasion

The first objective of the study was to determine the effect of descriptive analytics on tax evasion among Small and Medium Enterprises (SMEs) in Nairobi Central Business District, Kenya. Participants were asked to indicate the extent to which they agreed with statements relating to descriptive analytics using a five-point Likert scale ranging from strongly disagree to strongly agree. Descriptive statistics were computed to summarize the respondents' perceptions of descriptive analytics, while regression analysis was conducted to determine its effect on tax evasion. The findings are presented in [Table 1](#).

Table 1. Descriptive Analytics on Tax evasion.

Statement	Mean	Std. Deviation
Filing tax returns within the deadlines set by KRA is important to a business	4.38	.912
Late filing of tax returns attracts penalties for the business	3.84	1.314
Outstanding tax arrears might affect business operations in the future	4.38	.912
Composite Mean	4.20	1.063

Table 1 illustrates that respondents strongly agreed that filing tax returns within the deadlines set by KRA is important to a business, with a mean of 4.38 and a standard deviation of 0.912. This finding implies that SMEs recognize the importance of timely tax filing as a fundamental compliance obligation. Respondents also strongly agreed that outstanding tax arrears might affect business operations in the future, also with a mean of 4.38 and a standard deviation of 0.912. This finding suggests that SMEs understand the long-term consequences of accumulating tax debt, including potential business disruptions. Respondents further agreed that late filing of tax returns attracts penalties for the business, with a mean of 3.84 and a standard deviation of 1.314. This implies that SMEs are aware of the punitive consequences associated with non-compliance. The composite mean for descriptive analytics was 4.20 with a standard deviation of 1.063, suggesting that to a large extent respondents recognized the importance of descriptive analytics for monitoring filing deadlines and tracking tax obligations.

The regression analysis results revealed that descriptive analytics had a positive and statistically significant effect on tax compliance (reduction of tax evasion) among SMEs in Nairobi CBD. The final regression model showed that descriptive analytics had a standardized beta coefficient of 0.175 with a p-value of 0.033, which was below the significance threshold of 0.05. The correlation analysis also established a positive relationship between descriptive analytics and tax compliance, with a Pearson correlation coefficient of 0.241 at a significance level of 0.044. These findings imply that the application of descriptive analytics enhances the capacity of SMEs to monitor and review financial information, track filing deadlines, and identify outstanding tax arrears, thereby improving tax compliance practices and reducing tax evasion. Since the significance value was less than 0.05, the null hypothesis H01, which stated that descriptive analytics has no significant effect on tax evasion among SMEs in Nairobi CBD, was rejected.

These findings are consistent with the research by Zou [36], which examined the role of artificial intelligence and machine learning classification models in detecting tax evasion among Chinese businesses. The study established that descriptive analytics techniques, such as year-to-year comparisons and expense-to-income ratio analysis, improved the identification of

irregular tax patterns and increased detection accuracy compared to conventional rule-based methods. Similarly, AlQudah et al. [3] examined the effect of machine learning and big data analytics on tax evasion detection in Jordan, surveying 200 auditors from 10 firms, and found that descriptive analytics tools helped auditors identify anomalies in financial records by summarizing historical data and highlighting irregularities in revenue declarations, thereby improving detection accuracy compared to conventional rule-based methods. In the Kenyan context, Kandagor [12] investigated the effect of taxpayer knowledge on turnover tax evasion among SMEs in Kariokor Market, Nairobi, and established that businesses maintaining descriptive records of their financial transactions demonstrated higher compliance levels compared to those that did not. The study found that descriptive analytics, through the analysis of filing patterns and tax arrears, provided a factual starting point for evaluating evasion levels among SMEs. Chege et al. [7] further established that SMEs using basic descriptive analytics tools such as sales summaries and expense tracking were better positioned to meet their tax obligations and avoid penalties associated with late filing and underreporting.

The findings also support the Economic Deterrence Theory proposed by Becker [5], which suggests that taxpayers are less likely to engage in evasion when they perceive a high likelihood of detection. In this context, SMEs are likely to comply with tax obligations when their historical tax records are continuously monitored through descriptive analytics, as the perceived risk of detection increases [10, 12]. The findings further align with the Resource Dependency Theory of Pfeffer and Salancik [30], which explains that organizations depend on external resources, including technological systems and information, to achieve operational efficiency. SMEs that apply descriptive analytics are better positioned to identify errors and irregularities in tax reporting, thereby reducing dependence on external tax consultants and strengthening internal compliance processes [15, 30].

Despite these positive findings, the study differed from the concerns raised by Zou [36] regarding the limitations associated with poor data quality and incomplete records. The present study established that descriptive analytics remained effective among SMEs in Nairobi CBD even with differences in

record-keeping practices across business categories. This suggests that descriptive analytics can still provide meaningful support in improving tax compliance within SMEs operating in developing economies where formal record-keeping may be less standardized. Additionally, while AlQudah et al. [3] noted low adoption of big data analytics due to inadequate technological infrastructure, the current study established that although descriptive analytics positively influenced tax evasion reduction among SMEs in Nairobi CBD, some enterprises still experienced challenges associated with limited digital literacy and low adoption of automated accounting systems, as reflected in the descriptive statistics where the mean for automated accounting system adoption was 2.92 on a five-point scale. These findings demonstrate that descriptive analytics, when applied systematically, can substantially reduce tax evasion among SMEs in developing economies by enhancing monitoring capabilities, improving record-keeping practices, and strengthening the perceived likelihood of detection. This study tested the null hypothesis that descriptive analytics has no significant effect on tax evasion among SMEs in Nairobi CBD. Based on the regression results ($\beta = 0.175$, $p =$

0.033), the null hypothesis was rejected, confirming that descriptive analytics significantly reduces tax evasion among SMEs.

3.2. Effect of Advanced Analytics on Tax Evasion

The second objective of the study was to determine the effect of advanced analytics on tax evasion among Small and Medium Enterprises (SMEs) in Nairobi Central Business District, Kenya. Advanced analytics was measured using three dimensions, namely diagnostic analytics, predictive analytics and prescriptive analytics. Respondents were asked to indicate the extent to which they agreed with statements relating to each dimension using a five-point Likert scale ranging from strongly disagree to strongly agree. The descriptive statistics for the three dimensions of advanced analytics are presented in Table 2.

Table 2. Descriptive Statistics for Advanced Analytics.

Dimension	Statement	Mean	SD
Diagnostic Analytics	A cash-based bookkeeping system makes it difficult to report income taxes accurately.	3.72	1.365
	The use of an automated accounting system improves data analysis and reporting.	2.92	1.361
	Employees' digital literacy enables effective use of the tax system and reduces tax-related errors.	3.74	1.323
	Composite Mean	3.46	1.350
Predictive Analytics	High compliance with tax laws helps businesses avoid lawsuits.	3.46	1.403
	Failure to meet tax obligations may lead to litigation.	3.86	1.299
	Overstating expenses reduces tax liability.	4.38	0.912
	Composite Mean	3.90	1.222
Prescriptive Analytics	Adopting digital accounting systems improves tax compliance.	3.57	1.400
	Adequate tax education and training help employees understand tax laws.	3.25	1.366
	Availability and use of tax manuals support accurate tax reporting.	3.74	1.360
	Composite Mean	3.52	1.376

Table 2 illustrates that respondents agreed that a cash-based bookkeeping system makes it difficult to accurately report income taxes for tax purposes, with a mean of 3.72 and a standard deviation of 1.365. This finding suggests that reliance on manual cash-based records creates opportunities for errors and intentional misreporting, thereby increasing tax evasion risks. Respondents also agreed that the level of digital literacy among employees enables effective use of the tax system and reduces tax-related errors, with a mean of 3.74 and a standard

deviation of 1.323. This finding implies that investing in employee digital skills can directly improve tax compliance by lowering tax filing mistakes and improving understanding of tax obligations. Similar outcomes were reported by Kimani et al. [15], who found that diagnostic analytics helped identify root causes of non-compliance, including cash-based bookkeeping systems, limited digital literacy, and inadequate understanding of tax obligations, with SMEs using diagnostic analytics better positioned to identify errors and irregularities

in tax reporting. However, respondents were neutral regarding whether the use of an automated accounting system improves data analysis and reporting, with a mean of 2.92 and a standard deviation of 1.361. This neutral response implies that adoption of automated accounting systems among SMEs in Nairobi CBD is not yet widespread or that respondents have limited experience with such systems. This finding contrasts with the concerns raised by Bellon [6] regarding the limitations associated with poor data quality and incomplete records. Despite these challenges, the composite mean for diagnostic analytics was 3.46 with a standard deviation of 1.350, indicating moderate agreement that diagnostic analytics capabilities help identify root causes of tax compliance challenges. These findings support the Economic Deterrence Theory proposed by Becker [5], which suggests that enhanced detection capabilities through diagnostic analytics raise the perceived probability of being caught, thereby deterring tax evasion [10, 12].

In relation to predictive analytics, Table 2 shows that respondents strongly agreed that overcasting expenses reduces tax liability for a business, with a mean of 4.38 and a standard deviation of 0.912. This finding implies that SMEs are aware of common tax evasion techniques, specifically the manipulation of expense reporting to lower taxable income. Respondents also agreed that failing to meet tax obligations might lead to litigation proceedings for a business, with a mean of 3.86 and a standard deviation of 1.299. This implies that SMEs recognize the legal consequences of non-compliance, including the potential for costly legal disputes. The research respondents agreed to a lesser extent that high compliance levels with tax laws and regulations helps businesses avoid lawsuits, with a mean of 3.46 and a standard deviation of 1.403. This implies that while SMEs understand the protective value of compliance, this understanding may be less strongly held than awareness of evasion techniques. These findings align with Sánchez et al. [33], who found that predictive analytics, through the use of machine learning classifiers, helped identify SMEs at high risk of underreporting, late filing, or intentional evasion, with predictive models using historical tax records, financial indicators, and behavioural tendencies effective in estimating the probability of non-compliance. In Kenya, Owens and Schlenker [28] found that predictive analytics, through risk-scoring models, helped identify possible tax evasion by analysing historical tax records, financial indicators, and behavioural tendencies, enabling tax authorities to allocate limited enforcement resources more effectively. The composite mean for predictive analytics was 3.90 with a standard deviation of 1.222, suggesting that SMEs recognize the predictive relationship between compliance behaviours and business outcomes. Chege et al. [7] further established that predictive analytics helped the Kenya Revenue Authority identify SMEs at high risk of non-compliance, enabling targeted audits and interventions that improved overall compliance rates.

Concerning prescriptive analytics, the study findings revealed that respondents agreed that the availability and use of tax manuals support accurate tax reporting, with a mean of

3.74 and a standard deviation of 1.360. This finding implies that providing accessible reference materials can help SMEs improve their tax filing accuracy. This supports Kotsogiannis [17], who found that prescriptive analytics helped regulators and policymakers identify the best ways to increase SME compliance by recommending targeted interventions, with simulation models determining whether the best ways to reduce evasion would be through digital reporting tools, targeted audits, tax education, or harsher fines. Respondents also agreed that adopting a digital accounting system improves tax compliance level within a business, with a mean of 3.57 and a standard deviation of 1.400. This implies that SMEs perceive technology adoption as a pathway to better compliance outcomes. This finding aligns with Bellon [6], who demonstrated that digital reporting and e-invoicing greatly reduced VAT evasion in Peru by enabling prescriptive analytics that recommended specific actions for improving compliance. Maiyo et al. [19] further established that prescriptive analytics helped SMEs reduce their exposure to evasion issues by recommending best practices for financial reporting and record-keeping, finding that SMEs that followed prescriptive recommendations were better positioned to comply with tax obligations and avoid penalties. However, respondents were neutral regarding whether adequate tax education and training help employees to understand tax laws and regulations, with a mean of 3.25 and a standard deviation of 1.366. This neutral response implies that many SMEs may not have adequate access to tax training programs or may not prioritize employee tax education. This finding contrasts with Kandagor [12], who investigated the effect of taxpayer knowledge on turnover tax evasion among SMEs in Kariokor Market, Nairobi, and established that taxpayer education and simplified filing procedures significantly improved tax compliance among SMEs. However, the findings are complementary rather than contradictory, as prescriptive analytics can deliver taxpayer education and simplified guidance through digital platforms. The composite mean for prescriptive analytics was 3.52 with a standard deviation of 1.376, indicating moderate agreement that prescriptive recommendations can enhance tax compliance. These findings support Maiyo et al. [19], who established that prescriptive analytics helped SMEs improve their tax compliance by providing actionable recommendations on record-keeping, digital accounting systems, and tax education. SMEs that adopted prescriptive recommendations experienced reduced tax evasion and improved compliance outcomes.

Due to severe multicollinearity among diagnostic, predictive, and prescriptive analytics with correlation coefficients ranging from 0.831 to 0.862, which exceeded the recommended threshold of 0.80 as recommended by Tabachnick and Fidell [34], these three variables were combined into a composite Advanced Analytics Index (AAI). The study findings revealed that the Advanced Analytics Index had a strong, positive, and statistically significant effect on tax compliance among SMEs in Nairobi CBD. The final regression model showed that the Advanced Analytics Index had a standardized

beta coefficient of 0.408 with a p -value of 0.003, which was below the significance threshold of 0.05. This effect was more than twice the magnitude of descriptive analytics alone (0.175), indicating that advanced analytics capabilities are particularly powerful for reducing tax evasion. The correlation analysis further established a strong positive relationship between the Advanced Analytics Index and tax compliance, with a Pearson correlation coefficient of 0.687 at a significance level of 0.01. This finding implies that the integrated use of diagnostic analytics (identifying root causes of tax inconsistencies), predictive analytics (anticipating tax-related risks), and prescriptive analytics (providing actionable recommendations) enables SMEs to comprehensively address tax compliance challenges. These findings align with the Economic Deterrence Theory, which suggests that enhanced detection capabilities through advanced analytics raise the perceived probability of being caught, thereby deterring tax evasion [10, 12]. They also support the Resource Dependency Theory, which explains that organizations with greater access to technological resources are better positioned to meet regulatory requirements [6, 15]. Comparable evidence was reported by Kotsogiannis [17], who demonstrated that prescriptive analytics helped policymakers identify effective interventions for improving SME compliance. Bellon [6] found that digital reporting and e-invoicing significantly reduced VAT evasion in Peru by enabling comprehensive analytics capabilities. In the Kenyan context, Kandagor [12] established that taxpayer education and simplified filing procedures, which are examples of prescriptive recommendations, significantly improved tax compliance among SMEs in Nairobi. Maiyo et al. [19] found

that diagnostic and prescriptive analytics helped SMEs improve tax compliance by identifying root causes of non-compliance and providing actionable recommendations. Sánchez et al. [33] established that predictive analytics, through machine learning classifiers, helped identify SMEs at high risk of non-compliance. These findings collectively demonstrate that advanced analytics capabilities, when integrated and applied systematically, can substantially reduce tax evasion among SMEs in developing economies. This study tested the null hypotheses that diagnostic analytics, predictive analytics, and prescriptive analytics have no significant effect on tax evasion among SMEs in Nairobi CBD. However, since these three variables exhibited severe multicollinearity, they were combined into a composite Advanced Analytics Index. The regression results for the Advanced Analytics Index ($\beta = 0.408$, $p = 0.003$) were statistically significant, leading to the rejection of the null hypotheses.

3.3. Moderating Effect of Firm Size

The third objective of the study was to determine the moderating effect of firm size on the relationship between data analytics and tax evasion among Small and Medium Enterprises (SMEs) in Nairobi Central Business District, Kenya. Firm size was examined to establish whether it strengthened or weakened the relationship between data analytics and tax evasion. Hierarchical regression analysis was employed to assess the moderating effect of firm size, while interaction terms were used to determine the statistical significance of the moderation effect. The findings are presented in Table 3.

Table 3. Descriptive Statistics for Firm Size.

Statement	Mean	Std. Deviation
Businesses with high total assets pay less amount of tax to the taxing authority	3.68	1.120
Businesses with low total assets pay less amount of tax to the taxing authority	3.52	1.080
Total assets of a business do not determine the level of tax to be paid by the business	3.45	1.150
Composite Mean	3.55	1.117

Table 3 illustrates that respondents agreed that businesses with high total assets pay less amount of tax to the taxing authority, with a mean of 3.68 and a standard deviation of 1.120. This finding implies that respondents perceive larger firms with substantial assets as more likely to engage in tax evasion practices, possibly through sophisticated tax planning mechanisms or aggressive tax avoidance strategies. Respondents also agreed that businesses with low total assets pay less amount of tax to the taxing authority, with a mean of 3.52 and a standard deviation of 1.080. This finding suggests that smaller firms with limited assets are also perceived as evading

taxes, potentially due to informal operations, weak record-keeping systems, or limited regulatory oversight. Respondents further agreed that total assets of a business do not determine the level of tax to be paid by the business, with a mean of 3.45 and a standard deviation of 1.150. This implies that while respondents perceive both high and low asset businesses as engaging in tax evasion, they also recognize that factors beyond firm size influence tax compliance behaviour. The composite mean for firm size was 3.55 with a standard deviation of 1.117, indicating that respondents perceived firm size as a relevant factor in tax compliance behaviour. This finding implies that

business owners and managers believe that the size of an enterprise influences its tax practices and compliance outcomes, which supports the inclusion of firm size as a moderating variable in this study.

The hierarchical regression analysis revealed that firm size had a significant moderating effect on the relationship between data analytics and tax evasion among SMEs in Nairobi CBD. The interaction term between descriptive analytics and firm size was negative and statistically significant with a coefficient of -0.163, a standardized beta of -0.198, and a p-value of 0.000, which was below the significance threshold of 0.05. This finding implies that firm size significantly moderates the relationship between descriptive analytics and tax evasion, meaning that the effect of descriptive analytics on improving tax compliance becomes stronger as firm size increases. In practical terms, a large SME with more employees, higher total assets, and greater annual turnover will benefit more from implementing descriptive analytics tools than a small SME with limited resources. The interaction term between the Advanced Analytics Index and firm size was also negative and statistically significant with a coefficient of -0.203, a standardized beta of -0.229, and a p-value of 0.000, which was below the significance threshold of 0.05. This finding implies that firm size significantly moderates the relationship between advanced analytics and tax evasion as well, with larger SMEs benefiting more from advanced analytics capabilities in reducing tax evasion compared to smaller SMEs.

The simple slopes analysis further revealed important patterns about how the effectiveness of data analytics varies across different firm sizes. For small firms, defined as that one standard deviation below the mean in terms of employees, assets, and turnover, the effect of descriptive analytics on tax compliance was 0.089 with a p-value of 0.124, which was not statistically significant. This finding implies that for very small SMEs, descriptive analytics alone may not be sufficient to produce meaningful improvements in tax compliance. However, the effect of advanced analytics on tax compliance for small firms was 0.245 with a p-value of 0.031, which was statistically significant, suggesting that even small firms can benefit from advanced analytics capabilities, though the effect size is moderate. For medium firms, defined as those at the mean level of firm size, both descriptive analytics and advanced analytics had significant effects. Descriptive analytics had a beta of 0.175 with a p-value of 0.033, while advanced analytics had a beta of 0.408 with a p-value of 0.003, indicating that medium-sized SMEs benefit significantly from both types of analytics, with advanced analytics providing approximately double the benefit of descriptive analytics alone. For large firms, defined as that one standard deviation above the mean, both effects were strongest and most significant. Descriptive analytics had a beta of 0.261 with a p-value of 0.001, while advanced analytics had a beta of 0.571 with a p-value of 0.000, implying that large SMEs experience the greatest reduction in tax evasion from adopting data analytics technologies. The pattern revealed by the simple slopes analysis shows

a clear progression: as firm size increases, the effectiveness of both descriptive and advanced analytics in reducing tax evasion increases progressively.

These findings align with the Resource Dependency Theory proposed by Pfeffer and Salancik [30], which explains that organizations with greater resources are better positioned to adapt to external regulatory requirements and technological changes. The findings also support the Laffer Curve Theory, which suggests that factors like business size, sector characteristics, and access to digital technologies influence taxpayer behaviour and tax compliance outcomes, as reported by Sánchez et al. [33]. Consequently, larger SMEs are more capable of adopting data analytics tools that strengthen compliance and reduce tax evasion.

Similar outcomes were reported by Le et al. [18], who investigated the moderating role of firm size in the relationship between tax compliance and firm performance among 322 non-financial companies listed on the Ho Chi Minh Stock Exchange from 2016 to 2023. The results showed that tax compliance positively affected financial performance, especially among small enterprises, and firm size moderated this relationship, as the positive impact of tax compliance decreased in large enterprises. This finding suggests that the benefits of compliance are more pronounced for smaller firms, while larger firms may have more resources to absorb compliance costs or engage in tax planning strategies that mitigate the performance benefits of compliance. Orkoh and Levin [27] used firm-level data and an instrumental variable approach in Ghana to establish that firm size determines the relationship between tax burden and compliance, finding a nonlinear relationship where compliance rises with moderate tax increases up to a threshold of 45 percent, beyond which compliance declines, with this threshold varying by firm size. Medium-large firms exhibited a 30 percent threshold, micro enterprises 46 percent, and small enterprises 49 percent, demonstrating that firm size determines the level of tax burden that firms can tolerate before compliance begins to decline. The findings further support Islam [11], who found that tax evasion risk is generally thought to be influenced by firm size, while Omboi and Muhwa [24] further established that larger SMEs may have more sophisticated accounting systems and better incentives to maintain good standing with authorities, whereas extremely tiny firms may operate informally or under the threshold for strict regulation. These findings collectively demonstrate that firm size plays a critical moderating role in the relationship between data analytics and tax evasion among SMEs in Nairobi CBD, with larger firms better positioned to leverage data analytics technologies for improved tax compliance compared to smaller firms that face resource constraints and limited digital adoption capabilities. This study tested the null hypothesis that firm size has no significant moderating effect on the relationship between data analytics and tax evasion among SMEs in Nairobi CBD. The interaction terms for both descriptive analytics $\times$ firm size ($\beta = -0.198$, $p = 0.000$) and advanced ana-

lytics $\times$ firm size ($\beta = -0.229$, $p = 0.000$) were statistically significant, leading to the rejection of the null hypothesis.

4. Conclusion and Recommendations

The study demonstrates that data analytics, when integrated as a supplementary tool in tax administration, significantly enhances tax compliance and reduces tax evasion among Small and Medium Enterprises (SMEs) in Nairobi Central Business District, Kenya, particularly through descriptive analytics and advanced analytics encompassing diagnostic, predictive, and prescriptive capabilities. By providing structured monitoring of filing deadlines, identification of tax arrears, diagnostic analysis of compliance challenges, predictive assessment of tax risks, and prescriptive recommendations for improved practices, data analytics facilitates more organized financial record-keeping, improved tax reporting accuracy, and more coherent compliance behaviour among SMEs. Furthermore, it helps mitigate common barriers such as poor record-keeping, limited digital literacy, and inadequate understanding of tax obligations, thereby fostering greater taxpayer confidence and engagement in the compliance process. Although concerns regarding severe multicollinearity among diagnostic, predictive, and prescriptive analytics necessitated their combination into a composite Advanced Analytics Index, the integrated approach proved methodologically sound and theoretically meaningful, as these constructs collectively represent a higher-order capability distinct from descriptive analytics and particularly powerful for reducing tax evasion. The study further established that firm size plays a critical moderating role in the relationship between data analytics and tax evasion among SMEs, with larger firms benefiting more from both descriptive and advanced analytics compared to smaller firms, underscoring the importance of firm size as a resource factor that determines how much benefit an SME can derive from data analytics investments. The findings confirm the applicability of the Economic Deterrence Theory, the Resource Dependency Theory, and the Laffer Curve Theory in the context of SME tax compliance in Kenya, demonstrating that enhanced detection capabilities, greater organizational resources, and optimal tax policies respectively contribute to improved tax compliance behaviours among SMEs. In light of these findings, it is recommended that the Kenya Revenue Authority strengthen the use of descriptive and advanced analytics to monitor taxpayer behaviour, identify filing irregularities, and detect potential cases of non-compliance at an early stage, while investing in advanced analytics infrastructure that enhances tax administration and revenue collection. The government, through the National Treasury, should support investments in digital analytics technologies and strengthen the legal and regulatory framework governing the application of artificial intelligence and data analytics in tax administration while ensuring adequate data privacy and security. SME owners and managers should invest in digital analytics tools that support accurate financial reporting, monitoring of tax obligations, and timely

compliance with tax requirements, including automated accounting software, electronic invoicing systems, cloud-based record-keeping platforms, and reporting dashboards, while investing in regular employee training on digital financial systems, KRA platforms such as iTax and eTIMS, and sound record-keeping practices. Furthermore, because firm size moderates the effectiveness of data analytics, smaller SMEs should consider collaborative approaches such as shared digital platforms or business associations to improve access to analytics technologies, while the Kenya Revenue Authority should provide targeted support to smaller firms through simplified digital compliance procedures, user-friendly platforms, and taxpayer education programmes. Moreover, institutions should establish clear guidelines and support systems to address issues of data quality, digital literacy gaps, and compliance costs while encouraging responsible innovation and technology adoption, with the government considering providing incentives, including tax relief or subsidies, to encourage SMEs, particularly smaller enterprises, to adopt digital analytics technologies. Future research is encouraged to examine the long-term impact of data analytics on tax compliance and evasion, its influence on higher-order compliance behaviours such as voluntary disclosure and tax planning, its role in specific sectors and industries, and the balance between technological enforcement and taxpayer education. Such efforts will contribute to optimizing the potential of data analytics tools in tax administration while safeguarding revenue collection and equity, particularly in developing country contexts where SMEs constitute a substantial portion of economic activity and tax evasion remains a significant challenge to domestic revenue mobilization.

Abbreviations

AAI	Advanced Analytics Index
CBD	Central Business District
EDT	Economic Deterrent Theory
KRA	Kenya Revenue Authority
RDT	Resource Dependency Theory
SMEs	Small and Medium Enterprises

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Conflicts of Interest

The authors declare no conflicts of interest.

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