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Original Article

The Impact of Cash Register Machine on Value Added Tax Income: A Case of Wolaita Sodo Town

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Abstract

Introduction: Taxation is a mandatory financial obligation imposed by governments to fund public expenditures, with a long history in Ethiopia. The introduction of cash register machines (CRMs) has significantly improved Value Added Tax (VAT) compliance and revenue collection in several countries, including Ethiopia, by reducing sales underreporting and increasing transaction transparency. Despite these gains, VAT revenue in Ethiopia still falls short of its potential. Limited taxpayer awareness, high operating costs, inconsistent audit follow-up, and mixed perceptions of CRMs continue to undermine full compliance. This study therefore addresses the central problem of how these factors affect the effectiveness of CRMs in enhancing VAT income in Wolaita Sodo Town, Southern Ethiopia.

Methods: The study employed a quantitative research approach with a **causal** research design. The target population consisted of 1,145 individuals: 1,124 taxpayers, 18 VAT experts from the tax authority, and 3 cash register machine suppliers. Using random sampling for taxpayers and purposive sampling for VAT experts and suppliers, a total of 317 respondents were selected. Structured questionnaires were distributed to these respondents to assess the challenges associated with using cash register machines to collect VAT.

Results: The research highlights the positive impact of cash register machines (CRMs) on Value Added Tax (VAT) collection in Wolaita Sodo Town, attributing success to significant awareness and training efforts. However, it points out the need for improvements in audit transparency and cost management. It was found that while CRMs are effective in reducing VAT evasion, particularly with audit follow-ups, there's room for enhancing audit processes and reducing operational expenses.

Conclusion: The study concludes that there is positive perception among businesses about the use of cash register machines for VAT collection, driven by effective training and awareness initiatives. Despite mixed opinions on the identification of VAT evasion, there is a consensus on the critical role of tax audit follow-ups in reducing evasion, although concerns remain about audit process transparency and additional operational costs. The study emphasizes that while perceptions of cash register machines are important, the real fiscal benefits will only be realized through stronger tax enforcement and enhanced taxpayer knowledge.

Keywords: VAT, VAT policy, Tax Compliance, Audit follow up, Tax evasion, Administration cost, Attitudes, Cash Register Machines

Introduction

Taxation represents a mandatory financial charge or some other type of levy imposed upon a taxpayer (an individual or legal entity) by a governmental organization in order to fund various public expenditures and failure to comply results in legal penalties. It, in its essence, is the sacrifice of a portion of an individual's or entity's wealth for the utilization by public authorities, including both the state and local governance structures (1-3). Taxes are a primary source of public revenue, enabling governments to fund essential services such as infrastructure, health care, social security, and defense. The goal of any tax system is to generate sufficient revenue to support these public expenditures. While developed nations often supplement taxes with alternative revenue sources, many developing countries depend heavily on taxation to finance government operations (4-6).

Taxation serves as a pivotal method for governments to amass revenue required for spending on goods and services. Compared to developing countries, developed nations have succeeded in accruing substantial revenue through the imposition of taxes, largely due to the efficiency of their tax systems. These systems are often characterized by their

economic efficiency, administrative simplicity, flexibility, political accountability, and fairness, unlike those in developing economies, which are hampered by limited monetization and underdeveloped formal sectors (7,8).

Empirical research in various countries shows that cash register machines (CRMs) improve Value Added Tax (VAT) compliance and revenue by reducing sales underreporting and enhancing record accuracy. However, the effectiveness of CRMs is not uniform (9,10). There are several study reports that revealed effective implementation CRN implementation to collect taxes. For instance, studies from Nigeria (11), Tanzania (12), Greece (13), Rwanda (14,15) and Zimbabwe (16) have documented significant improvements in VAT collection following CRM implementation, demonstrating their potential when supporting conditions are met.

One critical aspect affecting the impact of CRM on VAT income is the knowledge and awareness of business owners and operators regarding VAT regulations and the benefits of using CRMs (17). Limited knowledge about VAT regulations and the benefits of CRMs may lead to non-compliance and evasion practices (3,18,19). Additionally, the effectiveness of CRMs in

combating VAT evasion may be influenced by the level of tax audit follow-up conducted by MOR. Adequate tax audit follow-up can deter businesses from engaging in evasion practices, as the risk of detection and penalties increases (20,21). Furthermore, the use of CRMs entails operational costs for businesses, including the initial purchase, maintenance, and employee training. These costs can influence businesses' willingness to comply with CRM requirements and may affect the overall effectiveness of CRMs in reducing VAT evasion (22). Another crucial factor is the perception and attitude of business owners and operators toward using CRMs. Positive perceptions are linked to higher compliance rates and more effective sales recording (10,13,18,19,23).

The concept and practice of taxation have deep historical roots, with evidence of its existence dating back to ancient civilizations, such as the Axumite period in Ethiopia (5). The adoption of CRMs since their 2008 introduction in Addis Ababa and nationwide expansion by 2010/11 has improved VAT compliance and revenue collection (24,25). These devices, offered in a range of prices and supplied by accredited vendors, have enhanced the integrity and transparency of tax collection by reducing sales underreporting and tax evasion (26).

Comprehensive support and training have further eased businesses' transition to electronic reporting (27) contributing to Ethiopia's broader fiscal stability goals (28). The VAT system is a crucial revenue source for governments worldwide, including Ethiopia. However, VAT evasion remains a significant challenge, undermining the effectiveness of the tax system and reducing revenue collection (29). VAT evasion occurs through various means, including underreporting of sales, over reporting of purchases, and completely unregistered businesses (30).

In Ethiopia, the Ministry of Revenue (MOR) has implemented several measures to combat VAT evasion, including the mandatory use of cash register machines (CRMs) for businesses with an annual turnover exceeding a specified threshold (8,31,32). Despite these efforts, VAT revenue collection has not reached its potential, indicating potential challenges in the implementation of CRM requirements and the effectiveness of these machines in combating VAT evasion. The Ministry of Revenue (MOR) of Ethiopia has put several strategies in place to address VAT evasion, such as requiring businesses with an annual turnover above a certain limit to use CRMs (33,34). Nevertheless, VAT revenue collection has fallen short of its possible

targets, suggesting that there may be difficulties in implementing CRM mandates and that these devices may not be as effective in reducing VAT evasion.

In Ethiopia, despite these documented successes, little research has examined why VAT revenues still fall short of potential in specific local contexts. In particular, evidence is scarce on how factors such as taxpayer awareness, perceptions of CRMs, operational costs, and audit follow-up affect CRM effectiveness in regional towns like Wolaita Sodo (7,8,35,36). This study aims to investigate the impact of CRM on VAT income in Wolaita Sodo town, focusing on the following variables: knowledge and awareness of VAT regulations, VAT evasion, tax audit follow-up, operation costs of CRMs, and the perception and attitude of using CRMs.

Methods and Materials

Research approach

The study used a quantitative survey to assess the impact of cash register machines (CRMs) on VAT income. A quantitative research approach was chosen to allow for objective measurement and statistical analysis of relationships among key variables—such as knowledge, audit follow-up, operational costs, and taxpayer perceptions—across a large population of

taxpayers, tax experts, and CRM suppliers. This approach enables generalizable findings and helps identify the strength and significance of factors influencing CRM effectiveness in Wolaita Sodo town.

Research Design

The research design provides the overall strategy for addressing the research problem. This study assesses the impact of cash register machines on VAT income in Wolaita Sodo town for the period 2017-2021 and adopts a causal research design. Data were collected through structured questionnaires administered to taxpayers, VAT experts, and CRM suppliers and VAT revenue records were reviewed. The data were coded and entered into SPSS for analysis using descriptive statistics, correlation, and multiple regressions to measure and test the relationships between CRM use and VAT revenue.

Target population

The total population of machine supplying organizations staffs are 3 (that has branch in Wolaita Sodo), Value added tax registered business entities owners or managers are 1,124 and tax experts and administrators in Wolaita Sodo town administration are 18, The total population is 1,145 among them 296 was taken as a sample of the rest and those sampled

population were selected from the entire target population.

Sample size

The mathematical formula used for determining the sample size, the researcher adopted a simplified formula reported in literature (37), assuming a 95 % confidence level

$$n = \frac{N}{1 + N(e^2)}$$

Where,

n = Sample size, N = Desired population number, e = Level of precession that assume and e = 0.05

When the formula is applied to the above population the sample size which is necessary for the study is determined below as follows:

$$n = \frac{1124}{1 + 1124(e^2)} = \frac{1124}{1 + 1124(0.05^2)} = 296$$

The total sample for the study, therefore, was 317 (i.e. 296 taxpayers; 3 machine suppliers; and 18 VAT experts).

Sampling technique

Because the study involved three distinct populations, different sampling methods were applied. Random sampling was used to select respondents from the total taxpayers to ensure unbiased representation. Purposive sampling was used to select CRMs suppliers and VAT experts because these groups are few in number and possess

specialized knowledge essential to the research objectives. Their targeted inclusion ensured the collection of expert insights on CRM implementation and VAT administration that a purely random approach could not guarantee.

Sources of data

The study implemented both primary data and secondary data. As part of primary data source, questionnaires was distributed to machine supplying organizations staffs, from the Value added tax registered organizations and from tax experts and administrators by using different mechanisms, to assess the problems of cash register machine to collect VAT. The source of the secondary data includes VAT income from the organization, researcher papers, journals, text books, Internet sites and web pages.

Data collection method

A survey was used to collect primary data through structured questionnaires, a common method for gathering standardized responses efficiently (38). To ensure reliability and validity, the questionnaire underwent a pre-test with 20 respondents drawn from the target population but not included in the final sample. Feedback from the pre-test helped refine ambiguous questions and improve clarity.

To minimize bias, random sampling was applied to taxpayers, and enumerators were trained to maintain neutrality in administering the survey. Participation was voluntary and confidential, reducing social desirability bias. These measures enhanced the credibility of the data and the robustness of subsequent statistical analyses.

Data presentation and analysis

The data collected using the data collection instrument was presented using tables and graphs and analyzed using percentages, means, and standard deviation in line with the objectives of the intended case study. The data was cleaned, coded, and entered in to Statistical Packages for Social Sciences (SPSS program) version 21 for analysis. The study used descriptive statistics, correlation and multiple regression analysis to establish the relationship between the independent variables of the impact of cash register machine and the dependent variable.

Econometric methodology

Multiple linear regression analysis was used to determine the challenging factors of collection of VAT by using cash register machine.

The dependent variable of the study is VAT revenues and regressed as follows:

$$VAT\ Revenue = \beta_0 + \beta_1 Audit\ follow\ up + \beta_2 Knowledge\ and\ Skill + \beta_3 Tax\ Evasion \\ + \beta_4 Administration\ cost + \beta_5 Attitude\ and\ Perception + \epsilon_i$$

Where,

β_0 = Constant term

β_i = Coefficients of explanatory variables

ϵ_i = Error term

Audit follow up, knowledge and skills, tax evasion, administration cost, and attitude and perception are explanatory variables assumed to have effect on dependent variables (VAT income).

Dependent variable

- **VAT Income:** Total VAT income progress of taxpayers by using cash registers machine, measured using a five-point Likert scale.

Independent variables

- **Audit Follow-up:** Frequency and thoroughness of VAT audits conducted by the local tax authority, measured as an index derived from Likert-scale survey items on scheduling, frequency, and adequacy of audits.
- **Knowledge and Skills:** Taxpayers' awareness and understanding of CRM usage and VAT regulations, measured using composite scores from questionnaire items rated on a five-point Likert scale.
- **Tax Evasion:** Degree of intentional underreporting or non-reporting of sales, captured through respondent self-assessments and perceptions of evasion in

their sector, using a five-point Likert scale.

- **Administration Cost:** Direct costs incurred by businesses for CRM purchase, maintenance, and training, recorded as the annual cost in Ethiopian birr and standardized for analysis. Measured using a five-point Likert scale.
- **Attitude and Perception:** Taxpayers' overall attitude toward CRMs (e.g., perceived ease of use, benefits for transparency), measured as a composite of Likert-scale responses.

Results and Discussion

The results show that respondents exhibit a high level of awareness ($M = 4.189$) regarding VAT collection through CRMs, reflecting effective efforts by the Wolaita Sodo Revenue Branch in awareness creation. There is a moderate positive inclination (mean score of 3.956) among participants towards the potential improvement of business perception through VAT implementation, and taxpayers exhibit reasonable awareness (mean score of 3.885) regarding VAT collection using CRMs. The perceived adequacy of training by ERM Wolaita Sodo Revenue Branch on CRMs usage is high (mean score of 4.216).

Awareness and training on VAT collection

Respondents expressed strong confidence in the knowledge and skills of staff regarding VAT collection through CRMs with a mean score of 4.556, $SD = 0.5113$. The awareness creation programs organized by the Ministry of Revenue (MOR) were also rated favorably (mean = 4.611, $SD = 0.5016$), indicating perceived efficiency in promoting tax morale and compliance. However, there was moderate dissatisfaction regarding the adequacy of training provided to VAT-registered organizations (mean = 3.722, $SD = 1.4060$), suggesting room for improvement. Additionally, respondents generally perceived machine suppliers as performing their duties satisfactorily (mean = 4.444, $SD = 0.5113$).

VAT evasion and audit follow-ups

Regarding VAT evasion, respondents expressed moderate agreement on the fairness of measures against tax evasion (mean = 3.125, $SD = 1.4431$) and noted some shortcomings in identifying evasion (mean = 2.895, $SD = 1.1641$). Nevertheless, there was strong consensus that audit follow-ups significantly reduce evasion (mean = 4.361, $SD = 0.9886$). Opinions varied on the overall effectiveness of VAT implementation in curbing tax evasion (mean = 2.578, $SD = 1.1821$).

Concerns were raised about the adequacy of audit follow-up selection criteria (mean = 2.889, SD = 1.4507), while satisfaction with training provided by the Ethiopian Revenue and Customs Authority (ERCA) was moderate (mean = 4.278, SD = 0.4609). The effectiveness of cash register machines in reducing tax evasion received mixed opinions (mean = 3.778, SD = 0.5483). Despite these concerns, respondents expressed strong confidence in VAT implementation as a deterrent to tax evasion (mean = 4.667, SD = 0.4851).

Tax audit follow-up on VAT collection

Respondents reported concerns regarding the transparency and clarity of taxpayer selection criteria for audits (mean = 1.667, SD = 0.5940). Feedback on the MOR tax audit follow-up system was generally negative (mean = 2.556, SD = 0.8556), highlighting significant challenges. Nonetheless, there was strong belief in the potential of audits to enhance VAT collection (mean = 4.556, SD = 0.5113), indicating that respondents view audits as valuable despite procedural shortcomings.

Tax operation costs and CRM implementation

The use of cash register machines was widely perceived to reduce operational costs (mean = 4.222, SD = 0.5483) and administrative costs (mean = 4.000, SD =

0.7670). However, opinions were more divided regarding additional costs associated with the ERM system (mean = 2.222, SD = 0.7321), indicating neutrality in perceptions. The implementation of VAT was generally seen as a mechanism to improve compliance (mean = 3.444, SD = 1.2935).

Supplier perspectives on supporting machine users

Expressed high confidence in the competency of their staff supporting machine users (mean = 4.333, SD = .5774) and demonstrated commitment to awareness and technical training (mean = 4.333, SD = .5774). While acknowledging the potential for additional costs associated with comprehensive training (mean = 4.667, SD = .5774), responses indicate that suppliers generally perceive the training as manageable.

Regarding budgetary support for machine users, responses varied (mean = 3.333, SD = 1.5275), suggesting differences in suppliers' financial capacity to assist users. Availability of working tools was generally satisfactory (mean = 3.333, SD = .5774). Machine users were perceived as competent in operating cash register machines (mean = 4.000, SD = 1.0000). Finally, suppliers unanimously agreed that their organizations provide exceptional technical training to customers (mean =

5.000, SD = 0.000), reflecting a strong perception of excellence.

The correlation analysis provides key insights into the relationship between VAT income and various factors following the introduction of cash register machines, revealing that VAT income is very strongly positively correlated with VAT evasion ($r = 0.821$, $p < 0.001$), suggesting that higher revenue areas may face greater opportunities or incentives for non-compliance. Similarly, VAT income is strongly positively correlated with tax audit follow-up ($r = 0.835$, $p < 0.001$), indicating that more intense audit activities tend to occur in higher revenue contexts, likely as a countermeasure to rising evasion. The correlation between VAT income and operational costs is also substantial ($r = 0.685$, $p < 0.001$), reflecting that increased revenue streams often necessitate higher operational expenses, possibly due to expanded use of technology or greater compliance requirements. In contrast, perceptions and attitudes towards cash register machines exhibit negligible correlations with VAT income ($r = 0.043$, $p = 0.458$) and VAT evasion ($r = 0.001$, $p = 0.984$), indicating that subjective factors such as user attitudes are less influential on fiscal outcomes than objective elements like audit practices and operational costs.

Overall, these findings emphasize the critical role of robust audit mechanisms in enhancing VAT compliance and highlight potential areas for improving technology engagement and user training to maximize the effectiveness of cash register machines in tax collection.

The regression model assessing the impact of cash register machines on VAT income in Wolaita Sodo town demonstrates a substantial explanatory power, with an R^2 value of 0.784, indicating that approximately 78% of the variability in VAT income is accounted for by the predictors in the model. The Adjusted R^2 of 0.780 further supports the robustness of the model, considering the number of predictors included. The Durbin-Watson statistic of 2.118 suggests no significant autocorrelation in the residuals, affirming the model's adequacy. Knowledge about tax systems and cash register technology significantly influences VAT income, with a coefficient of 0.135 ($p = 0.005$). This finding aligns with previous studies indicating that increased taxpayer knowledge enhances compliance and revenue collection (39,40). VAT evasion exhibits a strong positive relationship with VAT income, with a coefficient of 0.380 ($p < 0.001$). This suggests that higher levels of detected or reported VAT evasion are associated with

increased VAT income, possibly due to more effective detection and recovery efforts (40,41).

Tax audit follow-up also shows a robust positive correlation with VAT income, with a coefficient of 0.302 ($p < 0.001$). The high standardized coefficient of 0.442 underscores the significant impact of rigorous tax auditing on increasing VAT income, consistent with findings from other Ethiopian regions (40,41). Operational costs have a slight positive effect on VAT income, with a coefficient of 0.066 ($p = 0.080$). This non-significant result suggests that while increased operational expenses may be associated with higher revenue, the relationship is not strong enough to draw definitive conclusions (39,40).

Perceptions and attitudes towards CRMs show a minimal and statistically insignificant effect on VAT income, with a coefficient of 0.051 ($p = 0.360$). This indicates that subjective factors like user attitudes are less influential on fiscal outcomes than objective factors like audit practices and operational costs (39,40). The regression analysis highlights the importance of knowledge dissemination and strict audit practices in enhancing VAT income. However, it also underscores the need for improvements in training and

technology engagement to maximize the effectiveness of CRMs in tax collection.

These findings highlight that while technology adoption is essential, effective enforcement, comprehensive audits, and well-structured training programs are critical drivers of VAT revenue improvement. Overall, the study underscores the importance of integrating awareness, technical training, and robust audit mechanisms to optimize VAT collection. To improve VAT collection, the Revenue Branch should expand awareness and training programs, clarify audit procedures, and enhance transparency in taxpayer selection. Operational efficiency and financial support from machine suppliers should be monitored and standardized, while feedback and monitoring systems should be established to track the impact of cash register machines and associated initiatives. These measures will strengthen enforcement, optimize resources, and sustain improvements in VAT revenue.

Ethical Approval and Consent to Participate

Ethical approval was not required for this study because it involved the collection of non-sensitive data from business entities, employees, and machine suppliers through surveys and interviews related to VAT collection practices. Participation was

voluntary, and all respondents provided informed consent before taking part in the study.

Availability of Data and Material

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Access may be subject to restrictions to protect the confidentiality of participating businesses, employees, and machine suppliers.

Competing interests

The author declares no competing interests.

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Authors' contributions

TK conceptualized the study, collected and analyzed the data, and wrote the manuscript.

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