JOURNAL OF ECONOMICS & DEVELOPMENT (JED) - ABOUT JED

Indexation

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1. About the Journal

The Journal of Economics and Development (JED) is a refereed open access peer reviewed research journal published by the Department of Economics at the Saint Augustin University of Tanzania (SAUT). JED mission is to provide a platform for researchers, academics, professionals, practitioners, policy-makers and graduate students in tackling social, economic and development challenges; to impart and share knowledge in the form of high quality empirical and theoretical research papers, case studies and literature reviews. JED serves as a platform for the convergence of ideas and insights from a wide range of academic fields (Multidisciplinary).

JED is dedicated to fostering innovation through the synergy of knowledge. It is a platform for exchanging ideas in new emerging trends in social, economic and development related areas with more focus and exposure. JED ultimate mission is to publish research that strengthens knowledge of economists, policy makers, researchers, academics and graduate students as well.

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Science and Technology: Technology and Innovation, Environmental Studies, Climate Change, Agricultural and Rural Development

JED constitutes a valuable resource of scientific knowledge and applied research results from both academics, practitioners and policy-makers, by becoming an indispensable ally in tackling modern economy's developmental challenges.

2. Submission - General Instructions

Manuscripts should be submitted by one of the authors of the manuscript(s). All manuscripts should be double - spaced typed in Times New Roman font 12 size throughout. Themanuscript should be submitted as attachment to the e-mail. Regardless of the source of the word-processing tool, only electronic Word (doc, files) is preferred for submission. Only submissions by email are strongly preferred to facilitate rapid publication process and minimize administrative costs. All submissions by anyone other than one of the authors of the manuscripts will not be accepted. The submitting author takes responsibility for the paper during submission and peer review processes.

2.1 Manuscript submission

Submit as attachment to the following emails: editor.jed@saut.ac.tz or secretary.jed@saut.ac.tz

3. Types of Research Papers

3.1 Original research papers

These are papers that include original / primary empirical datathat have not been published anywhere. This type of papers normally should not exceed 25 double-spaced pages of text (including

references) and should contain no longer than 10 figures and tables. Such papers should be within a length of 3000-5000 words overall (including everything). This type of papers should be structured as follows: the Abstract, up to 10 Key words, Introduction, Literature review, Methodology, Results,and Discussion, Conclusion, Acknowledgements (if any), Competing Interests (if any), Consent (where applicable), Ethical approval (where applicable) and at least 30 main References.Tables and Figures should be in the appropriate sections of the main text.

3.2 Short Research Articles

They should be written in a form of small single-result findings. Although brief, such articles can include enough information, particularly in the methods and results sections, to allow the reader understand what was done. Such papers should be withinthe range of 2500-4000 words, including 3-4 tables and figuresand about 15-20 key references. It should be structured with Abstract, up to 6 Key words, Introduction, Literature, Methodology, Results and Discussion, Conclusion, Acknowledgements, Competing Interests, Ethical approval (whereapplicable), List of references. Tables and figures should be in the appropriate sections.

3.3 Short Communications

Short Communications are urgent communications of important preliminary results that are very original, of high interest and likely to have a significant impact on the subject area of the journal. A Short Communication needs only to demonstrate a 'proof of principle'. Authors are encouraged to submit an Original Research Paper to the journal following their Short Communication. The length should be about 2500-3500 words, about 2-3 figures and tables, about 15-20 key references. Thestructure should be as described in 3.2.

3.4 Minireview Papers

Minireviews are brief historical perspectives or summaries of developments in fast-moving areas covered within the scope of the journal, and they must be based on published articles. They should be within the range of 2000-3000 words, about 30 references in total, about 3 - 5 figures and/or tables. The subject matter should be within the scope of the journal. The goalof the Minireviews is to provide a concise summary of a particular field in a manner understandable to all readers.

3.5 Policy Papers

The purpose of the policy paper is to provide a comprehensiveand persuasive argument justifying the policy recommendations presented in the paper, and therefore to act as a decision- making tool and a call to action for the target audience. Such papers should be within the range of 2500-3000 words, with about 3-4 figures and/or tables, and about 15-20 key references.

4. Guidelines for Authors

4.1 Manuscript preparation and submission

Preparation and submission of the manuscript should be done according to the journal's instructions. The manuscript texts should be written in English. Manuscripts will be first reviewed by JED Editorial Board. The main text of a manuscript must be submitted as a Word document {.doc} file. The manuscript should be 4500 words minimum to 5000 words maximum, and well-typed on A4 size paper 1.5 space, using 12 pt of Times New Roman. The manuscript.

4.2 Organization and structure of the manuscript.(Important)

Your paper manuscript should be organized/ structured in the following manners:
Title page, (2) Abstract, Key words and JEL Classification, (3) Introduction (the problem & objectives), (4) Literature review, (5) Methodology, (6) Results & Discussion, (7) Conclusion, (8) Acknowledgement if any, (9) References, (10) Appendixes (if more Tables and Figures are included).

Manuscripts should be typed 1.5 in Times New Roman font 12 size throughout. The English Language of the manuscript should be clear, simple and explicit.

The use of the International System of Units (SI) measurements is recommended: m (meter), g (gram), kg (kilogram), µg (microgram), s (second), min (minute), h (hour), d (day), y (year), l (litre), µl (microlitre), ng/ml and excessive use of abbreviations should be avoided. Research papers that have new, significant, innovative and original findings are suitable for consideration by the journal.

4.2.1 Title page

The title is part of a paper that is read the most, and it is usually read first. It is the most important element that defines your study. The initial aim of a title is to capture the reader's attention and to highlight the research problem under investigation. A good title should contain fewest possible words to adequately describe the content and purpose of the study.

The title of the paper should be centered on the page, typed in bold 12-point Times New Roman font, with major words being capitalized. Write the title of your article with capital letter forfirst character. The running title should not exceed 100 characters. Include the names of all authors, their affiliations, e-mail addresses and telephone numbers. Place an asterisk (*) on the name of the corresponding author.

4.2.2 Abstract

Abstract is a brief summary of the whole paper. It should be written in good English, without jargons, numbers, and references. It should be one paragraph of about 150 to 300. It should not contain abbreviations and references.

4.2.3 Keywords

Below the abstract, provide at least 4 to 10 keywords (or short phrases suitable for article indexation).

4.2.4 JEL Classification

Provide up to 4 to 5 important words which identify the subject area of your study.

4.2.5 Introduction

Introduction means "Making a case for your research topic". This means, Introduce the title of your research in a comprehensive manner. Make a case on your study by leading the reader from a general subject area to a particular topic of inquiry. Introduction should provide the scope, context and the significance of the study being conducted. It should explain why the study is important or necessary.

Introduction should summarize current understanding and background information on the topic studied. It should also state the purpose of the study, the Statement of the purpose and the problem statement.

The introduction should not be an extensive literature review, although it should provide sufficient background information for the reader to understand and evaluate the results of the study without referring to previous publications on the same topic.

A good introduction should provide a summary of the study's topic in a manner that lays a foundation for understanding of the research problem.

4.2.6 Statement of the problem

It is the main organizing principle guiding the analysis of your paper. It is where you should focus on what you want to say about your topic. It is the core subject matter of scholarly writing in discovering new knowledge and understanding of the study. It is often written after introduction.

It should explain how the present study/research is a solution to the problem or gap.

If the study has questions or hypotheses, they should be presented after the study objectives.

4.2.7 Aims/objectives of the paper

After the problem statement, a clear written objectives/ aims of the paper should be given. The objectives/aims of the paper should flow directly from the statement of the problem. They should be directed to answering the research question(s)/hypotheses.

4.2 8 Literature review

It is an overview of previously published works on a particular topic. The term can refer to a full scholarly paper or a section of a scholarly work such as books or academic articles. It is a survey of books, scholarly articles, and any other academic sources relevant to a particular theory, and issues. A literature review of academic article/paper should provide a summary description of relevant previous studies related to the topic or research problem being investigated.

4.2.9 Methodology

This section should include sufficient technical information on the way the paper would be conducted (or was conducted).Any procedural details that have been published previously should be referred to by citations. When a modified approach to methodology was used by the author, such modification of the previously published methodology approach should be explained in detail.

4.2.10 Results and Discussion

Results should be described as concisely as possible in one of the following ways: equations, text, table(s), or figure(s). Avoid an extensive use of graphs and tables to present data. The reproducibility and statistical significance of measurements, material or economic variables should be included where possible (relevant).

The discussion should provide an interpretation of the results and their significance with regard topreviously published research work. Reference to previously published results is recommended. Avoid any significant repetition or reiteration of the introduction.

4.2 11 Conclusion

It should be in a form of one paragraph summarizing the most important finding(s) of the research that needs to be provided. It should also include some references cited.

4.2.12 Acknowledgments (If any)

This should include source of any financial support, gifts, technical assistance and advice received from colleagues and others that should be indicated in here.

5. Peer Review Process

All manuscripts submitted to JED must follow focus and scope, and author guidelines of this journal. The submitted manuscripts must address scientific merit or novelty appropriate to the focus and scope. All manuscripts must be free from plagiarism contents. Authors are advised to use plagiarism detection software to do conduct plagiarism check on their manuscripts.

The manuscripts submitted to this journal will be double blind reviewed at least by 2 {two} or more expert reviewers. The reviewers give scientific valuable comments improving the contents of the manuscript.

Final decision to accept or reject the manuscript will be made by Editors according to reviewers comments. Publication of accepted manuscripts including the sequence of published articles will be made by Editor in Chief by considering sequence of accepted date and geographical distribution of authors as well as thematic issue.

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JED provides immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge. JED is an open access journal which means that all its content is freely available without charge to users or / institution. Users are allowed to read, download, copy, distribute, print, search, or link to full text articles in this journal without asking prior permission from the publisher or author.

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5.3 Authorship of the manuscript

The only people who should meet authorship criteria should be those listed as authors in the manuscript, because they are the one who should be able to take public responsibility for the content of the manuscript in the following ways:

(i) have made significant contributions to the conception, design, execution, data acquisition, or analysis/interpretation of the study;
(ii) have drafted the manuscript or revised it critically for important intellectual content;
(iii) have seen and approved the final version of the paper and agreed to its submission for publication.

These are the people to be considered authorship of the manuscript, people who have made substantial contributions to the work reported in the manuscript. People who should be acknowledged in the "Acknowledgements" section of the manuscript, after their written permission to be named as been obtained. The corresponding author should ensure that all appropriate coauthors are included in the authors and no inappropriate coauthors are included in the author list.

6. References

Literature citations in the text and in ***the list of references must follow the APA referencing style*** (current version). Only references cited in text should be included in the list of references. References included in the list must not exceed thirty (30) in numbers.

6.1 Standard Journal Article

(a) Author(s) of article (surname(s)&initials), Year of publication, Title of article, Journal title*(italicized)* volume, issue number, and page numbers. (If more than five authors, list the first author followed by et al*.,(italicized)*

(b) Jin Y., & Yang, H. (2006). The English proficiency of college and university students in China: As reflected in the CET. *Language, Culture and Curriculum, 19*(1), 21-36.

(c) Author(s) Name(s) and Initials. (year), «Title ofarticle», *Journal name*, vol. X, n° X, p. XX-XX. Published conference proceedings

(d) Verbeke, W., Ward, R.W. and Viaene, J. (2000). Probit Analysis of Fresh Meat Consumption in Belgium: Exploring B.S.E. and Television Communication Impact. Agribusiness: *An International Journal,* 16(2), 123-136.

6.2 Books and monographs

Author(s) of book (surname(s), initials& year). *Title of book*. Edition. Place of publication: Publisher; and the year of publication. Name, A., Name, B. (year), *Title of the book,* Edition,Place of publication.

6.3 Chapter or article in a book

Author(s) of chapter (surname(s) & initials). *Title of chapter*. In: Editor(s) name, editors. *Title of Book.* Place of publication: Publisher; Year of publication, Page numbers.

Author(s) Name(s) & Initials. (year). *Title of chapter*, in Name, C. (eds.), *Title of book,* Editor, chap. X, p. XX-XX.

6.4 Proceedings

Name, A., Name, B. (year), « *Title of article*», Proceedings of theXXe symposium XXX, City, Country, p. XX-XX.

6.5 Electronic sources

Author (year), « *Title of document*», http:// full address (accessedday/month/year).

6.6 Manuscript Submissions Covering Letter

The covering letter should be addressed to: The Editor-in- Chief, Journal of Economics and Development (JED). The cover letter should include the names of the author(s), institution(s), e- mail address(es) and the type of the work to be considered forpublication in the JED. The covering letter should be brief and clearly well written.

For a research paper written by a group of researchers, the corresponding author should obtain the consent of all co-authors prior to submission of the manuscript. The soft copy of the original manuscript typed in double spacing and well formatted according to guidelines for authors should be sent as an e-mail attachment to: editor.jed@saut.ac.tz. or secretary.jed@saut.ac.tz

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Journal Website: www.jed@saut.ac.tz

Submissions should be double space on Times New Roman 12 and should not be more than 14` typed pages (about 3500 – 4500 words).
Submit by email: **editor.jed@saut.ac.tz** or **secretary.jed@saut.ac.tz**
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Publication Format: Online publication

6.9 Publication Fees charged

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There is no fee charges for Article Submission

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Impact of Saint Augustine University of Tanzania on national economic development efforts

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Abstract

Saint Augustine University of Tanzania (SAUT) has a critical role to play in local, regional, and national economic development efforts in the country. Higher education and economic development are inextricably linked to one another. Universities have long been seen as partners in economic development processes. Since many people are unfamiliar with economic development as it relates to universities, this is an important subject to be addressed in the university strategic planning. The paper is based on a literature review of development concepts. Improvements in the level of education impact positively on the lives of the people. Development concepts described in this paper include: economic development, sustainable development, and the notion of human capital development. The ways in which SAUT participates in local, regional and national economic development efforts are also described. The paper argues that increase in the level of education makes people more conscious about their role in social development. This has a self propelling effect and is important for sustainable socio-economic development. The paper notes that an increase in the level of education provides the country with needed skills to meet the challenges of socio-economic development and globalisation.

Keywords: Higher education impact, economic development, sustainable development, national efforts, SAUT.

JEL: R10, R11

1. Introduction

Development is a complex issue, with many different and sometimes contentious definitions. A basic perspective equates development with economic growth. The United Nations Development Programme (UNDP, 2008) uses a more detailed definition, development is lead long and healthy lives, to be knowledgeable, to have access to the resources needed for a decent standard of living and to be able to participate in the life of the community. Achieving human development is linked to a third perspective of development which views it as freeing people from obstacles that affect their ability to develop their own lives and communities. Development, therefore, is empowerment: it is about local people taking control of their own lives, expressing their own demands and finding their own solutions to their problems (Todaro, 2003). Development economics is a branch of economics that looks at how development works from an economic perspective in developing nations. As a field, development economics looks not only at traditional economic rubrics, such as GDP or per capita income, but also at standard of living, health care, education, and equal rights opportunities. As a result, development economics concerns itself with political processes and agendas, as well as with more specific economic agendas (Nafziger, 2006). Much of contemporary development economics grows from these early works, although the field has since grown far beyond its early roots into a more holistic look at all the disparate elements that make up a healthy society. Development is the act of making some area of land or water more profitable or productive or useful; "the development of Mwanza resources"; "the exploitation of agricultural and mineral deposits".

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A process in which something passes by degrees to a different stage (especially a more advanced or more mature stage) the development of this idea took years the evolution of Greek civilization the slow development of her skill as a writer (ARD, 2011; WiseGEEK, 2011). Development is about improving quality of life and ensuring that everyone has the choice in what that life looks like. These choices are broadened through the joint effort of local people, governments, institutions of learning, international bodies and a range of civil society organisations including NGOs, community organisations, churches and religious groups. Good development is lead by those living in poverty and tackles the inter-related causes of poverty. It works for long-term change, not quick-fixes (World Vision UK, 2011). Thus it is no wonder that countries with similar average incomes can differ substantially when it comes to people's quality of life-access to education and health care, employment opportunities, availability of clean air and safe drinking water, the threat of crime, and so on (World Bank, 2000).

1.1 The Problem

Economic development is a term which generally refers to the sustained, concerted effort of policymakers and community to promote the standard of living and economic health in a specific area. Such effort can involve multiple areas including development of human capital, critical infrastructure, regional competitiveness, environmental sustainability, social inclusion, health, safety, literacy, and other initiatives. Economic development differs from economic growth. Whereas economic development is a policy intervention endeavor with aims of economic and social well-being of people, economic growth is a phenomenon of market productivity and rise in GDP. Economic growth is one aspect of the process of economic development (Sen, 1983). The scope of economic development includes the process and policies by which a nation improves the economic, political, and social well-being of its people (O'Sullivan and Sheffrin, 2003).

Economic development' is a term that economists, politicians, and others have used frequently in the 20th century. The concept, however, has been in existence in the west for centuries. Modernization, westernization, and especially industrialization are other terms people have used when discussing economic development. Although no one is sure when the concept originated, most people agree that development is closely bound up with the evolution of capitalism and the demise of feudalism (Wikipedia, 2011). Economic development has been understood since the World War II to involve economic growth, namely the increases in per capita, and attainment of a standard of living equivalent to that of industrialised countries (Mansell and Wehn, 1998; Schumpeter and Backhaus, 2003). Economy development can also be considered as a static theory that documents the state of economy at a certain time. Changes in this equilibrium state to document in economic theory can only be caused by intervening factors coming from the outside (Abbott, 2003; Schumpeter (2003).

The study of economic development encompasses theories of industrial/economic modernisation causes, the historical phases or waves of economic development, and the organizational aspects of enterprise development in modern societies with knowledgeable social scientists. Economic development embraces sociological research on a variety of topics including: business organisation, enterprise development, evolution of markets and management, and cross-national comparisons of industrial organisation patterns. In economics, the study of economic development was borne out of an extension to traditional economics that focused entirely on national product, also known as the aggregate output of goods and services. Economic development was concerned with expansion of the people's entitlements and their corresponding capabilities, mobility, nourishment, literacy, education, training and other socio-economic indicators (Hirschman, 1981). Borne out of the backdrop of Keynesian theory that advocates government intervention, and neoclassical economics that stresses reduced intervention. This theory led to increased high-growth in countries such as Singapore, South Korea and Hog Kong, including some planned governments in countries such as Argentine and Chile. Economic development emerged amidst these mid-20th century theoretical interpretations of how economies can prosper a nation (Sen,1983). Also, a major contribution to development economics by other economists asserted that economic development grew to concentrate on the poor regions of the world of Africa, Asia and Latin America, yet on the outpouring of the fundamental ideas and development models (Ranis et al, 2000).

SAUT trains social scientists who can handle all aspects development matters in the communities, from the perspectives that promote human behavior toward development. SAUT social scientists provide insights into the different ways individuals, groups, and institutions can make decisions, exercise power, and respond to needed changes. They conduct research, collect data, look at the data in detail, analyzing historical records on the people's lives, and interpreting the effect of economic development and other aspects of society. Through their studies and analyses, social scientists offer insight into the physical, cultural, social and economic development of humans, as well as the links between human activity and the environment. While a bachelor's degree is the minimum educational requirement for many market and research jobs, however, higher degrees are usually required for advanced and more

technical positions US (Department of Labor, 2009). SAUT graduates have strong quantitative skills that provide them with the latest methods of development, in conducting surveys, analyzing and interpreting the results.

In line with the above background, the main purpose of this paper is to describe the ways in which SAUT impacts on national economic development efforts in Tanzania, and to highlight the meaning of development concepts that address SAUT's national economic development efforts. The outline of this paper is as follows: section 2 deals with methodology; section 3 provides policies for economic development; section 4 explains the meaning of growth, human development and sustainable development; section 5 provides discussion and section 6 concludes.

1.2 Objective

The overall objective of this study was to explore and describe the impact of SAUT on national economic development efforts with a view to shedding some light on the institution's commitment and involvement.

1.2 Research questions

1.2.1 One frequently asked question in this regard is how an institution such as SAUT contributes to national economic development efforts in Tanzania? .

1.2.2 Where should SAUT starts when it comes to deciding the best ways to participate in economic development process?

2. Methodology

Research methodology is a theory of how an inquiry should proceed **(**Aaker et al. 2000). It involves an analysis of the assumptions, principles and procedures in a particular approach to inquiry. Methodologies explicate and define the kinds of problems that are worth investigating (Corbin and Strauss, 2008; Derek and Kerryn, 2020; Barker, 1998; and McCombes, 2023). The paper uses a review of literature to elicit debate and discussion on the possible impact of SAUT on national economic development efforts as presented by different authors. The paper uses journal articles, books, related reports and publications to make their arguments (Bailey,1994).

2.1 Research design

The design used in this study is a descriptive design. This design is intended to provide an appropriate framework for this research. A very significant decision in research design process is the choice to be made regarding research approach since it determines how relevant information for the study will be obtained **(**Fraenkel and Warren, 2002; McCombes, 2023). For this reason, the study used a descriptive design. This design enabled the researcher to collect the relevant secondary information from a wide range of sources on the topic. A descriptive/qualitative design portrays an accurate profile of the people, events and situations. This design offered the researcher a profile of describing relevant aspects of the phenomena of interest from an individual, institutional, organizational, and industrial perspective McCombes (2023).

3. Policies of economic development.

In its broadest sense, the policies of economic development encompass the following major areas: 1. Governments undertaking to meet broad economic objectives such as price stability, high employment, and sustainable growth. Such efforts should include monetary and fiscal policies, regulation of financial institutions, trade, and tax policies. Including pPrograms that provide infrastructure and services such as highways, parks, affordable housing, crime prevention, and education.

2. Job creation and retention through specific efforts in business finance; marketing, neighborhood development, workforce development; small business development, business retention and expansion, technology transfer, and real estate development.

3. The primary focus of economic development is about professionals. One growing understanding in economic development is the promotion of regional clusters and a thriving metropolitan economy (Nafziger, 2006).

In today's global environment, location is vitally important and becomes a key in competitive advantage. The cluster of similar industries, specialties, skilled labour force, and technologies help lower transaction costs and foster a growing environment of commerce, entrepreneurship, exports, and other market productive activities. In addition, local services such as restaurants, stores, and trades experience growth as well, helping to develop a vibrant region for the wider community. Economic Development Administration of a country such as the US recognizes the importance of clusters. With their continued regional innovation clusters initiative aims to create jobs and grow the economy through the geographic concentrations of industries and firms in their need for talent, technology, and infrastructure (WiseGEEK. 2011).

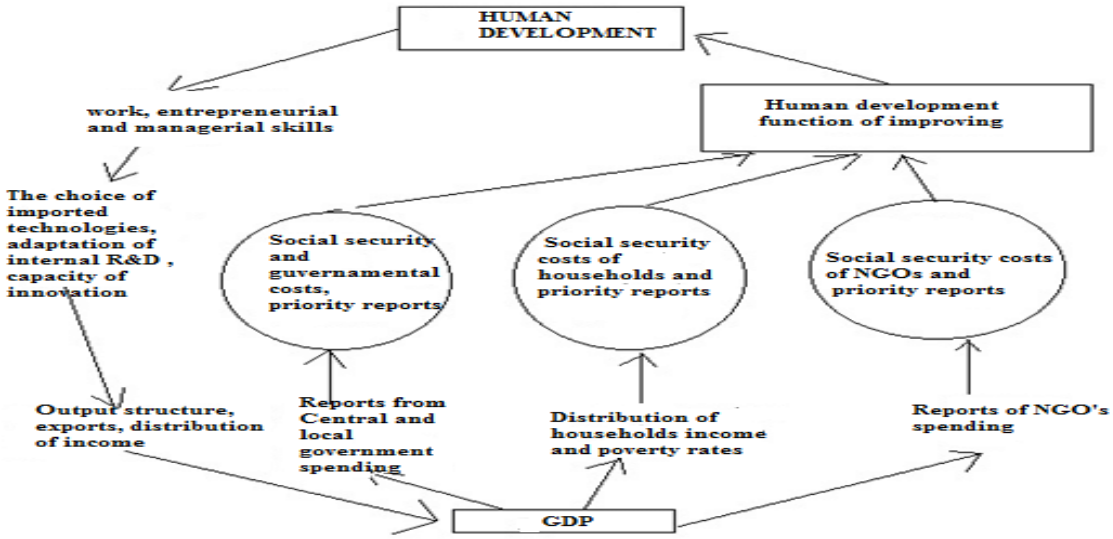
Economic development has evolved into a professional industry of highly specialized practitioners. The practitioners have two key roles, namely: to provide leadership in policy-makers, and to administer policy, programs, and projects. Economic development practitioners generally work in public offices on the state, regional, or municipal level and organizations that may be partially funded by local, regional, state, or federal tax money. As such they function as individual entities and in some cases as departments of local governments. Their role is to seek out new economic opportunities and retain their existing business wealth. Numerous other organizations exist whose primary function is not economic development work in partnership with economic developers. They include the news media, foundations, utilities, schools, health care providers, faith-based organizations, colleges, universities, and other education or research institutions (Ibanez, 2011).

4. Growth, human development and sustainable development

4.1 Growth and Development

Following Dependency theorists cited by Ranis et al, (2000), argue that LDC's have sometimes experienced economic growth with little or no economic development initiatives. This is a case where such countries have functioned mainly as resource-providers to wealthy industrialized countries. However, there are opposing arguments of growth causing development, because some of the increase in income gets spent on human capital development such as literacy, education and health (Wikipedia, 2011). Economic growth and human development is a two-way relationship (Ranis et al, 2000). Moreover, the first chain consists of economic growth benefiting human development with GNP. Specifically, GNP increases human development by increasing expenditure of families, government and organizations such as NGOs. With rise in economic growth, families and individuals will likely increase expenditures with heightened incomes, which in turn leads to growth in human development. Further, with increased consumption, health and education grow also, contributing to economic growth (Anand and Sen, 2000). In addition to increasing private incomes, economic growth also generates additional resources that can be used to improve social services such as healthcare, safe drinking water and other (Figure 1).

Figure 1 : Linkages between economic growth and human development



Source: Adaptation of Ranis, Stewart and Ramirez (2000)

By generating additional resources for social services, unequal income distribution will be mitigated as such social services are distributed equally across each community, thereby benefiting each individual, thus, increasing living standards for the public. Concisely, the relationship between human development and economic development can be explained in the following three ways. First, increase in average income leads to improvement in health and nutrition, also known as capability expansion through economic growth. Second, it is believed that social outcomes can only be improved by reducing poverty, also known as capability expansion through poverty reduction. Third, social outcomes can also be improved with essential services such as education, healthcare, and clean drinking water, also known as capability expansion through social services.

Recent emphasis by the United Nations is on "human development," measured by life expectancy, adult literacy, access to all three levels of education, as well as people's average income, which is necessary condition of their

freedom of choice. In a broader sense, the notion of human development incorporates all aspects of individuals' well-being, from their health status to their economic and political freedom (Hanushek et al, 2008). For the United Nations Development Programme, Human Development is the end-economic growth means". It is true that economic growth, by increasing a nation's total wealth, also enhances its potential for reducing poverty and solving other social problems.

But history offers a number of examples where economic growth was not followed by similar progress in human development. Instead growth was achieved at the cost of greater inequity, higher unemployment, weakened democracy, loss of cultural identity, or overconsumption of resources needed by future generations (World Bank, 2000). To be sustainable, economic growth must be constantly nourished by the fruits of human development such as improvements in workers' knowledge and skills along with opportunities for their efficient use, more and better jobs, and better conditions (William and Harley, 2020). Conversely, slow human development can put an end to fast economic growth. Economic development with slow human development and rapid growth have a virtuous circle in which human development and growth can become mutually reinforcing. When slower human development has invariably been followed by slower economic growth, this growth pattern was known as a "dead end (World Bank, 2000). Essentially, SAUT's economic development efforts are related to its human development, which encompasses, among other things, health and education. These factors are, however, closely related to economic growth so that development and growth often go hand in hand (Nafziger, 2006).

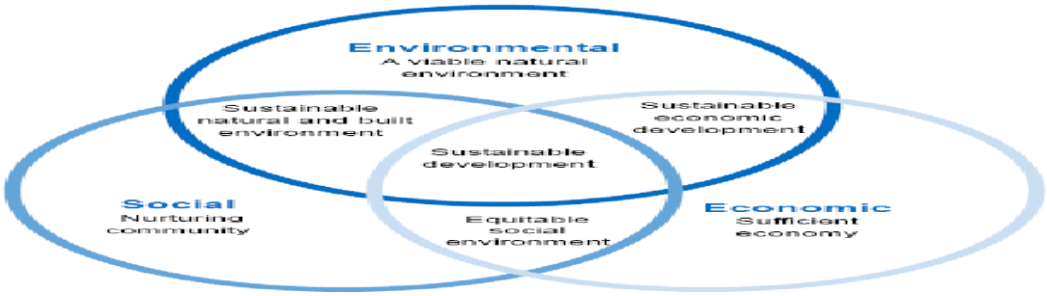
4.2 Sustainable Development

Sustainable development is a term widely used by politicians all over the world even though the notion is still rather lacking a uniform interpretation. Important as it is, the concept of sustainable development is still being developed and the definition of the term is constantly being revised, extended, and refined. Using this term, one can try to improve its definition as one learn more about the relationships among its main components, namely: economic, social, and environmental factors of sustainable development, as one decides on their relative significance based on one system of values (World Bank, 2000). United Nations (1996) argued that, classically, development is sustainable if it "meets the needs of the present without compromising the ability of future generations to meet their own needs." It is usually understood that this "intergenerational" justice would be impossible to achieve in the absence of present-day social justice, if the economic activities of some groups of people continue to jeopardize the well-being of people belonging to other groups or living in other parts of the world (World Bank, 2000).

The continuing deforestation of the Amazon basin and Congo basins, known for their outstanding biodiversity, will definitely lead to the extinction of an unresearched plant species that could help cure acquired immune deficiency syndrome (AIDS), or a lethal disease threatening people all over the world. Emissions of greenhouse gases, generated mainly by industrial countries, definitely lead to global warming and flooding of certain low-lying islands and villages, resulting in the displacement and impoverishment of entire nations as it has been the cases recently (Srinivas, 2009). Social justice defined as equality of opportunities for well-being, both within and among generations of people, can be seen as having at least three aspects: economic, social, and environmental (William and Harley, 2020).

Only development that manages to balance these three groups of objectives can be sustained for long. Conversely, ignoring one of the aspects can threaten economic growth as well as the entire development process (World Bank, 2000). Sustainable development is also about maintaining a delicate balance between the human needs to improve lifestyles and feeling of well-being on one hand, and preserving natural resources and ecosystems, on which we and future generations depend on the other hand (Figures 2 and 3).

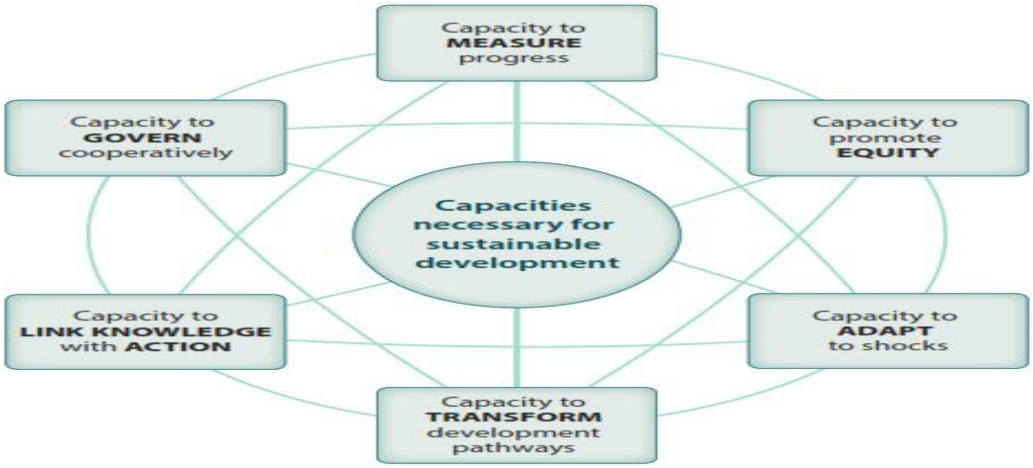
Figure 2: Sustainable Development Concept



Source: Hakim, M.A. and Naggar, H.E. (2014).

This type of development meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development implies economic growth together with the protection of environmental quality, each reinforcing the other.

Figure 3: The Six Central Capacity for Sustainable Development



Source: Clark, William C., and Alicia G. Harley. (2020).

The essence of this form of development is a stable relationship between human activities and the natural world, which does not diminish the prospects for future generations to enjoy a quality of life at least as good as our own. The term refers to achieving economic and social development in ways that do not exhaust a country's natural resources (Srinivas, 2009). Sustainable development is a process of change in which the exploitation of resources together with the direction of investments, orientation of technological development, and institutional change are made consistent with the future as well as present needs. Sustainable development respects the limited capacity of an ecosystem to absorb b the impact of human activities.

Some people also believe that the concept of sustainable development should include preserving the environment for other species as well as for people as shown in Figure 3 (Srinivas, 2009). Sustainable development ties together concern for the carrying capacity of natural systems with the social challenges facing humanity. Following Figure 3, the field of sustainable development can be conceptually broken into three constituent parts, namely: environmental sustainability, economic sustainability and sociopolitcal sustainability (Hakim and Naggar, 2014). In terms of capacities for sustainable development, figure 4 presents six interdependent capacities which are necessary for successful pursuit of sustainability, they include: (a) capacity to measure progress toward sustainable development, (b) capacity to promote equity within and between generations, (c) capacity to adapt to shocks and surprises, (d) capacity to transform the system onto more sustainable development pathways, (e) capacity to link knowledge with action for sustainability, and (f) capacity to devise governance arrangements that allow people to work together in exercising .

5. Discussion

The discussion section in this paper is divided into four main sub-sections, they include the following:

5.1 SAUT's role in national economic development

Historically, higher educational institution has economic development as part of its core mission. Most universities serving the region have allocated fiscal, physical and human resources and have created entrepreneurship systems within the institutions to advance economic development of the region. Saint Augustine University of Tanzania connects workforce development to the economic development of Tanzania by matching instructional programmes to the needs of business and industry in the country. Extra efforts in this direction should include working together with government and business to identify specific needs, providing work-based learning opportunities for students, offering and supporting apprenticeship programmes, convening and being responsive to advisory committees with representative from business and industry. Once the needs have been identified, SAUT and industry/business should work together to attract students into these critical programmes (Gigerich, 2009). In an earlier day, when the role of universities in the national economy was discussed, universities were credited with providing opportunities for citizens to develop themselves and advance economically. It was readily conceded that these educated persons were, by their

presence and the larger contributions they were capable of making, beneficial to society. In some SAUT campuses faculty conduct research which occasionally produce scientific breakthroughs for economic development. It was recognized that these breakthroughs improved the life in unanticipated ways. But SAUT was not broadly perceived as pivotal, as key to the economic success of a region or of the nation (Sampson, 2004).

SAUT plays a greater role in national economic development in Tanzania in promoting economic and social development of the people even at the present moment. With its graduates, SAUT expects to continue playing an enlarged role in advancing the prosperity and wellbeing of the country's regions. Knowledge is the driving force in the rapidly changing globalised economy and society. The quantity and quality of SAUT's specialised human resources is determined to provide their competence in regional, national and the global market economy, where demand and supply are the major forces of creative economy. Emergence of knowledge as driving factor results in both challenges and opportunities for the country. The critical challenge for Tanzania is how best to provide strategically the workforce needed to develop and strengthen its economic development. While the literature recognizes the role of higher educational institutions in local and regional economic development and their importance in reference to human capital development, very little attention has been devoted to the ways they can contribute to local, regional and national economic development efforts (Riddel, 2006).

5.2. The ways in which SAUT impacts on national economic development efforts

Universities have a critical role to play in regional, statewide and national economic development efforts. Clearly, higher education and economic development are inextricably linked to one another. For Tanzania to be successful in the process of economic development, SAUT, one of the many universities in the country should be given equal treatment, in order to be one of the key partners throughout the process. For the past 25 years of its existence, SAUT has played a crucial role in generating new ideas and in accumulating and transmitting knowledge to future labour forces. Yet, the institution has remained peripheral to development concerns, with little or no consultation by local authorities. Although it is not the sole generator of knowledge needed for development in the country, as an institution of high learning, through its research and training, SAUT has the ability to produce expertise needed in the country, manage development, engineer social transformation, and preserve social values and cultural ethos (IIEP, 2007).

5.2.1 Evolving roles

From my own perspective, in the past, universities focused on one main objective - educating students in different subject matters for different roles in society. In many cases, universities taught students and awarded degrees based upon the programmes that have been in place for many years. These programmes were driven by what the universities wanted to teach and what students were interested in. While there is nothing wrong with this type of approach, it is usually not very responsive to the needs of private sector employers. As a result, many students would graduate with a degree in a subject matter/areas that did not translate into a good job in a growing economic sector. Over the years, universities have evolved their roles into a broader mission that better support companies and economic development efforts. While the education of students should be the primary objective, other roles have become more important to better support business and economic development initiatives. During the past twenty years almost, research and development activities at universities have become much more important. In some countries, educational and governmental entities have put more money into research related activities. This change has been driven by the evolution of the world economy, the demands by business community and the need for universities to find additional funding sources.

Universities have also recognized the need to help nurture entrepreneurs through technical and financial assistance programmes. These efforts have resulted in the survival of many young businesses that otherwise might have failed due to lack of capital, access to research and management expertise. SAUT recognizes the need to help these companies survive for a variety of reasons, the obvious one being national economic development in Tanzania. If SAUT can help entrepreneurs survive and succeed, it will be making a significant contribution to the geographic area it is serving. It can use this success to market the institution to new students locally, regionally and internationally, including business partners, and at the same time, secure financial returns for the university. SAUT recognizes the need to become intimately involved in local, regional and national economic development initiatives for the benefits of the country. Part of this increased role in economic development efforts can be traced to economic development organizations doing better jobs of reaching out to institution and its desire to help contribute to the public good in the country (Gigerich, 2009).

5.3 SAUT contributions to economic development efforts

In many countries, universities (public and private) have made significant contributions to national economic development efforts. Universities around the world have become more aggressive in terms of economic development initiatives, helping governments and business community initiatives. SAUT, as a private university has been one of many institutions of higher learning that has been contributing to economic development efforts in the country. SAUT's participation in other development activities such as business related initiatives and technology would require significant funding the government and corporate partnership, that may be of benefit to the institution (Gigerich, 2009). It is critically important to point out that the contributions of universities along with many others institutions, can result in short and long-term positive development outcomes for the country.

For example, Wits University has made a concerted effort to focus its energies in developing and commercializing HIV/AIDS related solutions by investing in young companies, partnering with the business community to meet their needs and adopting economic development as part of the university's mission to help improve South Africa. Efforts by Wits university to leverage its scientific disciplines to help business and entrepreneurs succeed, have already generated tremendous results in South Africa. University of Cape Town and Pretoria University have also supported development in information systems and business and have shown great interest in partnering with economic development stakeholders to help implement regional economic development strategies in the different areas in the country, which resulted in many positive outcomes for South Africa.

5.4 Suggested effective ways to support economic development efforts

There are several ways in which SAUT can significantly contributes to local, regional, and national economic development initiatives: (i) it should first have a desire to do so; (ii) it must know its strengths and assets that can be leveraged to benefit its organization and geographic area in which it can have an impact; (iii) it must have a vision of what it would like to achieve; (iv) it must have an implementable strategic plan.

To maximize the results for the region/country, SAUT must network (be engaged) with the government, the private sector, other academic institutions and the non-profit organisations (NGOs). If everyone is working together to support economic development initiatives, everyone will benefit. SAUT should determine the best ways to participate in local, regional, and national economic development initiatives. It is important for the university to look for the ways it can best leverage its assets to help support its mission and the economic development goals of the country (Gigerich, 2009).

As to where should SAUT starts when it comes to deciding the best ways to participate in economic development process?. It should first begin the process by completing a comprehensive inventory of all activities that have a material impact on economic development initiatives in Tanzania. This process will allow the institution to identify its key assets which can be leveraged to help grow the local, regional, national economies. The next step in this process requires SAUT to take its key assets and match them with local, regional, national economic development initiatives. This presents an opportunity for the leveraging of the people, facilities and capital by the university to support national economic development efforts.

This mapping process allows the university for a more efficient use of public, private and not-for-profit human and financial capital to its disposal. Once the mapping process has been completed, it is then important for SAUT to develop a strategic plan, with the necessary implementation steps. This strategic plan will help guide the university in the most effective ways to contribute to economic development initiatives in the country (Gigerich, 2009; Chiswick, 2002).

However, the only main issue in this regard for SAUT is the unavailability of funding by the government to institution. As a result, this makes it difficult for the institution to make meaningful contribution to national economic development efforts in Tanzania. A list of suggested key elements to be considered when it comes to economic development strategic plan is provided below following Gigerich (2009). The list of the key elements presented below is not exhaustive, and it includes the following: (1) Description of initiatives and key SAUT staff(s) responsible for implementation. (2) Description of geographical areas to be served given the fiscal/budget impact in short-term and long-term. (3) Success measurements (quantitative & qualitative) of the key implementation milestones/steps. (4) Provide timeline for implementation. (5) Provide key internal and external resources/partners required for implementation and Success (People & Funding). Mitigate the key internal & external challenges to overcome to ensure success in terms of culture, funding and people.

6. Conclusion

SAUT has a critical role to play in local, regional, statewide and national economic development efforts. Higher education and economic development are inextricably linked to one another. Universities have long been

viewed as important partners in economic development. Universities are important and do play critical role in economic development. People who are not familiar with economic development as it.
relates to universities, could learn this important issue as addressed in the university strategic planning.

This paper investigates the ways in which SAUT impacts on national economic development efforts by referring to a number of issues on how it has been involved. The paper is based on secondary sources collected using document methods with literature review of development concepts. The paper argues that improvements in the level of education by SAUT would help impact positively on the lives of the people. Development concepts described in this paper include both economic development, sustainable development, and human capital development.

The paper has described the ways in which SAUT continues to participate in local, regional and national economic development efforts. Arguing that SAUT graduates are competent and capable to handle the process of economic development that would make people more conscious about their role in social development. This has an important self - propelling effect for sustainable socio-economic development in the country. SAUT strategic plan helps to guide the university in the most effective ways to contribute to economic development initiatives in the country (Gigerich, 2009; Chiswick, 2002).

The only issue for SAUT in this regard is the unavailability of funding by the government to institution. As a result, this makes it difficult for the institution to make meaningful contribution national economic development efforts in Tanzania. Finally, the paper, however, notes that an increase in the level of education provides the country with needed skills to meet the challenges of socio-economic development and globalisation.

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The impact of environmental protection policies on greenhouse gas emissions in Tanzania: An empirical analysis

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Abstract

The aim of this study was to investigate the impact of environmental protection policies on greenhouse gas emissions in Tanzania. Total natural resources rent, foreign direct investment, gross domestic product and environmental protection policy were applied as determinants of greenhouse gas emission. Ordinary least squares - Heteroskedasticity corrected was appropriate for the current study's analysis of time series data from 1990 to 2021. The environmental protection policy entered the model as a dummy variable with 0 before policy adoption and 1 during and after adoption. No effect on greenhouse gas emission resulted from foreign direct investment and economic growth. Total natural resources rent had a negative significant impact implying that the 1997 environmental protection policy and other afterward laws and regulations affected natural resources in that could significantly reduce greenhouse gas emissions. The country also experienced higher greenhouse gas emissions in the years after the environmental protection policy of 1997 was adopted compared to the period before its adoption. This was likely due to the fact that from 1997 onward, economic growth was higher than the years before the policy was adopted. The study introduced a dummy variable in the model to reflect the effect of policy on emission.

Keywords: Pollution control adoption, air pollution, environment and trade

JEL: Q52, Q53, Q56

1. Introduction

Human activities are increasing globally due to the increase in world population as well as global technological advancement. Some of these activities pollute the environment and cause hazardous effects on human life. According to the World Health Organization (2016), a quarter of all global deaths are linked to environmental risks. Countries are striving to reduce greenhouse gas emissions because of their global warming effects. Governments and policymakers are striving to achieve a net zero emission by 2050 (Hailemariam & Erdiaw-Kwasie, 2022). The United Nations climate summit in Glasgow in November 2021, called COP26, highlighted at length the importance of having net-zero greenhouse gas emissions by 2050. For example, China proposed a two-stage carbon emission goal in 2020 indicating that by 2030 and 2060 it will make all efforts to attain 'carbon peak' and 'carbon neutrality' respectively (Guo & Che, 2023). Greenhouse gas emissions have strong negative externalities on the process of economic development, an indication of market failure. Although many countries are committed to reducing greenhouse gas emissions to zero by 2050, statistics show that emission of gases have increased dramatically and therefore global warming has emerged as a major policy concern around the world (Hailemariam & Erdiaw-Kwasie, 2022; Alam et al., 2021; Chakraborty & Maity, 2020; Diffenbaugh & Burke, 2019). Total greenhouse gas emissions are projected to reach 75 Gigatons CO_2-equivalent by 2060 (OECD, 2020). In the East African Community, heads of state agreed to develop policies and strategies to address the adverse impacts of climatic change. The East African Community Climate Change Policy was introduced in 2011 to provide an integrated, harmonized, multi-sectoral

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framework for responding to climate change (EACCCP, 2011). The EAC Partner States were required to immediately adopt the policy and implement it.

Tanzania is experiencing rapid economic growth with urbanization and industrialization leading to significant challenges in pollution management from wastewater, air pollution, noise, and vibration, chemical waste, and land pollution (NEMPSI, 2022). Air pollution is one of the forms of pollution experienced countrywide although the magnitude of pollution varies from location to location depending on the economic activities. According to statistics collected from the public on environmental pollution complaints from 2019 to 2022, Dar es Salaam accounts for 88 percent of air pollution incidents, while Dodoma, Mwanza, Arusha, and Mbeya account for 2 to 4 percent. On average, Dar es Salaam has a higher income and consumption levels compared to other urban and rural areas (Waryoba, 2023), which implies more activities in Dar es Salaam than in other parts of the country.

Emissions from industries affect 66 percent of major cities including Dar es Salaam, Mwanza, Arusha, and Mbeya. It extends further to 40 percent of municipalities including Iringa, Singida, Temeke, Morogoro, Musoma, Ilemela, Kigoma, and Kigamboni (NEMPSI, 2022). The common industries that generate air pollutants include coal and oil-fired thermal plants, cement production industries generating particulate matter, waste recycling, recovery industries generating emissions but also heavy metal air pollutants depending on the raw waste processed. The major challenge of industrial pollution is lack of efficient air pollution control equipments in industries and their locations near urban populations (NEMPSI, 2022). However, there is no enough data on environmental protection expenditure in Tanzania. For example, in the years 2017 and 2018, the environmental protection expenditures were TZS 11.3 billion (0.01 percent of GDP) and TZS 10.2 billion (0.008 percent of GDP) respectively (IMF, 2023) and these are the only two data available from the source.

Tanzania among other countries is striving to reduce greenhouse gas by protecting the environment and reducing climatic change impact by formulating different policies and laws. Among those policies that specifically emphasized controlling greenhouse gas emissions are; the National Environmental Action Plan (NEAP) of 1994, the Sustainable Industrial Policy of 1996, The National Environment Policy (NEP) (1997), The National Forest Policy (1998), the legal framework for dealing with greenhouse gas emissions is Environmental Management (EMA) Act No. 20 of 2004. However, Tanzania signed multilateral agreements and protocols on environmental protection including the Convention on Biological Diversity (CBD), 1996, UN Convention to Combat Desertification (UNCCD), 1994, United Nations Framework Convention on Climate Change (UNFCCC), 1996, Kyoto Protocol to the UNFCCC, 2002, the Ramsar Convention,2000, Basel Convention on the Control of Trans-boundary Movements of Hazardous Waste and their Disposal, 1993, Bamako Convention on the Ban of the Import into Africa and the Control of Trans-boundary Movements of Hazardous Wastes within Africa, 1993, Vienna Convention for the Protection of the Ozone Layer, 1993, Stockholm Convention on Persistent Organic Pollutants (POPs), 2004, Montreal Protocol on Substances that Deplete the Ozone Layer,1993 to mention but a few. It is, however, not known how far these policies, agreements, protocols, and laws have helped in reducing greenhouse gas emissions in Tanzania.

2. Theoretical Backgrounds

According to Guler & Ozarslan (2023), the relationship between the environment and economics can be evaluated in the context of externalities. Environmental pollution is a negative externality that leads to market failure in environmental economics. The relationship of negative externality between individuals and firms within the scope of economic theory can be examined in a particular theoretical framework with the help of an analytical model (Guler & Ozarslan, 2023). However, to arrive at the theoretical model, some assumptions have to be made for example we assume complete information, perfect completion, no pre-existing pollution, current pollution, and the presence of fixed pollution technologies.

$$-C'_j(e_j) = D'_i(E) \quad (1)$$

where, e_j is the emissions produced by j-th firm, and therefore $C'_j(e_j)$ is the cost of environmental pollution caused by j-th firm emissions. $D'_i(E)$ is the welfare loss encountered by i-th individual due to emissions up to E.

The emission cost for every firm in the market is shown in Equation 2 below. The point where the first-order derivatives are equated to each other in the equation is considered the first condition for efficient allocation, which is the output of the social objective function aimed at reducing emissions.

$$-C'_j(e_j) = -C'_k(e_k) = \dots = -C'_n(e_n) \quad (2)$$

Emission costs increase if the actual emissions are greater than the expected values ($e_j > \hat{e}_j$). Another condition is that the marginal reduction costs of the firms in the market are equal. The first derivative of the cost function in

equations 1 and 2 is called the Marginal Abatement Cost (MAC) (Phaneuf & Requate, 2017; Guler &Ozarslan, 2023). In this scenario, individuals try to compensate for their welfare losses, and firms that pollute the environment face the cost of reducing pollution while internalizing negative externalities. Although coarse theorem can effectively solve local problems relating to efficient allocations, there is a need for government policy intervention in the market since the market alone cannot fully internalize the problem. Therefore, environmental protection policies are needed since they are closely related to societies' welfare and the cost structures of the firms while solving efficient allocation problems.

3. Literature Review

Greenhouse gas emissions particularly carbon dioxide is mostly caused by human activities. That is why GDP growth influences CO2 emission (Dominick, 2014) making factors behind GDP like foreign direct investment (Waryoba, 2017) important explanatory variables of greenhouse gas emission. One of the first studies to examine the link between human activities and carbon emissions was Ehrlich & Holdren (1971), and later Hailemariam & Erdiaw-Kwasie (2023). Various studies investigated how different practices can impact greenhouse gas emissions. Because an automatic reverse of environmental pollution may take a very long time (Dominick, 2014). For instance, progress toward a circular economy significantly improves environmental quality by reducing CO2 emissions (Hailemariam &Erdiaw-Kwasie, 2023). Greenhouse gas emissions can be reduced by improving material flow efficiency and extending the useful life of products and materials (Cimen, 2021; Munaro et al., 2020).

Environmental protection tax is another practice for reducing greenhouse gas emissions. Du & Zhou (2022) found that the improvement of sulfur dioxide emission charge standard can effectively inhibit industrial sulfur dioxide emission, which verifies the existence of environmental effects of pollution levy policies. Wu & Chen (2023) examined the impact of fiscal environment protection expenditures on agricultural carbon emissions in China using panel data of 31 provinces (cities) from 2007 to 2020. The empirical tests show that fiscal environment protection expenditures have significant negative impacts on agricultural carbon emissions; fiscal environment protection expenditures have a heterogeneous impact on agricultural carbon emissions in different regions, which shows that it has a significant impact on the eastern and central regions and provinces with relatively "high" carbon emissions, while it has insignificant impact on the western regions and provinces with relatively "low" carbon emissions. Further, the results of mechanism analysis show that the impact of fiscal environment protection expenditures on agricultural carbon emissions is mainly manifested in its inhibiting effect on agricultural diesel, fertilizer, and film use of carbon emissions. According to Laborde et al. (2021), carbon emissions from agricultural production account for nearly 15 percent of the total human carbon emissions. Guo & Chen (2023) used panel data from 30 Chinese provinces from 2009 to 2020 to investigate the connection between carbon emission intensity and investment in environmental protection. It was found that investment in environmental protection has a nonlinear inverted U-shaped relationship with carbon emission intensity, that is, with the increase in environmental protection investment, its effect on carbon emission has changed from promoting to inhibiting. The results corroborate with the study by Sijin & Xiaocong (2022), Sheng & Zhang (2021); Lin & Yang (2022); Huang & Gao (2016), and Simionescu & Gavurova (2023).

Yang, Tang, and Zhang (2020) conducted a study in China on the direct impact of environmental regulation on carbon emissions and its indirect effects on carbon emissions through foreign direct investment (FDI), energy consumption, industrial structure, and technological innovation using special econometric model and the provincial panel data of 2003–2017. The results show that the direct impact of environmental regulation on carbon emissions is significant and positive. Environmental regulation could indirectly influence carbon emissions by influencing, FDI, energy consumption, and technological innovation.

There are mixed results from different scholars as to whether environmental protection policies and legal frameworks have significant impact on greenhouse gas emissions reduction. For example, Huang (2014) and Xiu (2014) found that the policies have a significant impact on reducing greenhouse gas emissions, just like in Du (2013), Xiu & Liu (2014), Huang, Li & Chen (2014), Huang & Guo (2017), Zhang et al. (2019) and Zhang (2016). Some scholars point out that strict environmental regulation may increase business costs and weaken an enterprise's competitiveness (Maria & Werf, 2013; Grafton et al., 2014; Allaire & Brown, 2016; and Sterner et al., 2016). Liu et al., (2023) conducted a study in Asia Pacific Region using panel data from 1991 to 2021 concerning the relationship between environmental policy stringency, innovation, and carbon emissions. They found that a positive shock in environmental policy stringency has a significant negative impact on carbon dioxide and vice versa in both the short and long term.

Assamoi and Wang (2023) conducted a study in China and the United States taking data from 1985 to 2021 using NARDL. The empirical results show that improvement in EPU deteriorates environmental quality in both countries. However, a negative change in EPU reduces emissions in China and increases them in the United States. In addition, a positive change in environmental policy stringency will lead to fewer emissions, while a negative change will worsen environmental damage. Simionescu and Gavurova (2023) checked whether income inequality enhances

pollution in the EU-13 countries from 2002 to 2021 using the Fully Modified Least Square (FMOLS) estimators and method of moment's quantile regression. The result shows that in most cases, the Gini index and gender pay gap negatively impacted Greenhouse Gas Emissions. For robustness check, from 2006 to 2021, the environmental protection investments of the general government reduced greenhouse gas emissions only in the long run.

4. Methodology and data

4.1 Research Design

The study followed a quantitative research method since the use of modeling necessitated the regression analysis application. Several models can be utilized, for instance, Nonlinear Auto Regressive Distributed Lad model (NARDL) (Liu et al., 2023; Asamoi and Wang, 2023), panel asymmetric ARDL (Li et al., 2023), quantile fixed-effect panel data (Albulescu et al., 2022), non-linear panel ARDL model (Yirong, 2022), Systematic General Method of Moments (Hassan & Rousseliere, 2022; Wang et al., 2020), panel threshold (Ouyang et al., 2019), autoregressive distributed lag ARDL model (Sarkar, et al., 2018; Isam, et al., 2021; Rahman & Alam, 2021; Islam et al., 2017; Wahid et al., 2017), vector error collection model (Alom et al, 2017; Sharmin & Tareque, 2018), vector autoregressive models (Amin, Ferdaus & Porna, 2012; Islam, Irfan & Shahbaz, 2022), and mixed models (Sharmin, 2021) just to mention a few. The current study used an Ordinary Least Squares (OLS)-Heteroskedasticity corrected model in the analysis. The following expression was used to verify the variable relationships

$$ghg_t = \propto + \beta_1(nrr)_t + \beta_2(fdi)_t + \beta_3(pol)_t + \beta_4(gdp)_t \quad (3)$$

where, ghg represents Greenhouse Gas emissions, nrr is natural resources rent,fdi is foreign direct investment, pol represents the policy dummy, and gdp is the gross domestic product.

4.2 Data and Data Sources

Different studies have used various variables to analyze the cause of CO_2 emissions. For example, studies that used energy intensity are Salim et al., (2017), Islam et al., (2020), Amin et al., (2012), and Sharmin & Tareque, (2017). Those that used population as one of the variables causing CO_2emissions are Zang, Tang & Yang (2020), Guo & Chen, (2020), and Zang, Way & Way, (2022). Studies that used technological innovation as a variable that indirectly determine how environmental protection policies affect greenhouse gas emissions are Zang, Wang & Wang (2022), Zang, Yang & Tang, (2020), Jiun, Wang & Zang, (2020), Ai, Reng & Xiong, (2021), Zang (2021), Yan et al., (2020), Liu, Li & Yin, (2018), Bel & Joseph, (2018) and Cae et al., (2019) among the recent studies. Studies that used total energy consumption as a variable in measuring greenhouse gas emissions among other studies include Zang, Yang & Tang, (2020), Hassan & Chongbo, (2020), Dale (2021), Sarkar (2021), Hassain (2011), Hazeab, et al.,(2017), Wang & Fang (2018), Kan, et al., (2020), Franco, (2021), Hassain, (2020), Ahmad & Zhao, (2018), Valencia-Herera,(2020), Ahmad et al., (2020), Ali, Law & Zannnah, (2016), and Alan, Udin& Islam, (2017).

Recent research that used greenhouse emissions as a dependent variable are Dale, (2020); Tsai, Chang & Chang, (2016) and Wu& Chen (2017). Many other studies used variables like Fossil fuel consumption, GDP, Population, Affluence, Urbanization, Industrial structure, Foreign Direct Investment (FDI), non-renewable energy consumption, and environmental regulation among other variables. This study used variables that are indirectly affected by environmental protection policies to determine how those policies are effective in reducing greenhouse gas emissions in Tanzania. The reason for using these variables is that no data for Tanzania measures the stringency of the policies or the environmental protection policy index. The explanatory variables used in this study are foreign direct investment, fdi measured in USD, and total natural resources rent, nrr measured in percentages of GDP. The control variable was GDP growth rate, gdp while the explained variable is greenhouse gas emissions, ghg was measured in kilotons (kt) of CO2 Equivalent. Data sources were the World Bank data, and Climate Watch data.

4.3 Results and Discussion

4.3.1 Pre-estimation Tests

Figure 1 represents time series graph of variables used in this study namely greenhouse gas emissions (ghg) measured in kilotons of CO2 Equivalent, natural resources rent (nrr) as percentages of GDP, foreign direct investment (fdi) in USD and GDP growth rate.

Figure 1: Time series graph of variables

Source: World Bank and Climate Watch Data (2023)

Data for greenhouse gas emissions show that emissions have been increasing since 1990 from about 40,000 kilotons of CO2 equivalent in 1990 to about 90,000 kilotons of CO2 equivalent. This shows that emissions have increased more than double in thirty years in Tanzania. Natural resources rent contributed a large percentage of GDP in the period between 1990 and 1997 which ranged between 10 to 14 percent, however, the contribution declined to an average of 5 percent from 1998 to 2018, and then in 2020 the rent started to increase. Foreign direct investment was very low in the years from 1990 to 1998. Thereafter it started increasing and fluctuating largely from 1999 to 2021. GDP growth rate was below 5 percent between 1990 and 2000 and it then maintained an average of 6 percent from 2001 to 2019 which then declined probably due to the effects of the corona virus. Table 2 presents the pre-estimation tests. Panel (a) presents a correlation analysis of the variables to test the existence of strong linear associations among independent variables to avoid spurious regressions. The analysis shows that there were no strong correlations among independent variables since all variables reported a correlation coefficient of less than -/+ 0.7 in absolute terms. According to the rule of thumb a correlation coefficient of ≥ 0.7 or ≤ 0.7 is considered problematic.

Table 2: Pre-estimation tests

(a) Correlation analysis

Emissions	Rent	FDI	GDP	
1	-0.6068	0.7661	0.3863	Emissions
	1	-0.542	-0.5095	Rent
		1	0.4746	FDI
			1	GDP

(b) Normality test

Variable	Jarque-Bera test	p-value
Emissions	2.57057	0.276572
GDP	3.71334	0.156192
Rent	5.47323	0.0647893
FDI	2.36428	0.306622

(c) Unit root test

Variable	Critical Value	Test Statistics
Emissions	-1.03199	-2.87023
GDP	-0.454433	-3.0044
Rent	-0.271055	-2.0663
FDI	-2.66932	-3.28468

Two-tailed critical values for n = 32: 5% 0.3494, 1% 0.4487

Source: Authors' computation

The Jarque-Bera test was carried out to uncover the normality of variables as shown in panel (b). It was found out that all variables had p values greater than 0.05 indicating that the variables were normally distributed. But even when the criteria are relaxed to 10 percent levels of significance, only natural resources rent seem to contend with normally test. That is, being not normally distributed, the rest remain normally distributed. The Augmented Dickey-Fuller (ADF) test was used to determine whether each variable had a unit root. The results from panel (c) show that the null hypotheses of the existence of unit roots are strongly rejected, indicating that all variables were stationary at level form. The test statistic of individual variables was greater than the estimated critical values. This was expected because the values were in terms of rate rather than level values.

Yang, Tang & Zhang (2020) found out that the relationship between environmental regulation and carbon emission is positive and significant. This study found out those environmental policies significantly increased greenhouse gas emissions in Tanzania. Angelis et al. (2019) found evidence that the environmental policy rigidity index, used to explain environmental regulation, exhibits negative and enormously significant coefficients. Simionescu & Gavulova (2023) found out that the environmental protection investments of the general government reduced GHG emissions only in the long run. Table 3 shows the results from the regression analysis on how the independent variables affect the greenhouse gas emissions in Tanzania. The results show that total natural resources rent has a negative and significant impact on reducing greenhouse gases.

Table 3: Heteroskedasticity-corrected OLS

	coefficient	std. error	t-ratio	p-value
Const	0.567631	0.373899	1.518	0.142
Lnnrr	0.077617	0.031723	2.447	0.0221
Policy	0.100481	0.034455	2.916	0.0076
Lnfdi	−0.000326890	0.002862	−0.1142	0.91
Lngdpr	0.011799	0.013202	0.8937	0.3804
lngdpr_1	−0.00705290	0.008173	−0.8629	0.3967
lnghg_1	0.943831	0.037094	25.44	7.13E-19
R-squared	0.995243	Adjusted R-squared		0.994054

Source: Auhor's calculation, (2023)

It was observed that a one percent increase in total natural resources rent will increase greenhouse gas emissions by about 0.08 percent. The effect is statistically significant at 5 percent levels of significance. This is contrary to what is expected. The possible explanation is that the extractive industries have little emissions compared to production industries which are not affected by the natural resource rent. Nevertheless, the natural resource rent is likely to be lower among investors that they consider no loss in continuing to extract the minerals. Therefore, it is high time now for the government through the ministry of minerals and energy to revise its policy on natural resource rent. Otherwise, natural resource extraction poses a big environmental threat to the development of our country. Because companies involved in the extraction of natural resources are contributing negatively to environmental conservation in Tanzania. Foreign direct investment is important in reducing greenhouse gas emissions in Tanzania due to technological aspect. New technology is replacing obsolete technology in the production process. However, this is possible if the investor is not shifting pollution to the host country. Normally, developing countries are regarded as the dumping sites of obsolete technology from developed nations. This implies that regulations are strong enough to influence FDI to significantly reduce greenhouse gas emissions. Xu, Zhou & Li (2016) explored the relationship between foreign direct investment, environmental regulation and energy consumption which revealed a negative influence of environmental regulation on foreign direct investment in both long and short term. According to Chung (2014) and Zhou et al., (2016) polluting industries tended to invest more in countries with lesser environmental regulation. Tanzania has to increase stringency in protecting the environment in order to continue influencing FDI to contribute on reducing greenhouse gases.

Table 4: Collinearity Test

Variable	**Rent**	**FDI**	**Policy**	**GDP**	**Lag GDP**	**Lag Emission**
VIF	**3.995**	**3.108**	**7.275**	**3.391**	**2.847**	**2.195**

Source: Authors' computation

The GDP growth rate has no significant impact on reducing greenhouse gas emissions in Tanzania. The study contradicts the findings by Guler and Ozarslan (2023), Wang, Wang and Zhang (2022) who found out that economic growth has a significant impact on carbon emissions. The policy introduced in 1997 shows that it significantly increased greenhouse gas emissions instead of reducing them. Multicollinearity test was conducted to detect if there were collinearity problems and it was found that the model has no collinearity problems since the value inflation factor for each variable was less than 10 as shown in Table 4. For Multicollinearity problem the variance inflation factor should 10 and above.

5. Conclusions

This study analysed the impact of environmental protection policies on greenhouse gas emissions in Tanzania. Out of six variables used, only natural resources rent and environmental protection policy dummy were significant in influencing greenhouse gas emission. Total natural resources rent had a significant but positive impact on greenhouse gas emissions. This implies that environmental protection policies indirectly impact greenhouse gas emissions through natural resources rent. Foreign direct investment had a significant but positive impact on greenhouse gas emissions in Tanzania. The years through which the policy was adopted seem to have higher greenhouse gas emission than the years before the policy was adopted. The policy was adopted in the period privatization was taking place to spur economic growth. So, privatization policy seems to be more powerful thereby outweighing the influence of environmental protection policy. If more investment is done in the country and without strict environmental protection policies, more emission will be expected even with the current environmental policy being present. Reinforcement of the environmental protection policy is what the current practice is missing. Nevertheless, the available instruments are mostly concerned with land and water pollution rather than air pollution which is in the center of the current study's focus. Therefore, it is imperative that air pollution control be seriously taken into consideration in the ongoing environmental protection practices.

The current study, however, was limited to data availability. With 32 observations, the current study's findings posed a risk of validity problem. The findings of the current study are likely to change with increasing number of observations. Therefore, future studies should include more observations to check for robustness of the current study's findings. The policy dummy is likely to mislead the findings because it is true that years after 1997 had higher economic growth signifying the presence of more economic activities which influence emission. As a matter of facts, it is of methodological significance to consider other policy indicators rather than the binary approach employed in the current study.

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Class Size as A Factor Influencing Pass Rates: Lessons from Introductory Macroeconomics and Macroeconomics Examinations at ST. Augustine University of Tanzania

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Abstract

This study investigated whether pass rates are related to class size in introductory macroeconomics and microeconomics analysis examinations at the St Augustine University of Tanzania (SAUT), Department of Economics, Malimbe Campus during the academic year 2022-2023. The POST-Test and DIFF (Difference) as measures of performance were used during the investigation. The OLS regression was used to identify the characteristics of economics education that could have impacted on the intensity of studying by students. The sample consisted of 145 first year students in introductory macroeconomics and microeconomics classes. The data was consolidated such that each observation described a class instead of describing a student. The results suggest that the pass rates were not influenced by the class size, but by both lecturer's and students' ability to study and perform. The study concluded that the characteristics of the classes over which lecturers and department have control could also have influenced the pass rates to some extent. It is suggested that the Department of Economics should headhunt lecturers with knowledgeable skills in the subjects for increased student's performance and pass rates as suggested by the study findings.

Key words: Class size, influencing factor, pass rates, introductory macro and micro, lecturer's teaching ability, department of economics, SAUT.

JEL: A2; A20; A22

1. Introduction

1.1 The problem

The effects of class size on students' pass rates have remarkable policy implications (Hoyt, 2003). Dawson (2007), posits that there is a need for further studies from which results could be used to conduct a cost benefit analysis, on the relationship between class size and student success rates in a given discipline such as introductory macro and microeconomics. The relationship between students' pass rates and performance has been investigated in the University teaching research (Becker, 1997). The effects of class size on pass rates and performance depend on the ability measure such effects have on the students Jacob and Rothstein, 2016). When measures of knowledge are used, the large class lecture method is as effective as small class instructional techniques. However, in terms of information transfer, problem solving, critical thinking, attitude change and motivation, the small class discussion methods are preferred (Islam and Manaloor, 2012). Although various studies have been conducted on the effect of class size and performance of students, three studies in particular, have valuable evidence on this issues (Raimondo et al,1990; Becker, 2001). Some of these studies have suggested that class size can affect students' attitudes negatively thereby affecting their performance (Hawtrey, 2007).

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It mostly appears that students do not feel at ease in large classes (Wilsman, 2013; Mueller, 2011). Siegfried and Walstad,1990).

This point of view was questioned by both Siegfried and Walstad (1996) and Wang and Calvano (2022), who believed that it is the quality of teaching and not the class size which is a detrimental factor on student success. There is little reason to fear that the effect of class size can be confined to endogenous factors hampering lecturers' efficiency (Caviglia-Harris, 2003). Lecturers' behaviour tends not to change with class size, thus suggesting that student pass rates and performance are both not influenced by class size (Colander and McGoldrick, 2009).

Given the above background to the problem, the main purpose of this study was to critically document the relationship between pass rates in introductory economics and class size at the St. Augustine University of Tanzania, Economics Department, Malimbe Campus during 2022-2023. This study provides additional useful empirical literature in this area of study, especially at SAUT. The study is divided into six sections: section 2 provides research methods; section 3 outlines the model specification; section 4 describes the empirical model; section 5 presents the results and discussion, and section 6 concludes. Three hypotheses were formulated to test the variables that could promote and improve students' performance/pass rates in introductory macroeconomics analysis 1 at the Institution.

1.2 Hypotheses

i The performance and student pass rates in introductory economics were not influenced by the type of the lecturer's teaching.

ii The Lecturer's chosen variables collectively have had *not* influence on the performance and pass rates of both small and large classes.

iii The Department collective decisions have not had influence on students' performance/pass rates.

2. Methodology

The POST – Test and DIFF (Difference**)** as measures of performance were used to investigate the pass rates into introductory macroeconomic analysis II and class size in this study (Kennedy and Siegfried,1997). The POST is the primary measure of performance used. It describes the POST-Test used to test the scores related to a total of 145 students investigated. An alternative measure to "POST" the "DIFFIRENCE" or "DIFF" was also examined. This measure describes the difference between the 50 questions of post-test and pretest scores. Since students did not have motivation to make an effort in answering the pretest questions correctly, the DIFF measure was questionable. Therefore, its use in the analysis was for consistency with the literature. This assisted only to reach similar conclusions to those provided by the Post measure as a dependent variable.

In order to investigate the effects of class size on various types of student pass rates or achievement, Brewer and Jozefowicz (2006) suggest that student performance should be analysed separately based on the following variables (i) RU: recognition and understanding of the basic macroeconomic principles, terms and concepts; (ii) EA: explicit application of both basic macroeconomic principles, terms and concepts; (iii) IA : implicit application of both basic macroeconomic principles, terms and concepts. From the literature review view point, any influence the class size would have on pass rate / performance of the students should have been manifested in terms of the two variables, namely, EA or IA (Colonescu, 2011).

2.1 Data and sample

The data used in this study provides student pass rates in introductory macroeconomics analysis II during the period 2022-2023. Siegfried and Wilkinson (1996) argued that data set also described the ways in which teaching was conducted by the different lecturers involved in teaching these modules/courses (Introductory microeconomics and macroeconomics). In using such date sets, some criticisms of the economics of educational research involving only one institution have been considered, as well as the other stating that the data did not reflect a designed experiment were all contained/minimized (Wolfe, 2020). The data used was from Introductory economics classes, with a total of 154 students. This number was reduced to 130 students for the purposes of analysis, with only 65 students in BAEC 1 and 65 students in BAED 1 classes, giving almost 80% to 85% of introductory economics classes to be within a size of 100 or less students**.** Recently, a small percentage of classes at SAUT Malimbe Campus falls into this category.

A study sample of 65 observations was necessary in ensuring that the SAT (Scholastic Aptitude Test) measure was representative. Only classes for which student numbers for whom SAT scores were at least five, and which have had at least one-quarter of the student observations for both pretest and post-test were considered (Manly, 1990). This approach resulted in a total number of 145 students with only 110 students having SAT scores available. If for example we average only over students with SAT scores, we would reduce the accuracy of measurement of the explanatory variables (Siegfried and Walstad,1990). Thus, it was believed that it could be better to limit the accuracy of the

measurement by using the full class average for other variables than SAT, instead of confining their measurement to a small number of students (Kennedy and Siegfried, 1997).

2.2 Approach to methodology

Since the objective of this study was to investigate the effects of pass rates/performance and class size, a number of factors on student learning were held constant during the analysis process. This follows the traditional educational production function commonly used in most economics of education studies (Gramlich and Greenlee,1993). The only difference between the previous studies and this study is that this study uses the average student data for each observation in the data set to describe a class instead of a student. Concerning student activities such as study hours, performance, ability and pass rate, only observations on those students who have completed both prescribed tests and examinations were used (Hawtrey, 2007). For each student measure, it was decided to make use of the averages over those students for whom data were available (Becker and Watts, 2001).

Classes were selected as units of observation for various reasons. Firstly, utilising student observations would have given larger class sizes and more weight in the analysis. Obviously, this would be inappropriate since the main focus of this analysis is the effect of class size (Harb and El-Shaarawi, 2006). First, each observation of class size would be equally counted in the empirical analysis, with the exception of the aggregation procedure which may present statistical problems. Second, independent variables such as scores measuring the ability and study hours may have contained some measurement errors. Only the averages would have the benefit to reduce the influence of these errors substantially (Jensen and Owen, 2003)**,** and the role of such measurement errors in the analysis can be determined (Kennedy,1994). Thirdly, most of unobserved students' activities can affect learning to the extent that such activities cannot differ on average across the classes. The use of class average data helps to eliminate obstacles of these variables on empirical results (Lopus and Maxwell,1995).

An investigation into the class average post scores of the students for whom the SAT scores were available to find whether these scores differed from the average post scores of those for whom the SAT scores were available, found no significant difference. This resulted in 65 classes ranging in size from 5 to 65 students. This was in the following range of 5 - 10, 10 - 15, 15 - 20, 20 - 25, 25 - 30, 30 - 35, 35 - 40, 40 - 45, 45 - 50, 50 - 55, 55 - 60, 60 – 65 and 65 + with a total of 12 observations. The class size 65 has been an influential observation which was identified using the DIFFTS and DFBETAS statistics (Belsley et al, 2004).

The unusual observations such as 65 can be more valuable in a data set (Zellner,2007). Zellner's caution strengthens the understanding that reducing class size observations does not improve the performance and achievement by students. Its inclusion changes from insignificant to significant with a positive sign on the Ln SIZE regression coefficients (Lopus and Maxwell, 1995). Given that the class averages were based on SAT scores providing a smaller number of students, all other class averages data were based on the larger number of students. Although the study averaged only over students with SAT scores, this was appropriate to reduce the measurement accuracy of all the independent variables of the model and to limit the measurement inaccuracy by using the full class average for variables with no SAT, rather than to confine the measurement to small number of students (Dickie, 2006).

2.3 Model specification

A suitable model to investigate class size effects on pass rate was formulated including flexibility in data (Fernandez-Cornejo,1998). It is assumed that students and lecturers are likely to be different in various aspects. These differences manifest themselves when it comes to a proper evaluation of students and lectures in terms of selected variables. In this study, the pass rates of the students were considered to be their choices between hours of study and leisure (Buse, 2012). The underlying assumption was that students who pass make the decisions to study or not to study by considering the alternative choice that maximises their perceived education production function; which was supposed to be a function of their performance characteristics. In this way, for student **i** the education functions for studying and not studying can be expressed as follows:

$$US_1 = Ys_1 + Us_1 \quad (1)$$

$$Uso = Yso + Uso \quad (2)$$

Where: Us_1 = utility of studying;
Uso = utility of not studying
Ys_j = determinants of U, which maximise satisfaction of studying (j = 1) and not studying (j = o) ;
Us_j = disturbance term (independent and normally distributed).

A student who is studying (i) is likely to pass if the utility of studying, Us_1 is perceived to be greater than the utility of not studying, Uso. In other words, this implies that $Us_1 > Uso$. The OLS regression was used to identify the characteristics of economics education that could have impacted on the intensity of studying. This econometric technique best suited was the regression models where a continuous variable is linearly dependent on a set of independent variables. The OLS model was specified following Gujarati (2006), as expressed in equation (3).

$$Y_i = Bo + Bxi_1 + Bxi_2 + \text{--------} + \mu i \quad (3)$$

where: Yi = dependent variable; X's = independent variables; B's = regression coefficients; and μi = stochastic error term.

One of the assumptions about the OLS model was that the explanatory variables were not linearly correlated. That is when there is no sign of multicollinearity in the explanatory variables. If the explanatory variables were correlated one of the remedial measures would be to apply the principal component analysis to the explanatory variables that were correlated (Koutsoyiannis, 2001; Gujarati, 2006).

2.4 Empirical model

The first steps in empirical model specification was to describe several explanatory variables included in the model/function as provided below:

SAT : average Scholastic Aptitude Test. This test was conducted verbally and scores. Since the ability is an important factor in economic education production function this factor was included in model specification.

MACRO : defined as one (1) to macroeconomics and zero (0) for microeconomics modules.

COUNT : defined as the post-test counts of the final grade. This variable was included the model to ensure specification.

SIZE : class size/ the number of students attending class during one year.

RATING: lecturer's effectiveness in lecturing and rated on a scale from 1 to 5, with higher number describing higher effectiveness.

TENURE: one for tenured or tenure track, normally zero; 28 lecturers in the relevant 89 obervations were turned or tenure-track.

YREXP: number of years of teaching experience in introductory courses or LnYREXP.

PRECON: fraction of students having previously studied introductory economics.

LECT : time spent by lecturer in class lecturing;

HOMEWK: number of assignments given to class during the semester;

HOURS : hours spent by student economics per week.

3. Results and discussion

Descriptive statistics of the variables are reported in table 1. To explain how class size would affect student's pass rates/performance, the following linear model specification was used:

Table 1: Descripive Statistics of the variables used in the model

Variable	Mean	S.D	Minimum	Maximum
SAT	16.1	3.4	31.5	68.7
MICRO	3.4	0.8	0.1	5.6
COUNT	8.5	3.9	9.1	40.2
SIZE	45.7	21.2	15.0	105.0
RATING	2.6	0.7	1.5	8.3
TENURE	10.4	7.3	0.8	30.4
YREXP	12.3	8.4	1.6	32.5
PRECON	0.60	0.28	0.1	1.2
LECT	0.86	0.16	0.2	1.1
HOMERK	3.8	3.6	0.1	13.1
HOURS	4.0	1.6	2.0	8.4

Source: Research data, 2022

$$POST = B_o + B_1\ SAT + B_2\ MACRO + B_3\ COUNT + B_4\ SIZE + B_5\ RATING + B_6\ TENURE + B_7 YREXP + B_8\ PRECON + B_9\ LECT + B_{10}\ HOMEWK + B_{11}\ HOURS + \mu. \quad (4)$$

Where: μ is the stochastic error term accounting for other endogenous variables not included in the model, but which were likely to affect the student's pass rates and performance. B's were the multiple regression coefficients of the OLS step-wise.

The sphericity test was used to verify the null hypothesis that the explanatory variables of the model were not correlated before being subjected to analysis. (Table 2).

Table 2: Estimated coefficients, step-wise multiple regression model

Variable	Estimated Coefficients	Lecturer's Influence Test	Department Influence Test
CONSTANT	-10,362 (-1.43)	-16.715 (-2.62)	-19.620 (-1.16)
SAT	0.91 (3.15)	1.39 (2.54)	1.44 (6.02)
MACRO	1.76 (2.46)**	0.87 (3.79)	-0.61 (-3.15)
COUNT	3.52 (4.12)***	3.81 (5.54)	1.41 (2.01)
SIZE (In)	-0.68 (-0.89)**	-0.76 (-1.14)	
RATING	1.12 (3.11)***	1.25 (2.33)	
TENURE	0.63 (2.83)***	0.41 (0.34)	
YREXP	3.10 (2.78)***	3,28 (2,54)	
PRECON	1,27 (0.86)**	0.39 (0.33)	
LECT	2.47 (3.02)***	1.78 (0.89)	
HOMERK	0,08 (1,11)		
HOURS	0,29 (-0,64)		
R	0.864	0.776	0.557
R^2	0.686	0.615	0.486
R^{-2}	0.632	0.523	0.423
S. Error	15.473	36.146	40.218
DW	2.896	2,162	1.634

Source: Author's calculations, 2022

Observation: t – values are in parentheses. *, **, and *** Significance at the 10%; 5% and 1% levels

This technique helped to reduce multicollinearity in the explanatory variables of the OLS (Manly, 1990; Anim and Lyn, (1994). The explanatory variables for which information was obtained are presented in the section under the empirical model. The empirical results were obtained using step-wise ordinary least squares (OLS) method with a variance error assumed to be inversely proportional to the number of averaged scores related to the dependent variable. The OLS results are represented using POST as a dependent variable.

The first column of the Table 2 provides the estimated regression coefficients of the explanatory variables. All t-values indicate significance at the 1% level (P<0,01). In contrast the coefficients of HOMEWK and HOURS of study were not significant. The hypotheses that students' pass rates were not influenced by the type of teaching was not accepted (P<0,40).

Once account was take for student ability as measured by SAT, pass rate was affected by the type of the teaching by the lecturer. The t-values for PRECON, LECT, RATING, TENURE, YREXP, SAT, MACRO, COUNT and SIZE were significant at the 1% (P<0,01) and 5% (P<0,05) levels respectively. In asking whether the things over which the lecturer has some control would affect pass rates, in particular it was investigated if student's performance was affected by the lecturer when spending less time lecturing, having more fun in class, giving more assignments (with no acceptable corrections), giving students more multiple-choice questions, teaching them irrelevant economic concepts or inducing students to spend more time/hours studying economics impacted them negatively.

The hypothesis that the lecturer's chosen variables collectively have no influence on the students performance was also rejected. Indeed such variables collectively play a vital role on the student performance. The probability of non acceptance of the hypothesis was estimated at (P<0,45). The third column of table 2 provides the test of the School in influencing the pass rates. It was also questioned whether things over which the lecturer has some control could affect students' performance.

In particular it was questioned if students' performance was affected by assigning them a turnered or tenure-track lecturer, assigning them a lecturer with considerable experience, assigning them a high-rated lecturer, reducing the class size, introducing economics prerequisite, or even the treatment of students by the department. To this effect, the hypothesis that the School collective decisions have no influence on students' performance was also rejected at the P <0,95.

It was believed that department's decisions collectively have influenced the performance and student pass rates. Looking at both the statistics R, R^2, R^{-2}. S.E and DW of the estimated coefficients and the lecturer's influence test, it could be argued that these statistics were significant at the 1% level (p<0,01); except the statistic DW which was significant at the 5% level or (P<0,05). Compared to the statistics of the department in influencing the pass rates, it could be stated that these statistics were still significant at the 5% level or (P<0,05). Table 3 provides the estimated coefficients of specification for microeconomics (Micro) and macroeconomics (Macro) classes. MACRO variable was earlier defined as having coefficient one for macro module and zero for micro module. This means that, on the final 130 observations, 65 were macro and 65 micro. The testing down procedure was applied to separate regression coefficients for macro and micro modules.

Table 3 - Estimated Coefficients, Step Wise Multiple Regression Micro and Macro.

Variable	Micro Class (N = 65)	Macro Class (N = 65)
SAT	1.46 (8.33)***	0.39 (6.08)**
COUNT	3.89 (4.03)***	2.67 (3.90)***
SIZE	1.07 (5.15) **	1.28 (4.72)**
LECT	2.01 (3.04)***	2.20 (2.46)***
R	0.664	0.662
R^2	0.571	0.554
R^{-2}	0.493	0.463
DW	1.178	1.164

Source: Author's calculations, 2023.

Obs: t-values are in parentheses. *; **, and *** are Significance at the 10%, 5%, and 1% levels

This specification provided the slope of the coefficients tested insignificantly different from oneanother at P < 0,65 for both macro and micro. In order to get more efficient estimates and to provides good exposition of data, it was decided to combine both data on micro and macro, using one intercept only to differentiate between them as shown in Table 3. Looking at the results in table 3, the following information could be provided:

(1) the t-values for both regressors of micro and macro were significant at the 1% level or (P<0,01), while the coefficient of LECT was also significant at the 1% level (p,0.01).

(ii) the statistics R and R^2 were significant at the 5% level or (P<0,05). In contrast, the statistics R^{-2} and DW were not significant.

Conclusion

The main purpose of this study was to investigate the influence of class size on pass rates and student performance in introductory macro and microeconomics at SAUT main campus. The finding suggested that larger class size has the same potential as the smaller class size in promoting learning in these subjects. The data was a one-institution data where the study was conducted and it was not of different institution with different types of data used. The class size was fairly distributed across range from 5 to 65 and more. The procedure of averaging student data to obtain observations on classes helped to reduce several econometric problems commonly found in this kind of studies.

By and large lecturers of introductory economics classes (macro and micro) cannot change their behaviour as class size changes (Wang and Calvano, 2022). The results also suggest that some students could have been affected positively while others negatively by the class size. These results should not necessarily be interpreted as a way of putting students in larger classes as a cost-saving measure. However, it is important to have a mixture of different types of classes, large and small, to allow students to make choice of class that best suits their learning ability. *Most factors related to lecturers teaching ability and the department collective decisions on teaching control to be more important in influencing the performance and pass rates.* Lecturer can influence students' performance and pass rate in various ways. These include lecturing less but well prepared, assigning relevant homework, teaching more relevant material and by inspiring students to study more on their own.

The department can influence students' performance and pass rates by assigning better-rated experienced and tenured or tenure-track lecturers. The economics lecturers and department collective factors and decisions have had influence on students' performance and pass rates. Because of their collective factors, it would be appropriate to advocate that they were found to be significant. Both the coefficient LECT, RATING and YREXP were significant. In the case of SAUT this implies that lecturers had good rating, experience, ability and good teaching of the subject. As a result students will have to perform well in tests and examinations. The empirical results of this study are encouraging for the Department of Economics at SAUT.

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Public Debt and Economic Growth Nexus in Sub Saharan Africa: Does the Quality of Institutions Matter?

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Abstract

This research aimed to provide insights into the relationship between public debt and economic growth in sub-Saharan African (SSA) countries. Our study focuses on 42 countries from 2000 to 2022, utilizing the System Generalized Method of Moments approach to investigate the impact of institutional quality indices on this relationship. The study findings suggest that public debt has a negative impact on economic growth in the SSA region, and that institutional quality is a critical determinant of economic growth. We also established that improving institutional quality can positively influence the relationship between public debt and economic growth. We believe that policymakers have an essential role to play in ensuring that public debt is utilized responsibly to promote sustained economic growth. Our view is that Governments in the SSA region should also focus on improving domestic revenue mobilization and public finance management to ensure the prudent use of public funds. We recommend that governments work to improve institutional quality and manage the public debt stock to create an investment-friendly environment that attracts foreign capital inflows and contributes positively to economic growth in the region. It is our hope that findings of the study will enable policymakers make informed decisions to promote economic growth and development in the SSA region.

Keywords*: public debt, institutions quality, economic growth, System GMM, Sub-Saharan Africa*

JEL: F34, F43

1. Introduction

In most Sub-Saharan Africa (SSA) countries public debt has been an important source of financing development projects, mainly as a way of supplementing local revenue sources. However, recently, the global economy has been shocked by the economic crisises of 2008, COVID-19, pandemic climate-related events and natural disasters, and high international prices for food, fuel, and fertilizers following the Russia-Ukraine War. As a result, most SSA countries have been exposed to slowing down economic activities and growth, as well as greater debt exposure (Kinyondo et al. 2021). Likewise, the high demand to finance public projects in SSA countries resulted in high public debt (Daba Ayana et al., 2023). Over the 2012-2022 period, the public debt to GDP ratio in SSA has increased by about 30 percentage points, from 28.8 percent of GDP to 59.1 percent (International Monetary Fund, 2023). Most of the countries are experiencing fiscal imbalances and unpredictable development as a result of rising debt levels (Ramzan *et al.,* 2023).

Empirically, the effect of public debt on growth is not clear. However, public debt can have either positive or negative effects on the economic growth of a country's economy.

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If public debt is used for development expenditure like building infrastructure then the country may benefit as it may have a multiplier effect on boosting economic growth. Conversely, public debt may retard economic growth if the funds are not channeled towards the right productive activities. Meanwhile, most studies on SSA have shown that public debt harms economic growth, but the quality of governance or institutions may be used to mitigate this negative effect (Kim et al., 2017). There are several ways in which the quality of institutions may affect the debt-growth nexus. It has been documented that countries with weak institutional quality may tend to redirect public debt from its intended purpose to areas more conducive to misappropriation (Sandow et al, 2022). Theoretically, quality institutions act as a catalyst for growth. Institutional quality may matter in the debt-growth relationship via the efficient and sensible use of public debt. Acemoglu *et al.* (2003) argue that institutions have more casual effects on economic outcomes, and therefore, countries with good governance tend to grow faster. Likewise, Mensah et al. (2018) and Nounamo et al. 2021 showed that public debt enhances economic growth in the presence of good governance or institutions. In contrast other studies (Kinyondo et al., 2021; Oppong et al., 2023) found that, even when we control for institutional quality, government debt still has a negative effect on economic growth. As a result, in the empirical literature, the moderate effect of the public debt-growth nexus has got more attention in the context of SSA.

Moreover, not all indicators of institutional quality are equally important in the debt-growth nexus (Kedir et al., 2023). Therefore, following Huque (2019), we deploy the six indicators of institutional quality (Voice and accountability, Political stability and violence, Government effectiveness, Regulatory quality, Rule of law, and Control of corruption) to investigate how the quality of institutions moderates the public debt-economic growth nexus in SSA. In the spirit of Kedir et al. (2023), we accord special attention to the relative weight of each of the indicators using principal components analysis which is in turn used to build an aggregate index of institutional quality.

Against this background, this paper investigates whether the quality of institutions has an impact on the debt-growth nexus of 42 selected SSA countries during the period 2000 to 2022. We also use the system GMM approach, which has several econometric advantages over the traditional panel approach and thus, provides more robust results and conclusions. Despite capturing the impact of institutions with a single institutional variable, this paper created an institutional index using the six governance indicators using the principal component analysis. We also consider the interaction term of public debt with each institutional quality indicator included to determine if the net impact of public debt on economic growth is boosted or hampered by the quality of institutions existing in SSA. Lastly, the existing studies in SSA have never analyzed the causality between external debt, institutional quality, and economic growth.

After this short introduction, the paper is organized in four other sections. Section 2 discusses the literature on public debt, institutional quality, and the economic growth nexus. Section 3 provides the descriptions of the data set and the econometric methodology used in this study, while Section 4 provides the empirical results and discussion. The final section concludes and suggests some important policy implications.

2. Literature Review

The neoclassical growth theory suggests that there is a positive relationship between debt and economic growth. This theory posits that in a stable macroeconomic environment with investment-friendly policies, borrowed funds invested in profitable ventures should have a positive impact on economic output (Matthew & Mordecai, 2016). This would make it easier to repay the debt. Specifically, the theory suggests that there is an incentive for capital-scarce countries to borrow and invest, especially when the return on investment is greater than the interest payment on the debt (Nguyen et al., 2003).

Another prominent theory, the overhang theory proposed by Krugman clarifies the debt-growth relationship (Krugman, 1988). According to this theory, external debt hurts economic growth. The overhang theory suggests that if a country's future debt stock is larger than its ability to repay, the expected debt service obligations will likely become a larger portion of the country's output. This can discourage investment and reduce growth due to the imposition of high marginal taxes by external creditors. In essence, debt servicing can reduce the country's potential for growth by exhausting its revenue (Abdullahi et al., 2016).

Empirically, numerous studies have analyzed the relationship between public debt and economic growth in a panel setting. For instance, Eberhardt and Presbitero (2015) studied 118 developing, emerging, and advanced economies covering the period 1960 to 2012 and found a consistent negative relationship between government debt and economic growth. Similarly, Hussain et al. (2015) examined 48 countries in Sub-Saharan Africa from 1995 to 2012 and also found a negative correlation between public debt and economic growth. In addition, Gachunga (2019) used the system GMM approach to investigate the impact of external debt on the economic growth of 38 SSA covering the

period 1990 to 2016, revealing a negative effect on the economic growth of SSA countries. Further, Lau et al. (2022) examined the effect of external debt on the economic growth of 16 developing countries in Asia from 1980 to 2016, and came up with the findings indicating a negative influence of external debt on economic growth in most Asian developing countries.

Recent studies have shown a growing interest in examining how the quality of institutions affects the relationship between public debt and economic growth. For instance, Ashogbon et al. (2023) conducted a study on the Nigerian economy from 1981 to 2021 using the ARDL estimation technique. They found that domestic public debt had a positive impact on economic growth in the long run, while external public debt had a negative effect. Additionally, institutional quality was found to harm economic growth in the long run, but not in the short run. In a similar study in Pakistan from 1996 to 2020, Ramzan et al. (2023) also used the ARDL estimation technique and discovered that public debt had a short-term positive effect on economic growth but a long-term negative impact. However, when combined with institutional quality indicators, public debt showed a significant positive association with economic growth in both the short and long run.

In a study using panel data, Zaib et al. (2023) employed panel quantile regression to examine the intertwined impacts of public debt, political-institutional performance, and economic growth in developing nations from 1996 to 2021. The results indicated a negative correlation between public debt and economic growth across quantiles. Conversely, political institutional performance and its interaction with public debt demonstrated a positive influence on economic growth, suggesting that robust political institutions can alleviate the adverse effects of debt. Additionally, Ouedraogo (2015) conducted a study on the influence of external debt and institutional quality on economic growth within the WAEMU. The estimation results from system GMM revealed the positive impact of external debt on economic growth up to a threshold of 51%, beyond which the economic performance of WAEMU turned negative. The findings also highlighted the positive effects of enhanced institutional quality on economic growth.

In SSA, Mensah et al. (2018) investigated the impact of institutional quality on the external debt–growth nexus for 36 economies over the 1996–2013 period. The results from the IV-System GMM showed a significantly positive effect of external debt and institutional quality on economic growth. However, the interaction term between institutional quality and external debt resulted in a significantly negative effect on economic growth. Additionally, Sani et al. (2019) examined the impact of public debt and institutional quality on economic growth using the GMM approach on a sample of 46 SSA countries over the period 2000–2014. The results confirmed a significantly negative effect of public debt and its interaction with institutional quality on economic growth. However, the measures of institutional quality had a significantly positive effect on economic growth. Similarly, Kinyondo et al. (2021) used the same estimation technique to examine the relationship between debt and economic growth, while also considering the influence of good governance indicators across 41 SSA countries. The data set covers the period from 2002 to 2015. The findings revealed that all governance indicators had a positive impact on economic performance, indicating the importance of good governance. Additionally, the coefficients of external debt and its interaction with governance indicators were negative. This supports the conclusion that even in the presence of good governance, public debt has a detrimental effect on economic performance.

Oppong et al. (2023) examined the impact of institutional quality and public debt on economic growth in 35 SSA countries from 2010 to 2020. The study utilized the System Generalized Method of Moments (SGMM) and Fixed Effect techniques. The results showed that an increase in public debt hurts economic growth, but this impact is mitigated when there is an improvement in institutional quality, as proxied by measures such as anti-corruption perception or government effectiveness. Furthermore, the findings demonstrated a positive relationship between institutional quality and economic growth. In a study conducted by Alemu et al. (2023), the impact of external debt on economic growth was analyzed with a focus on the mediating role of institutional quality. The researchers employed a heterogeneous panel Autoregressive Distributed Lag (ARDL) model to examine data spanning the period 1998 to 2019 in East African countries. The findings revealed a significant long-term positive effect of external debt on economic growth, but this effect was limited to a threshold level of 62.9%. Additionally, the interaction effect of institutional quality and external debt was found to have a significant positive impact on economic growth. This suggests that as the institutional quality of the region improves, the negative impact of external debt on economic growth declines.

3. Data and Methodology

3.1 Data

To analyze the role of institutional quality on a debt-growth nexus, this paper used data from 42 SSA countries over the period 2000-2022. The data of GDP per- capita growth (annual %) from World Development Indicators released by the World Bank, while total investment as a percentage of GDP, General government gross debt as a

percentage of GDP, current account balance as a percentage of GDP, population in millions inflation, average consumer prices were extracted from World Economic Outlook (WEO) compiled by the IMF. The data for institutional quality were obtained from the Worldwide Governance Indicator database.
The variables that are used in this study are defined as follows:

3.2 Dependent variable: Economic Growth which is measured as annual real GDP per- capita income growth.
Independent variables: This study used public debt-to-GDP ratio to measure debt burden in Sub-Saharan Africa (SSA). The expected sign could be positive or negative. Six institutional quality metrics were also used, which were compiled by the Worldwide Governance Indicators (WGI). These institutional indicators are measured on a scale of -2.5 to +2.5, where the highest score signifies better institutional quality and vice versa. As these metrics are multidimensional, it has been argued that they should be aggregated as a principal component to form a single index to avoid the risk of multicollinearity. Therefore, an institutional index (IQI) was created using the Principal Component Analysis (PCA) approach from the six governance indicators of the World Bank (World Bank 2020a). The resulting IQI is strongly and positively correlated with all institutions' variables, providing the most comprehensive explanation of these variables simultaneously. These are shown in Table 1.

Table 1. Correlation Matrix (IQI and Institutional Variables)

	IQI	Va	Ps	Ge	Rq	Rl	Cc
IQI	1						
Va	0.73	1					
Ps	0.65	0.60	1				
Ge	1.00	0.73	0.65	1			
Rq	0.88	0.78	0.59	0.88	1		
Rl	0.91	0.80	0.75	0.91	0.88	1	
Cc	0.84	0.69	0.67	0.84	0.77	0.87	1

Notes: IQI = Institutional Quality Index; ROL = Rule of law; CCORR = Control of Corruption; VAC = Voice and Accountability; RQ = Regulatory Quality; Government Effectiveness, and Political Stability. Source: Authors' Computations using Data Extracted from WGI, 2024.

The IQI calculation involves two components, each with its own eigenvalue (the variance of the component). The first component has an eigenvalue of 4.8226, which accounts for 80.38% of the common variance of the series. The second component has an eigenvalue of 0.4734 and explains 7.89% of the variation. A value greater than one indicates that the component captures more variance than its expected share of the total variance of the variables. Therefore, the first component is used in this instance. Another measure of sample adequacy is the Kaiser-Meyer-Olkin (KMO) index, which compares partial correlations and correlations between variables. A KMO value higher than 0.50 supports the use of PCA. In this case, the KMO value is 0.8940, which means that PCA's use is justified. Table 2 shows some important characteristics of the IQI computation.

Table 2. PCA and Eigenvectors

Variables	Sample
PCA eigenvectors (highest)	4.823
Proportion explained	0.804
Kaiser-Meyer-Olkin (Overall)	0.894

Source: Author's Computations using Data Extracted from WGI, 2024.

To address the main question of investigation of the study, the nexus between debt and growth, we added the interaction term of the institutional quality index with public debt. This was done to establish whether public debt has a positive or negative impact on the net effect of quality institutions on economic growth.
The control variables of the study include counter population in millions, which can have a positive or negative sign. Inflation, measured as the annual change in general price level is hypothesized to have a negative sign since it is a proxy for macroeconomic stability. The current account is used as an indicator of the relative importance of international trade to a given country. It is measured as a percentage of GDP and its sign is expected to be positive. Lastly, investment as a percentage of GDP is used as a proxy for the level of investment in physical capital, and its sign

is expected to be positive. Table 3 presents a definition of the variables, a priori expectations of relationship with dependent variable and sources of the data.

Table 3: Variables used

Variables	Descriptive	Sign	Source of data
GROWTH	Per capita income growth (annual %)	NA	WDI
DEBT	General government gross debt (% of GDP)	+/-	IMF
INV	Total investment (% of GDP)	+	IMF
INF	Inflation, average consumer prices (annual change)	-	IMF
IQI	Institutions quality index	+	WGI
VA	Voice and accountability	+	WGI
PS	Political stability	+	WGI
GE	Government effectiveness	+	WGI
RQ	Regulatory quality	+	WGI
RL	Rule of law	+	WGI
CC	Control of corruption	+	WGI
POP	Population in Millions	+/-	IMF
CA	Current account balance (% of GDP)	+	IMF

Source : Author's Compilation

3.3 Model Specification

The modelling approach to studying the direct and indirect impact of institutional quality on the debt-growth relationship is based on dynamic system GMM model by (Siddique et al., 2016). The model is specified as follows:

$$GROWTH_{it} = \beta_0 + \beta_1 GROWTH_{i,t-1} + \beta_2 DEBT_{it} + \beta_3 IQI_{it} + \beta_4 INV_{it} + \beta_5 INF_{it} + \beta_6 CA_{it} + \beta_7 POP_{it} + \mu_{it} \dots\dots (1)$$

where GROWTH is the real GDP per capita growth used as a proxy for economic growth. DEBT is the public debt-to-GDP ratio and IQI is the institutional quality indices; INV is the gross fixed capital formation as a percentage of GDP; POP is the population in millions; INF is the annual inflation rate; CA is the current account as a percentage of GDP; and μ_{it} is the random variable.

Furthermore, to test the hypothesis that institutional quality affects a debt-growth nexus, we follow Kim et al. (2017) and introduce the interaction term (DEB*INS) of public debt and institutional variable in the model based on the multiplicative interactive term. Therefore, the modified equation (1) reads as:

$$GROWTH_{it} = \beta_0 + \beta_1 GROWTH_{i.t-1} + \beta_2 DEBT_{it} + \beta_3 IQI_{it} + \beta_4 (DEBT * IQI)_{it} + \beta_5 INV_{it} + \beta_6 INF_{it} + \beta_7 CA_{it} + \beta_8 POP_{it} + \mu_{it} \quad (2)$$

3.4 Estimation Strategy

This paper utilizes the two-step GMM estimator proposed by Arellano and Bond (1991) to estimate the impact of institutional quality on the public debt-growth relationship in Sub-Saharan Africa. The system GMM is preferred due to its ability to address bias and country-specific effects simultaneously. This method provides efficient estimates and handles endogeneity and Heteroskedasticity issues effectively. Additionally, it addresses problems related to reverse causality (Makate et al., 2018) and is suitable for obtaining efficient estimators in the presence of serial correlation (Wooldridge, 2001). The validity of the instruments used in the two-step system GMM estimator is checked through the Hansen Test, where the p-value is greater than 10 percent, and the absence of a second-order serial correlation test (2).
Furthermore, we apply the technique developed by Juodis et al. (2021) to explore the relationship between public debt, economic growth, and institutional quality in Sub-Saharan Africa. This method reports the Wald test statistic and its p-value, the null and alternative hypotheses, and regression results concerning the HPJ bias-corrected pooled estimator. The approach also offers manual and automatic lag-length selection options using the Bayesian information criterion (BIC) and accounts for cross-sectional dependence and cross-sectional Heteroskedasticity in the errors. Moreover, this test may be utilized for Granger causality in equations with multiple relevant variables, although a balanced panel is required for the command.

4. Research Results

4.1 Preliminary Analysis

Tables 4 and 5 depict the findings of the study's descriptive and correlation analyses for the variables used. Table 4 displays the results of the descriptive summary statistical analysis of the variables used in the study. The results reveal that between 2000 and 2022, the real GDP per capita growth for 42 selected countries in Sub-Saharan Africa (SSA) ranges from -36.8 to 55.6, with an average value of 1.6 and a standard deviation of 5.0. The findings also indicate that the public debt-to-GDP ratio has an average value of 57.9 percent, with a standard deviation of 45.6 percent. Furthermore, the institutional quality indices vary from -2.5 (lowest) to 1.7 (highest). Additionally, Table 4 demonstrates that the mean values for investment, population, and investment were 22.1, 9.4, and 19.7, respectively.

A close look on the correlation matrix presented in Table 5, it is evident that there are mutual or complementary relationships between the variables in the model. The negative correlation between public debt and economic growth is noteworthy. In contrast, all institution quality variables and the index derived from them exhibit a mild but positive association with economic growth (Table 5). Additionally, the result indicates that investment and population have a positive relationship with economic growth, while inflation and current account balance negatively correlate with it. In addition, Table 5 shows that the correlation values of the explanatory variables do not appear to be high, indicating absence of Multicollinearity problems in the sample.

Table 4: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Economic growth	966	1.63	5.00	-36.78	55.59
Public debt	966	57.87	45.65	0.49	290.39
Investment	966	22.08	9.87	2.00	79.40
Inflation	966	9.42	33.03	-72.73	557.21
Population	966	19.68	29.76	0.08	216.75
Current account	966	-4.62	9.47	-84.11	24.76
Institutions quality index	966	0.00	1.00	-1.87	3.07
Voice and accountability	966	-0.55	0.73	-2.23	0.98
Political stability	966	-0.49	0.85	-2.50	1.28
Government effectiveness	966	-0.73	0.61	-1.88	1.15
Regulatory quality	966	-0.65	0.61	-2.37	1.20
Rule of law	966	-0.66	0.63	-1.87	1.02
Control of corruption	966	-0.60	0.65	-1.65	1.70

Source: Authors' Computations based on Data Extracted from WDI, WEO and WGI, 2024.

Table 5: Correlation Analysis

	Growth	Debt	Inv	Inf	Pop	cab	IQI	Va	ps	ge	rq	Rl	cc
Growth	1												
Debt	-0.13	1											
Inv	0.18	-0.07	1										
Inf	-0.12	0.12	-0.08	1									
Pop	0.06	-0.18	-0.02	0.08	1								
Cab	-0.06	0.01	-0.33	0.05	0.08	1							
IQI	0.10	-0.14	0.26	-0.10	-0.09	-0.06	1						
Va	0.07	-0.19	0.20	-0.11	-0.05	-0.10	0.73	1					

Ps	0.06	-0.06	0.24	-0.14	-0.46	0.00	0.65	0.60	1				
Ge	0.10	-0.14	0.26	-0.10	-0.09	-0.06	1.00	0.73	0.65	1			
Rq	0.07	-0.28	0.21	-0.14	-0.08	-0.04	0.88	0.78	0.59	0.88	1		
Rl	0.09	-0.14	0.26	-0.13	-0.16	-0.05	0.91	0.80	0.75	0.91	0.88	1	
Cc	0.08	-0.02	0.23	-0.10	-0.22	-0.06	0.84	0.69	0.67	0.84	0.77	0.87	1

Source: Authors' Computations based on Data Extracted from WDI, WEO and WGI, 2024.

4.2 Estimation Results

Table 6 displays the results of estimated models utilizing the dynamic system generalized method of moments (SGMM). The findings indicate that there is a positive and significant impact of economic growth with a one-year lag on economic growth at a 1% level of significance across all columns of the results. This conforms to theoretical expectations as previous levels of economic growth can potentially increase current economic growth through various channels such as an increase in available capital for savings, investment purposes, as well as an increase in aggregate demand (Manasseh et al., 2022). Furthermore, the results reveal a statistically significant negative impact of the public debt-to-GDP ratio on economic growth at a 1% level of significance across all models. This supports the dominant view in the literature that an increase in the debt-to-GDP ratio is associated with a decrease in economic growth. This suggests that public debt has a negative influence on the economic performance of SSA. These results are in line with previous findings (Sani et al., 2019; Manasseh et al., 2022). Nevertheless, Kinyondo et al. (2021) found a negative but insignificant effect of public debt on economic growth, while Mensah et al. (2018) found a positive and significant effect of external debt on economic growth in SSA.

This study has also established that the quality of institutions has a positive and significant effect on economic growth. Indices such as voice and accountability, political stability, government effectiveness, regulatory quality, the rule of law, and control of corruption also have a positive and statistically significant impact on economic growth. This supports Acemoglu et al.'s argument that institutions play a crucial role in economic growth as they shape the incentives of key economic actors in society, affecting investments in physical and human capital and technology, as well as the organization of production. This finding compares well with previous studies by Mensah et al. (2018), Sani et al. (2019), and Kinyondo et al. (2021). Further, the study found that the coefficients for the interaction terms are negative and statistically significant, except for the voice and accountability index. This suggests that even with good governance, government debts can hinder economic growth in Sub-Saharan African countries. However, the magnitude of the negative coefficient between public debt and economic growth declines significantly with the inclusion of the interaction term. This suggests that an improvement in the institutional quality have a significant influence in reducing the negative impact of public debt on economic growth. Therefore, an improvement in institutional qualities plays a pivotal role in not only minimizing the negative impact of public debt on economic growth in SSA. This finding is consistent with Sani et al. (2019) and Kinyondo et al. (2021). However, Manasseh et al. (2022) found that the interactive effects of external debt volatility and institutional governance had a positive and significant effect on economic growth in Sub-Saharan Africa.

Most of the control variables used in the models are widely used in the empirical analyses. For example, investment as a percentage of GDP has a positive and statistically significant impact on economic growth in all models, indicating that investment stimulates economic growth in SSA. Furthermore, the population coefficient has a positive and statistically significant effect on economic growth for all model estimation results. This suggests that larger populations in the SSA generate higher economic growth by providing cheap labour and creating markets for goods and services. Furthermore, similar to Ehikioya et al. (2020), we found a negative effect of inflation on economic growth in SSA. However, the coefficient of the current account as a percentage of GDP is negative but statistically insignificant, at all conventional levels, in influencing economic growth in all estimated models.

Table 6: Estimation Results

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Economic growth = L,	-0.098***	-0.108***	-0.119***	-0.098***	-0.102***	-0.106***	-0.087***
	(0.025)	(0.028)	(0.028)	(0.025)	(0.026)	(0.026)	(0.032)
Public debt	-0.014***	-0.012*	-0.022***	-0.029***	-0.025***	-0.023***	-0.023***
	(0.004)	(0.007)	(0.005)	(0.008)	(0.008)	(0.007)	(0.007)
Investment	0.067***	0.064***	0.048**	0.067***	0.074***	0.060***	0.061***
	(0.021)	(0.022)	(0.024)	(0.021)	(0.023)	(0.021)	(0.023)
Inflation	-0.015**	-0.013**	-0.020***	-0.015**	-0.013**	-0.014**	-0.016**
	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)

Population	0.016***	0.013***	0.037***	0.016***	0.015***	0.019***	0.022***
	(0.003)	(0.003)	(0.007)	(0.003)	(0.003)	(0.003)	(0.004)
Current account balance	-0.021	-0.010	-0.035	-0.021	-0.014	-0.022	-0.024
	(0.033)	(0.035)	(0.034)	(0.033)	(0.033)	(0.035)	(0.032)
Institution quality index (IQI)	1.089***						
	(0.247)						
IQI*debt	-0.013***						
	(0.004)						
Voice and accountability (VA)		0.913***					
		(0.350)					
VA*debt		-0.004					
		(0.005)					
Political stability (PS)			2.791***				
			(0.645)				
PS*debt			-0.029***				
			(0.008)				
Government effectiveness (GE)				1.775***			
				(0.402)			
GE*debt				-0.020***			
				(0.007)			
Regulatory quality (RQ)					1.090*		
					(0.585)		
RQ*debt					-0.014**		
					(0.006)		
Rule of Law (RL)						1.766***	
						(0.501)	
RL*debt						-0.016**	
						(0.006)	
Control of corruption (CC)							2.057***
							(0.516)
CC*debt							-0.022***
							(0.007)
AR(1)	-3.56***	-3.56***	-3.70***	-3.56***	-3.54***	-3.55***	-3.53***
AR(2)	-1.04	-0.49	-0.52	-1.04	-1.00	-0.94	-1.12
Sargan test	1.39	1.66	1.63	1.39	1.59	1.63	1.63
Hansen test	2.44	2.69	2.39	2.44	2.96	2.71	2.39
Observations	920	920	920	920	920	920	920
Number of year	23	23	23	23	23	23	23

*Notes:Economic growth is the dependent variable; *** p<0.01, ** p<0.05, * p<0.1 denotes statistical significance at 1%, 5% and 10% respectively. Standard errors in parentheses.*
Source: Authors' Computation based on Data Extracted from WDI, WEO and WGI, 2024.

Regarding the post estimation statistics, Table 6 shows that we can reject the null hypothesis of no first-order serial correlation in first differences (AR (1) test) but we cannot reject the null hypothesis of no second-order serial correlation in first differences (AR (2)). Therefore, we can conclude that there is no serial correlation problem in our model since there is absence of the second-order serial correlation in disturbances. Furthermore, the Sargan and Hansen tests of over-identifying restrictions show that we cannot reject null hypothesis that over-identifying restrictions are valid, thus implies all instruments are valid (Table 6).

4.3 Granger Causality Test Results

We conducted Granger non-causality tests in heterogeneous panels using the approach suggested by Juodis et al. (2021), which can be accessed using the "stranger" Command. The results are presented in Table 7. We found no evidence to reject the null hypothesis that economic growth does not cause public debt. However, we rejected the null hypothesis that public debt does not cause economic growth, at a 1% significance level. This indicates that the causality is unidirectional, from public debt to economic growth in Sub-Saharan Africa (SSA), and not the other way around. These findings are consistent with previous research by Çiftçioğlu, Sokhanvar (2018) and Kibona and Kirama (2024), and may be explained by the additional accumulation of public debt, which can lead to changes in economic growth.

Further, we tested the Granger causality between the quality of institutions and economic growth. The results showed bidirectional causality between the quality of institutions and economic growth, as the null hypothesis was rejected in both directions at a 1% significance level (Table 7). This finding is in line with Nair et al. (2021). Conversely, Asghar et al. (2020) demonstrated a unidirectional causal relationship between institutional quality and economic growth in developing nations of Asia. Kebede and Takyii's (2017) showed a unidirectional relationship between institutional quality and economic growth in Sub-Saharan Africa. As shown in Table 7, all indices related to the quality of institutions indicate a bidirectional causal relationship between voice and accountability and economic growth, but not between political stability and growth. However, other metrics, such as government effectiveness, regulatory quality, the rule of law, and control of corruption, depict a unidirectional causality between each index and economic growth.

Table 7: Juodis *et al*. (2021) Granger Non-Causality Test Results

Null Hypothesis	HPJ Wald test	pvalue_HPJ
Public debt does not Granger-cause economic growth.	24.02	0.00
Economic growth does not Granger-cause public debt.	4.83	0.31
Institution quality does not Granger-cause economic growth.	48.82	0.00
Economic growth does not Granger-cause institution quality	13.14	0.00
Voice and accountability does not Granger-cause economic growth	28.32	0.00
Economic growth does not Granger-cause Voice and accountability.	70.71	0.00
Political stability does not Granger-cause Economic growth.	4.99	0.29
Economic growth does not Granger-cause political stability	4.50	0.21
Government effectiveness does not Granger-cause economic growth	48.82	0.00
Economic growth does not Granger-cause government effectiveness	0.15	0.70
Regulatory quality does not Granger-cause economic growth	31.05	0.00
Economic growth does not Granger-cause regulatory quality	0.21	0.65
Rule of law does not Granger-cause economic growth.	8.09	0.09
Economic growth does not Granger-cause rule of law	0.81	0.37
Control of corruption does not Granger-cause economic growth	10.72	0.03
Economic growth does not Granger-cause control of corruption	1.17	0.28

Source: Own Computations based on Data Extracted from WDI, WEO and WGI, 2024.

5. Conclusion

This study presents a comprehensive analysis of the impact of institutional quality on the relationship between public debt and economic growth in Sub-Saharan Africa (SSA), employing the system GMM approach. The study specifically looks at how public debt and institutional quality interact with debt to impact economic growth in Sub-Saharan Africa. The research, using data from 42 SSA countries spanning over the period 2000 and 2022, came up with several findings. It underscored the negative impact of public debt on economic growth in the SSA region. The analysis also revealed that the quality of institutions has a critical influence on economic growth and can affect the widely observed negative relationship between public debt and economic growth. This underscores the crucial role of institutional quality in shaping the debt-growth relationship. Furthermore, these findings emphasize that good institutions are essential to foster economic growth and serve as a vital tool in mitigating or even preventing the adverse effects of public debt on economic performance.

The study has also identified three other crucial determinants of economic growth: heightened investment levels, reduced inflation rates, and an increased regional population. The Granger causality test also revealed a unidirectional causal relationship between public debt and economic growth while uncovering a bidirectional causal association between institutional quality measures and economic growth.

In the context of sub-Saharan Africa (SSA), responsible borrowing practices are necessary to counteract the negative impact of public debt on economic growth. Given that most SSA countries experience a shortfall in domestic revenue mobilization compared to their expenditure requirements, public debt is an inevitable aspect of the development process. Nevertheless, the prudent utilization of debt for capital accumulation, with the expectation of generating income upon completion while establishing favorable economic development conditions, remains a priority.

To reduce the debt burden, SSA countries may need to prioritize concessional loans over commercial ones whenever possible to minimize the financial burden. This however does not under-emphasize the need for enhancing domestic revenue mobilization and public finance management as imperatives to ensure increased domestic resources and the judicious use of public resources. With regard to the institutions that have influence on the deb-growth nexus, SSA countries should consider improving their quality. They also need to carefully and closely monitor the public debt stock, in order enhance the investment environment and attract more foreign capital inflows which is likely to reduce borrowing requirements.

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Appendix 1: Countries covered

#	Country Name	#	Country Name	#	Country Name
1	Angola	15	Eritrea	29	Mozambique
2	Benin	16	Eswatini	30	Namibia
3	Botswana	17	Ethiopia	31	Niger
4	Burkina Faso	18	Gabon	32	Nigeria
5	Burundi	19	Gambia, The	33	Rwanda
6	Cameroon	20	Ghana	34	Senegal
7	Cape Verde	21	Guinea	35	Seychelles
8	Central African Republic	22	Guinea-Bissau	36	Sierra Leone
9	Chad	23	Kenya	37	South Africa
10	Comoros	24	Lesotho	38	Tanzania
11	Congo, Dem. Rep.	25	Madagascar	39	Togo
12	Congo, Rep.	26	Malawi	40	Uganda
13	Côte d'Ivoire	27	Mali	41	Zambia
14	Equatorial Guinea	28	Mauritius	42	Zimbabwe

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Monetary Model of Exchange Rate Determination in Tanzania: A Cointegration Analysis.

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Abstract
The purpose of this paper is to consider a monetary model of exchange rate determination for Tanzanian and test for its long run relationship. The paper confines follow the analysis of the Dornbusch's (1976) monetary model of exchange rate determination. The paper uses quarterly time series data for Tanzania and U.S to analyze the exchange rate determination model for Tanzanian economy for the period of 2009 to the first quarter of 2019 making a total of 41 observations. The paper specifies the Autoregressive Distributed Lag model for analysis of monetary model and test for long run relationship through Bound test. The results from Bounds test concluded that the model has no long-run equilibrating relationship, thereafter the fitting of the long-run equation was done to extract the error correction term and visualize fitting of the long-run equation. The results that this study has come up with suggest that that there is no evidence of long-run relationship between exchange rate and the monetary model of exchange rate determination. With these results the study can conclude, though with caution that the sticky-price monetary model of exchange rate determination is inappropriate for forecasting long-run exchange rate trends in Tanzania.

Keywords: Exchange Rate, Monetary Models, Autoregressive Distributed Lag, Tanzania.

JEL: E5; E52; E58

1. Introduction

This paper presents a monetary model of exchange rate determination for Tanzanian economy and test for its long run relationship. There has been a number of popular exchange rate determination models that have been developed, used and modified by various scholars. The models may include sticky-price monetary model by Dornbusch (1976), flexible price monetary models by Frenkel and Mussa (1976) and real interest rate differential model by Frankel (1979). There are also various approaches developed in exchange rate determination like portfolio balance model, purchasing power parity approach and equilibrium and liquidity models (see Taylor, 1995, Hallwood and MacDonald, 1986; Levich, 1983 as cited by Boyko, 2002). Prices are assumed to be flexible and the purchasing power parity holds in the Frenkel & Mussa (1976) model of flexible-price monetary model, whereas Dornbusch (1976) treats prices as sticky in the short run since they adjust slowly relative asset prices. The two models assume both domestic and foreign money demand are stable, perfect capital mobility with uncovered interest rate parity. The Frankel (1979) model of real interest rate differentials assumes that there is an efficient market where bonds of different countries are perfect substitutes and the expected rate of depreciation of exchange rate is determined by current spot rate and equilibrium rate, expected long-run inflation differential among two countries, domestic and foreign.

This paper confines itself to the analysis of the Dornbusch's (1976) monetary model of exchange rate determination. We seek to analyze the long-run relationship of the model and see if it fits the Tanzanian economy context.

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This paper is divided into five sections; introduction, the model, data, estimation results and conclusion. In the following section we will discuss the model based on Dornbusch (1976) framework, then on section three data type, justification and sources is discussed, then section for gives the estimation results of the model and discussion of the results and the last section the paper gives some conclusion and areas for further extensions.

2. Methodology

2.1 The Model

In the model building following the Dornbusch (1976) framework we assume a small country economy in the large facet of the world were a small economy is insignificant and has no influence on the foreign prices of goods and financial assets. The model further assumes perfect capital mobility such that it equates expected net yields; world rate will equal domestic interest rate less expected rate of depreciation, import goods prices are assumed to be given hence sticky. Domestic output is also assumed to be imperfect substitute for imports, and aggregate demand for domestic goods.

2.2 Perfect capital mobility

Assets or bonds in domestic and foreign currency denominations are assumed to be perfect substitutes. With expectations formation on domestic currency depreciation, interest rate on domestic assets will exceed those assets in abroad by a margin of expected rate of depreciation. Given r is the domestic interest rate and r^* is the foreign rate of interest and x is the expected rate of increase of domestic currency price of foreign exchange.

$$r = r^* + x \qquad (1)$$

Consider a relationship between long-run exchange rate $\bar{e}$ to which an economy will converge and the spot exchange rate e, which the difference between the two explains the expectation of the market players.

$$x = \theta(\bar{e} - e) \qquad (2)$$

2.3 Equilibrium money market

Demand for real money balances equals real money supply, and the demand for real money balances is determined by domestic interest rate and real income. The functional form of the money market model follows a log of nominal quantity of money m, price level p and real income y. Given;

$$-\lambda r + \phi y = m - p \qquad (3)$$

Consider that the money market clears and net assets equals both in the domestic and foreign market, then we combine *(a), (b) and (c)* to get a relationship between spot rate, price level and long-run exchange rate as follows

$$p - m = -\phi y + \lambda r^* + \lambda\theta(\bar{e} - e) \qquad (4)$$

So, with equal interest rate and a fixed money supply in the long-run the exchange rate will be equal and the equality collapses to;

$$\bar{p} = m + (\lambda r^* - \phi y) \qquad (5)$$

where, (e) is long-run equilibrium price level

2.4 The estimation of monetary model

The basic estimation model that the study follows is given as:

$$s_t = \beta_1(m_t - m_t^*) + \beta_2(y_t - y_t^*) + \beta_3(r_t - r_t^*) + u_t \qquad (6)$$

where s is the natural log of nominal exchange rate, m and y denote natural logs of domestic money supply and real output, r is domestic short-term interest rate and u is the error term. All asterisk denotes foreign quantities of respective variables. The model used is adopted from Baillie & Selover (1987) with modification to exclude expectation formation to fit the Dornbusch (1976) sticky-prices model where prices are taken as given and do not adjust to affect nominal interest rate. The model expects parameters $\beta_1 = 1$, $\beta_2 < 0$, the sign for $\beta_3 = 0$ is expected if the economy follows the Dornbusch's sticky-price model or otherwise $\beta_3 < 0$ may be unclear if the economy's exchange rate

follows the Keynesian assumption of increasing domestic interest rate effect on currency appreciation or $\beta_3 > 0$ if there is a rise in interest rate due to inflationary expectations. However, our analysis is confined to a sticky-price model then we make strong assumption to assume that Keynesian assumption does not hold and that the prices are sticky enough not to affect interest rate and make conclusions about it.

2.5 Data sources and sampling

The study uses quarterly time series data for Tanzania and U.S to make analysis of the exchange rate determination model for Tanzanian economy. The period of the data is from 2009 to the first quarter of 2019 making a total of 41 observations. The main sources of the data were OECD Data bank for all variables of money supply (M1) m^*, nominal short-term interest rate r^*, and industrial manufacturing output index y^* for U.S. Data for Tanzania on the all variables money supply aggregate (M1) m, weighted exchange rate s, industrial manufacturing output y , and nominal interest rate r, were all collect and gathered from Bank of Tanzania (BOT) quarterly and annual monetary policy statements and other statistical publications. The variables and the time for analysis were purposely sampled based on literature and availability of data.

3. Results and Discussion

3.1 Unit root test: ADF test

Variables	s_t	$(m_t - m^*)_t$	$(y_t - y^*)_t$	$r_t - r^*_t$
Level	-1.02473	-3.4454**	0.8175	1.6692
1st difference	-4.4433*	-	-3.47036**	-3.85318*
2nd difference	-	-	-	

Note: The 1% and 5% significance level were -3.61 and -2.93 respectively, the asterisk represents level of significance, (*) =1%, (**) =5% and (***) =10%

The unit root test shows that the dependent variable, nominal exchange rate and two independent variables, output and nominal interest rates are integrated of order 1 hence following a random walk process since we fail to reject null that series contain unit root at levels but after first difference, we were able to reject null. However, money supply is integrated of order zero and stationary at level. The results for unit root suggest that we cannot establish a long run relationship of the model (6) above since variables are of different order of integration.

Table 2: OLS estimation of eq. (6)

	$Constant$	$(m_t - m^*)_t$	$(y_t - y^*)_t$	$r_t - r^*_t$	R^2	**DW-statistic**
Coefficients	-2.348177	0.365680	0.919307	-0.006221	0.93	0.77
$t-statistic$	(-3.1417)	(2.69838)	(6.8861)	(-0.34896)		

$* \; t-statistics \; are \; in \; parantheses$

In table 2 above we represent estimation results of equation (6), though results suggest that money supply and output are statistically significant except nominal interest rate, but we cannot conclude directly that because the estimates are based on some series that are not stationary, however the R^2 is very high with a significant small Durbin Watson statistic this perhaps is a clear sign of non-stationary series (Nkoro & Uko, 2016). Thus, we can detect that our model is faced with a problem of spurious regression and hence standard errors are no longer useful and t-statistic are not appropriate since errors may be serially correlated. With the results of the ADF test that shows one of the variables is *I (0)* and other variables are I (1), and from theory it is evident that if two or more series are *I (0)* and *I (1)* then the two series must be *I (1).* To show this a group ADF test was conducted:

Table 3: Intermediate ADF test results

Series	Prob.	Lag	Max Lag	Observations
D(S)	0.0010	0	9	39
D(MS1)	0.0013	2	9	37
D(OUTPUT_Y)	0.0148	3	9	36
D(INTEREST_R)	0.0054	1	9	38

From Table 3 it is evident that all the variables are *I (1)* therefore one or more variable is either *I*

(0). Therefore, to establish a long-run relationship we this criterion to choose the Autoregressive Distributed Lag (ARDL) model for this study. Specifying the ARDL model for the cointegration test we use:

$$\Delta Y_t = \delta_{0i} + \sum_{i=1}^{k} \alpha_i \Delta Y_{t-1} + \sum_{i=1}^{k} \alpha_2 \Delta X_{t-i} + \delta_2 X_{t-1} + \delta_2 X_{t-1} + v_{1t}$$

Here, k represent a number of ARDL model maximum lag that can be selected.

Table 4: ARDL model estimation results

Dependent variable: S_{t-1}(Nominal exchange rate), Method: ARDL			
Variable	**Coefficient**	t-statistics	Prob.
C	-0.603112	-1.292981	0.2074
S (-1)	1.106906	6.705498	0.0000
S (-2)	-0.405995	-1.577530	0.1268
S (-3)	0.471703	1.670258	0.1069
S (-4)	-0.469716	-3.533986	0.0016
MS1	0.099643	0.822479	0.4183
MS1(-1)	-0.253111	-1.078916	0.2905
MS1(-2)	-0.280915	-2.157830	0.0404
MS1(-3)	0.363662	2.057433	0.0498
OUTPUT_Y	0.351685	3.098628	0.0046
INTEREST_R	-0.000330	-0.042254	0.9666

Source: ARDL estimation , 2024.

The initial estimation of the ARDL model show that the best model selected is the 4, 3, 0, 0 lags model for dependent variable s, money supply m, real output y, and nominal interest rate r, respectively. At all selected lags for the model all variables are significant except nominal interest which is not significant.

3.2 Diagnostic test

3.2.1 Serial correlation test

The Breusch-Godfrey test (Godfrey, 1978) for serial correlation is performed to check for correlation between different lags of the residuals. Serially correlated residuals can lead to biased results. The test follows the following h**ypothesis**

H_0: $\rho = 0, No\ serial\ correlation$

H_1: $\rho \neq 0, There\ is\ serial\ correlation$

Here we want to fail to reject the null hypothesis for the residuals to serially uncorrelated to get efficient estimates.

3.2.2 Heteroskedasticity test

The test for constant variance i.e. tests for heteroskedasticity. It is assumed that residuals have a constant variance both in Ordinary Least Square estimation and ARDL model, since a model without homoscedastic residuals tend to produce inefficient estimation (Larsson, 2016). The test for heteroscedasticity is given as:

H_o: $Constant\ variance\ of\ the\ residuals - homoscedasticity$

H_1: $Non - constant\ variance\ of\ the\ residuals -$ H$eteroscedasticity$

Here we want to fail to reject the null for the residuals to be Homoscedastic and conform with the theory.

3.2.3 Specification error test

The Ramsey (1969) RESET test was run to test for miss-pecification error test, the test checks for non-linear combinations of the fitted values that can describe independent variables (Larsson, 2016)

Table 5: Diagnostic test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.118715	Prob. F(2,24)	0.8886
Obs*R-squared	0.362453	Prob. Chi-Square(2)	0.8342

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.708305	Prob. F(10,26)	0.1321
Obs*R-squared	14.67103	Prob. Chi-Square(10)	0.1445
Scaled explained SS	7.949994	Prob. Chi-Square(10)	0.6337

Ramsey RESET Test

	Value	df	Probability
t-statistic	0.251946	25	0.8031
F-statistic	0.063477	(1, 25)	0.8031

The Table 5 above presents three diagnostic tests for serial correlation, Heteroscedasticity and model misspecification test. The results indicate that there is no evidence of serial correlation since we fail to reject Breusch-Godfrey null hypothesis of no serial correlation. The Breusch-Godfrey Heteroskedasticity test shows no evidence of Heteroskedasticity, as well as the RESET test presents no evidence of misspecification error. Now that our model is good, we take a step further to check for cointegrating relationship and bound test.

3.2.4 ARDL Cointegrating and long run form: Model estimation

The cointegrating and long-run form model was estimated as shown in Table 6, and the error correction term represented as Cointegrating Equation theoretically shows the speed of adjustment from the disequilibrium. The long run coefficients for money supply and interest rate are not significant except output which is significant however its sign is not what we expected. In the monetary exchange rate model output is expected to have a negative sign which means mo97re output would appreciate domestic currency. In accordance to the results, it means a 1% growth of output leads to 1.18% increase in exchange rate hence depreciation of the domestic currency. However, it will be trivial to make conclusions about error correction term without performing a bound test to check for statistical significance of the long-run form model.

Table 6: Cointegrating and long-run form model

Variable	Coefficient	t-Statistics	Probability
D(S(-1))	0.404008	2.522252	0.0181
D(S(-2))	-0.001988	-0.010194	0.9919
D(S(-3))	0.469716	3.533986	0.0016
D(MS1)	0.099643	0.822479	0.4183
D(MS1(-1))	0.280915	2.157830	0.0404
D(MS1(-2))	-0.363662	-2.057433	0.0498
D(OUTPUT_Y)	0.351685	3.098628	0.0046
D(INTEREST_R)	-0.000330	-0.042254	0.9666
CointEq(-1)	-0.297102	-2.844372	0.0086

Long-run coefficients

Variable	Coefficient	t-Statistic	Prob.
MS1	-0.238035	-0.706395	0.4862
OUTPUT_Y	1.183721	5.878205	0.0000
INTEREST_R	-0.001110	-0.042180	0.9667
C	-2.029986	-1.629769	0.1152

Source: Author's calculations, 2024

The ARDL Bounds test was performed to test for long run relationship between dependent variable nominal exchange rate and broad money supply (M1), real output y, and nominal interest rate, of which all variables where $I(1)$ except money supply that was $I(0)$. Since one of the variables is integrated at level and all others at first difference then it follows that all variables are stationary at first difference (see Table 3 above). The bounds test follows the testing of the hypothesis;

H_0: $No\ long-run\ relationships\ exist$

For the cointegration analysis to establish a long-run relationship we sought to reject the null to establish any long-run equilibrium between the variables. Table 7 below evidently shows that the Bounds test F-statistic of 1.0816 is below the critical values bounds at all significance levels 1%, 2.5%, 5% and 10% for both $I(0)$ and $I(1)$ bound, which is the evidence of no long-run equilibrium relationship since we fail to reject the null hypothesis.

Table 7: ARDL Bounds test

3.2.5 Null hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	1.081626	3
Critical Value Bounds		
Significance	I (0) Bound	I (1) Bound
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Given the Bounds test results can conclude that the model has no long-run equilibrating relationship. However, we sought to visualize how the long-run equation fits with the dependent variable by extracting the error correction term (EC-term) and subtract it from the dependent variable, then we plotted the difference and the dependent variable to visualize fitting of the long-run equation. The figure 1 below shows the fitting of the long-run equation into the dependent variable s_t.

Figure 1: Long-run equation fitting

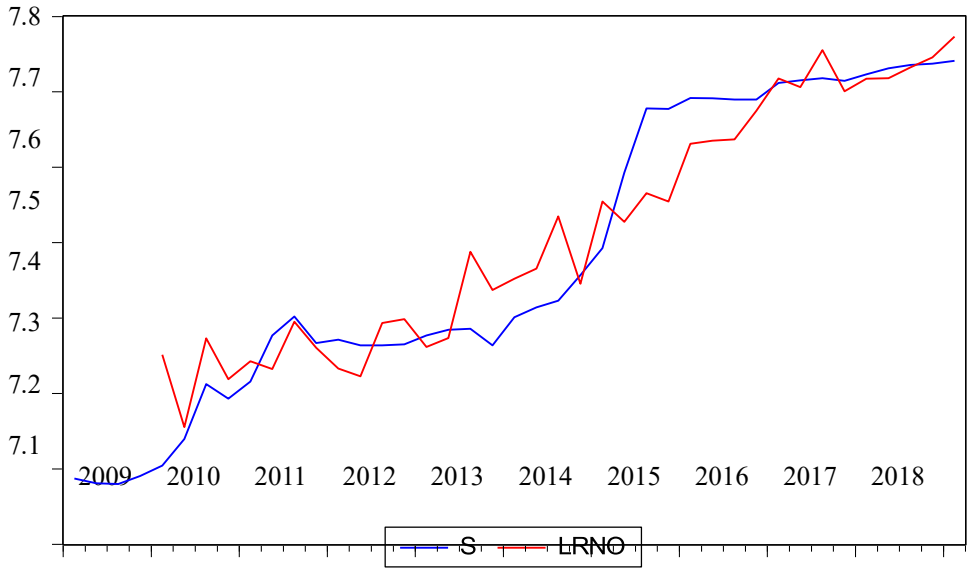

***Figure 1:* S *represents dependent variable* s_t *(nominal interest rate) and* LRNO *is the difference between error correction term (EC) and dependent variable (*s_t*)* [$s_t - EC$]

It is evidently that the model shows much of disequilibria trends and that the possibility of regression to study long-run adjustment is of no use for this purpose.

4. Conclusions

The results of this study generally suggest that that there is no evidence of long-run relationship between exchange rate and the monetary model of exchange rate determination in Tanzania. The error correction term represented as Cointegrating Equation theoretically showed the speed of adjustment from the disequilibrium. The long run coefficients for money supply and interest rate are not significant except output which is significant however its sign is not what we expected. In the monetary exchange rate model output is expected to have a negative sign which means more output would appreciate domestic currency. The Bound test also suggested that the model has no long-run equilibrating relationship.

With these results the study can conclude, though with caution that the sticky-price monetary model of exchange rate determination is inappropriate for forecasting long-run exchange rate trends in Tanzania. However, we cannot totally discard the monetary model of exchange rate since we could also allow for flexible prices and expectations to test the model. Since the scope of this study was confined to sticky-price model then we couldn't explore further to relax more assumptions for the model analysis.

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Appendix

Appendix 1: Data and variables definitions

Variable	Definition and measurement	Presentation	Source
s_t	Natural log of Weighted Average Exchange Rate (WAR)	S	Bank of Tanzania, Interbank Foreign Exchange Market (IFEM) Summaries
y_t	Natural log of Quarterly manufacturing output (GDP constant prices 2007, millions Tshs	_	National Bureau of Statistics (NBS), Tanzania
y^*_t	Natural log of U.S industrial output index, 2015	_	OECD Database, U.S
m_t	Natural log of Tanzanian Narrow Money (M1), billions LCU	_	Bank of Tanzania, Annual Monetary Statements (2009-2019)
m^*_t	Natural log of U.S narrow money (M1) index	_	OECD Database, U.S
r_t	Short-term overall lending rate (Tanzania)	_	Bank of Tanzania (BOT)
r^*_t	Short-term interest rate (U.S)	_	OECD Database, U.S
$y_t - y^*_t$	Difference between domestic and foreign values of log of output	OUTPUT_Y	_
$m_t - m^*_t$	Difference between domestic and foreign values of log money supply M1	MS1	_
$r_t - r^*_t$	Difference between domestic and foreign short-term interest rates	INTEREST_R	_