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CONTENTS

PUBLIC-PRIVATE PARTNERSHIPS AS A MODEL FOR THE DEVELOPMENT OF EDUCATION INFRASTRUCTURE AND PEDAGOGICAL STANDARDS: THE CASE OF VARAŽDIN COUNTY, CROATIA

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ABSTRACT

Purpose. *The aim of the paper is to analyse the model of public-private partnership in Varaždin County for the purpose of developing educational infrastructure and strengthening the pedagogical standard.*

Design. *A public-private partnership stands for a joint activity of the public and private sectors in the production of public goods or the provision of public services, either at the central government level or at the local self-government unit. The need for public-private cooperation is more common at the local level because global trends such as decentralization bind the local self-government to search for effective responses on their responsibilities. Based on the theoretical background of public-private partnership and the analysis of the external environment of the public-private partnership model on the example of the Varaždin County in the field of education, key factors that influence the model of public-private partnerships have been identified. Moreover, the effects of such partnerships between the public and private sector have been identified too, as well as the weaknesses, opportunities, and threats in applying such a model at the local and regional level and in the education sector.*

Findings. *In order to increase the efficiency of the country in the terms of public-private partnership, the benefits of a public-private partnership model should be recognized and the limitations should be reduced by providing the set of standards for the co-financing the model of public-private partnership for each sector separately (education sector, public transport, healthcare, environment, public order and safety, energy and etc.).*

1. INTRODUCTION

A public-private partnership (PPP) stands for a joint activity of the public and private sectors in the production of public goods or the provision of public services, either at the central government level or at the regional or local self-government units. The public and private sectors combine resources and expertise to meet certain public needs. Participation of a public partner in a project is usually accomplished by paying regular fees to a private partner for the services provided. The European Union promotes the importance of public-private partnership contributions, particularly through the local development, in order to increase living standards, for instance cheaper and more accessible use of resources. The need for public-private co-operation is more common at the local level because global trends such as decentralization bind the local self-government to search for effective responses to their responsibilities. Local economies, in order to maintain their competitiveness on the global market and ensure good business environment and the boost in the investment climate, rely on the public sector. On the other hand, local government due to lack of funds in the budget will also have to look for different ways of providing the public goods and, therefore, search for the support in the private sector. In many cases the local dimension contributes to the good functioning of public-private partnerships, mostly due to geographic and cultural similarities, facilitating relations based on local knowledge and resources. Croatia is fiscally decentralized, there are 576 units of local and regional self-government units (Središnji državni portal, 2018) which carry a number of functions in the areas of health, education and social welfare and dispose with the certain financial resources in co-operation with the ministries and other state bodies (Republika Hrvatska, Ministarstvo financija, 2018). Therefore, the public-private partnerships are of great importance for the development of its regions, i.e. counties, cities, and municipalities. Varaždin County has recognized this and launched the wave of building and upgrading schools in its area based on the model of public-private partnership (Varaždinska županija, 2018). According to the Register of public-private partnership contracts in Croatia, 15 projects have been realized so far in the total value of 2, 5 bil HRK. Of these, 11 projects were realized in Varaždin County (Agency for Investments and Competitiveness, 2018). The aim of this paper is to analyse the model of public-private partnership in Varaždin County with emphasis on the projects for the development of educational infrastructure and the strengthening of pedagogical standards. The purpose of the paper is to explore the key factors influencing the functioning of the public-private partnership model and the strengths, weaknesses, opportunities, and threats of the model. The hypothesis of the paper is that regional and local self-government units through a public-private partnership model in the education sector can positively influence on raising the pedagogical standards and prosperity of the local community. The structure of the work consists of the Introduction, followed by the theoretical background

and the significance of the public-private partnership. Then, Chapter 3 explains the methodology of the paper. In Chapter 4, the PEST and SWOT analyses of the public-private partnership on the example of Varaždin County in the education sector are conducted. Chapter 5 describes the effects of applying the public-private partnership model, while Chapter 6 presents the perspectives for the further development of public-private partnership in the education sector. Finally, it comes to the Conclusion, which synthesizes the whole paper.

2. THE THEORETICAL BACKGROUND AND IMPORTANCE OF THE PUBLIC-PRIVATE PARTNERSHIP

For public-private partnership as a form of co-operation between the public and private partnership, there is no universal definition. Although such co-operation has existed for centuries since the Roman Empire (the construction of ports, markets, and public baths), the goals of the association were not always the same, so the concept of public-private partnership differs from those throughout the history (Barković & Širić, 2010). At the present time, in times of globalization and the increasing number of people's needs, the public sector faces the task of satisfying public interests, i.e. the growing needs of the population. The primary task of each government is to meet the needs of a society. Due to the lack of financial resources in the budgets, governments need to look for other sources of funding to provide certain services in an efficient way. What implies the stabilization of public expenditures is the provision of better public goods in the shortest time possible.

Bailey (2004), states that the public-private partnership involves the mobilization of resources in the realization of common interests of more than one sector with the aim of preparing and monitoring the development strategy of a particular area. In Juričić (2008), Bettignies and Ros point out that the public-private partnerships are based on the co-operation of two sectors within which their experience and knowledge is exploited and they strive to deliver the best quality of public services on the basis of appropriate allocation of resources, risks, and benefits and result in value added for paid value of money that is achieved by the traditional organization of public service delivery. Šinković and Klarić (2007), define public-private partnership as a model of financial stimulation for the economy, which accelerates the development of infrastructure and public services. Also, Marenjak et. al (2007), under the concept of public-private partnership, imply a model of financing and contracting public infrastructure. Gulija (2004), states that in the narrow sense today, the public-private partnership means corporate ventures in which public and private sectors combine resources and expertise to meet a public need through appropriate allocation of resources, risks, and rewards. Moreover, the government should promote public-private partnership by developing programmes that will boost productivity patterns through ability to develop and manage new technologies, mount schemes that will

discourage brain drain and discourage migration, as well as channelling corporate and social responsibilities to channels where productivity can be enhanced (Oluwabunmi, Akintoye Victor, 2017). Given that there is no single definition of a public-private partnership, in his paper Juričić (2008), according to Petres, highlights 5 common features of the public-private partnership: (1) the partnership involves two or more entities; (2) in private-public partnership the project participants have a position of principal; (3) the circumstances are established, a long-term and stable cooperation between the partners; (4) in the public-private partnership model each of the participants brings something into the partnership; (5) the partnership implies shared responsibility for the outputs produced, that is, for the delivered services.

From all the above, it can be concluded that the main features of public-private partnerships are the relationship between public and private sector, knowledge exchange, risk sharing in public sector project implementation with the aim of delivering efficient public services of better quality (with added value).

The great importance of public-private partnership has been recognized in the United States during the 70s of the twentieth century. By adopting the first "Railroad Revitalization and Regulatory Reform Act" in rail transport, the private sector is allowed to enter the closed market in order to develop competition and improve railway property (Congress, 2018). Furthermore, the European Union has recognized the importance of public-private partnership. In the Lisbon Strategy 2000, public-private partnerships are pointed out as models for achieving the greatest competitiveness of the European economy (Ivan-Ungureanu and Marcu, 2006). The European Commission in 2004 issued the "Green Paper on Public-Private Partnerships of the European Union on Public Contracts and Concessions." It defines, classifies and characterizes contracts, the rules of a public-private partnership with EU regulations. The document states that public-private partnership implies cooperation between public authorities and private entrepreneurship which aims to secure financing, construction, reconstruction, management, and maintenance of public infrastructure or the provision of public services. Based on the Green Paper of the EU in Croatia, the public-private partnership area is covered by the Public-Private Partnership Act (OG 78/12 and NN 152/14) the Decree on Implementation of Public-Private Partnership Projects (OG 88/12 and 15/15), the Law on Concessions (OG 69/17), and the Public Procurement Act (OG 120/16) related to the procedures for the award of public contracts and concession contracts (Investment and Competitiveness Agency, 2018).

Varaždin County, based on the model of public-private partnership and the form of a private financial initiative (private sector through public sector projects builds public goods and provides services, then charges public service provided by the public sector and after the expiration of a multiyear lease, the public goods return to the public partner), has reconstructed the County Palace building and the construction and upgrading of the school buildings and the school halls in order to raise

the level of the pedagogical standard in the County. Pedagogical standards stand for the minimum infrastructure, financial and the human resources requirements for the realization and development of activities and the same conditions for a balanced development of primary and secondary education throughout the Republic of Croatia (Ministrastvo znanosti, obrazovanja i športa, 2008).

3. METHODOLOGY

Based on the theoretical background of public-private partnership and the analysis of the external environment (PESTLE analysis) of the public-private partnership model on the example of the Varaždin County in the field of education, the key factors that influence the model of public-private partnerships have been identified. A PEST is an acronym for political, economic, social and technological factors from the external environment that could affect the business (Sundać et. al, 2016). Very often in PEST analysis are included legislative and environmental factors, which forms PESTLE analysis. Moreover, the SWOT analysis was used, too. SWOT analysis is a framework used to evaluate a company's competitive position by identifying its strengths, weaknesses, opportunities and threats. By using SWOT analysis, the strengths of such partnerships between the public and private sector have been identified too, as well as the weaknesses, opportunities, and threats in applying such a model at the local and regional level and in the education sector. SWOT analysis is a foundational assessment model that measures what an organization can and cannot do, and its potential opportunities and threats (Investopedia, 2018). Based on the data from the Reports on the implementation of a public-private partnership in Varaždin County, the evaluation of the results of the application of such a model and the perspectives for the further development of the public-private partnership in the education sector have been established (Varaždinska županija, 2018).

4. ANALYSIS OF PUBLIC-PRIVATE PARTNERSHIP IN THE EDUCATION SECTOR OF VARAŽDIN COUNTY

Varaždin County has recognised the importance of investment in education for the economic growth. According to internal data, Varaždin County is the founder of 33 primary schools and 14 secondary schools.

In the education sector, in order to reach a strategic goal, one of the measures of the Varaždin County was to organize one shift in schools with the purpose to raise the pedagogical standard, enabling the launch of development programs. For the organization of lessons in one shift, a total of 22 school buildings and 10 school halls were needed to be constructed and upgraded. Given the limited budget, this was realized in the form of a Private Financial Initiative (PPP / PFI) for the period 2005 to 2009 (Varaždinska županija, 2018).

PPP (Public Private Partnerships) / PFI (Private Financial Initiative) features define the position of public and private partners. A public partner in this example, the County, realizes its interests by granting the right to build a private partner for the construction of school buildings and their use through lease agreements for the entire period from the takeover of built school buildings until the end of the construction right. A private partner finances and builds school facilities and maintain them for the entire duration of the rent. It realizes its interests through the reimbursement of the funds invested and the profit from renting school buildings for the entire term of the contract lasting from 25 to 30 years.

In the following, by the PEST analysis, the factors of the external environment of positive and negative impacts on the model of public-private partnership on the example of the Varaždin County in the education sector are identified. In the same example, by SWOT analysis the strengths, weaknesses, opportunities, and threats in this form of partnership between the public and private sector are identified too.

4.1. PEST analysis of the public-private partnership in the education sector of Varaždin County

The PEST analysis describes a framework of macroeconomic factors (political-legal, economic, socio-cultural, and technological) that are used for environmental analysis so that decision-makers can adjust the corporate / institution's behaviour in order to succeed in doing business. Table 1. shows PEST analysis of the public-private partnership in the education sector of Varaždin County.

Table 1.: PEST analysis for public-private partnership model in the education sector of Varaždin County

FACTOR	POSTIVE	NEGATIVE
POLITICAL AND LEGISLATIVE	- regional self-government initiative - support from other local self-government units - meeting the spatial needs of schools in Varaždin County - meetings and workshops on public-private partnerships attended by representatives of political parties, mayors, members of the County Council and representatives of banks and construction companies - the two-stage public procurement procedure - concluded 7 contracts with 4 companies of special purpose	- political instability - lack of support from the Government of the Republic of Croatia - the absence of regulations and acts for the public-private partnership area at the time of the launching of the model
ECONOMIC	- constructed/upgraded 32 objects by public-private partnership model - financing construction is provided by a private partner - private partner maintains buildings and equipment - better business efficiency	- limitations of the Varaždin County budget - constraints on the budget of municipalities and cities - payment of a fee depending on the exchange rate of the EURO, the EURIBOR and the interest rates
SOCIO-CULTURAL	- the better motivation of students and teachers - reduction of unjustified absences of pupils - reduction of negative grades - generational solidarity - raising the social standard of local communities through the use of school and hall space for manifestations, recreation, and other activities of locals - launching development programs	- the higher workload of teachers and technical staff - absenteeism of students
TECHNOLOGI-CAL	- risk sharing in project implementation - defining the availability of space and equipment - maintenance of space and equipment according to actual needs	- limitations on investment in specific public partner programs such as energy efficiency and renewable energy

Source: Authors.

Political-legal factors relate to the factors that state and state institutions have through the laws and regulation of particular importance affecting the functioning of a particular organization or project. The primary strategic goal of Varaždin County is to invest in education. In order to raise the pedagogical standard at the regional and local level, Varaždin County has begun building and upgrading educational infrastructure through the model of public-private partnership. It relied on the support of local self-government units (municipalities and cities). During the implementation of public-private partnership projects, it organized meetings and a workshop on public-private partnerships, attended by representatives of political parties, may-

ors, members of the county government, and representatives of banks and construction companies. Seven contracts were contracted with the four companies of special purpose and the procurement procedure was two-stage. Political factors that have a negative impact on the stability of public-private partnership's functioning are frequent changes in government, i.e. changes in political climate affecting the county's budget uncertainty, and initially, while launching the model in Croatia, there was a lack of regulations and acts for the public-private partnership area. Sundać et al., 2016, point out that the more unstable political system is, the political-legal sector of the business environment is more demanding for monitoring by decision-makers in the enterprise, both in terms of intellectual effort and time and capital invested.

As far as the economic environment and the education sector are concerned, it is important to keep track of the trends in other countries, especially those that are members of European Union as it is Croatia too. In order to not lag behind in education standards and improve the business efficiency with respect to other EU member states and global trends, the Varaždin County with the limited budget and budget of other local and regional self-government units launched a public-private partnership model. According to the public-private partnership model, 32 buildings were constructed and upgraded, which financing for a construction and maintenance the private partner has provided. During the duration of the contract, Varaždin County as a public partner pays to a private partner a non-fixed fee, depending on the exchange rate of EURO, EURIBOR, and interest rates.

Social factors affecting the operations of a particular institution include social values, culture, and different expectations that society places. As far as the education sector is concerned, the aim was to reduce the business burden of teachers and technical staff through the model of public-private partnership and reduce the absenteeism of students. By building additional capacities, one shift was organized, leading to the greater motivation of students, teachers and technical staff and opening new development programs. In addition, using the school and the school hall space for manifestation, recreation, and other activities, a social standard of the locals has been raised.

Taking into the consideration the technological factors, the model of public-private partnership brings advantages in a building maintenance because it enables current and investment maintenance to meet real needs and ensures compliance with all legal changes in security, sanitation, and other areas that are important to the functioning of the building. The current way of maintenance depended on secured financial means that were not sufficient.

4.2. SWOT analysis of public-private partnership in the education sector of Varaždin County

This section presents a SWOT analysis of the public-private partnership project of the Varaždin County in education sector. The SWOT analysis is a method used to

evaluate an institution's strategy and includes four key factors: strengths, weaknesses, opportunities, and threats (Toolshero, 2018). Strengths and weaknesses represent the internal characteristics of an institution, while opportunities and threats come from the environment. Table 2. shows the SWOT analysis in the educational sector of Varaždin County.

Table 2.: A SWOT analysis of the public-private partnership model in the educational sector of Varaždin County

	Opportunities - the use of a private initiative through public sector investment - division of the project implementation risk - realization of the project in real time - maintenance of facilities and equipment according to actual needs - payment of rent of facilities and equipment according to their availability	Weaknesses - budget constraints of regional and local self-government - poor education in the area of public-private partnership
Strengths - developed network of schools - satisfactory enrollment areas in elementary education - satisfactory number and types of enrollment programs in secondary education - applied vocational training	Chances - realization of development programs	
Threats - political and economic instability - the impossibility of influencing legal regulations which define the financing of regional and local self-government		Risks - the financial stability of a private and public partner

Source: Authors.

5. RESULTS OF THE PUBLIC-PRIVATE PARTNERSHIP MODEL IN THE EDUCATION SECTOR OF VARAŽDIN COUNTY

By applying the model of the public-private partnership in the education sector of Varaždin County for building the educational infrastructure and raising the pedagogical standards, the following results have been achieved: one-shift teaching, stabilization of business expenses, better social and pedagogical indicators, increased programs of extracurricular and sports activities, and greater social standard of the local community. By insight into the County's Reports on implementation of public-private partnership, by constructing and upgrading the additional space, existing space increased

by 35 % of the net utilized area by the private partnership model and the one shift teaching has been organized for 90 % of elementary and secondary students. Such teaching has reduced the working hours of the school from 12 hours to 8 hours, which in turn led to the reduction in energy costs by which energy costs for the newly constructed space were compensated. Consequently, these effects of public-private partnership enable that the largest percentage of financial resources for school managing to be spent on development programs.

The model of public-private partnerships and the new organization of classes (one shift) provided the following development programs:

- Spatial conditions for lifelong learning programs whose needs derive from working in the conditions of rapid change and development in social and economic life, and the application of new technologies and their introduction, and use through contemporary educational methods.
- Space and time for programs with gifted students through the Centres of Excellence in order to promote mathematics, physics, language, entrepreneurship, biology, chemistry, information technology, and new technologies and communication with elementary and high school students.
- New spaces enabled the introduction of a new network of programs, both in primary and secondary education to meet the needs of society.
- By building a school space in secondary education, it is possible to co-operate with higher education in a way that it will provide space for organizing professional and university studies of the required labor market. This will enable students to study at their place of residence, which will lower their study costs and increase their enrollment in secondary schools for deficient occupations.
- The construction of sports halls provided an even territorial coverage for the development of school sports under the conditions of great quality.
- There is a space for free activities of students engaged in extracurricular and extra-curricular activities. These activities enable a large number of students to satisfy their interests and develop their skills in specific areas and specialties.
- The built school and school halls allow the organization of the events and other needs of the locals after the lectures or on the weekends in order to raise the social standard of the local self-government unit.

By organizing classes in one shift, there has been also an improvement in discipline of students. In the period from 2005 to 2009, unjustified absences were reduced and fewer students were negatively assessed.

Generational solidarity develops and mutual help between the students of higher and lower grades. All cultural-artistic events in school are easier to organize and have a greater meaning and a better impact due to the unity of students and teachers who work in one shift.

6. PERSPECTIVES ON DEVELOPING THE PUBLIC-PRIVATE PARTNERSHIP MODEL IN THE EDUCATION SECTOR IN VARAŽDIN COUNTY

Public-private partnerships were used in these examples to secure the school space and hall space. Significant results have been achieved in this area. Its perspectives in the education sector are certainly great, especially in the field of equipping teaching aids, laboratory and workroom equipment, and development of other teaching programs.

Equipping the teaching aids would make them available to use, a private partner would provide financial resources, and the public sector would pay a rent. The partnership agreement would be signed for a few years according to the example of building the objects.

In the field of equipping the laboratory and workrooms, private partner finances procurement and maintenance, and the public partner provides space for equipment and pays the material costs of using the equipment. A private and public partner use the purchased equipment at the time defined by the contract. In the field of the development of the new teaching programs (curriculum), the private partner provides the equipment, and the public partner provides a curriculum in the field of education, training or retraining for the needs of a private partner.

7. CONCLUSION

Given the limited budget, Varaždin County in 2005 initiated a model of public-private partnership, which included the construction of 22 school buildings and 10 school halls. With regard to the course of realization of construction/upgrading facilities, they were grouped in seven contracts with four private companies of special purpose. The public-private partnership model was implemented in the form of a private financial initiative from 2005 to 2009. A private partner finances and builds school facilities and maintains them for the entire duration of the rent. At the end of the contract period, the constructed buildings that have been fully paid will be returned to the public partner or the County.

By the model of the public-private partnership, the pedagogical standard of elementary and secondary education increased, which enabled the organization of one-shift teaching in schools and the creation of conditions for development programs. Such a model got support from other local self- government units. It raises the social standard of communities through introduction of the new programs education system, which increases the better motivation of students and teachers and the use of school and hall space for manifestations, recreation and other activities of locals. On the other hand, there is more space to improve the model. According to the analyses,

the threats to the model are political and economic instability that affect the financing of the model, as well as the impossibility of influencing legal regulations, which define the financing of regional and local self-government.

The model of public-private partnership in Varaždin County is a good example of the model in the education sector, which has positive outcomes, but shortcomings in financing due to the economic and political environment in the country. In Croatia, in the process of approving such types of projects, the Agency for Investments and Competitiveness and the Ministry of Finance have a key role with the Ministry of Economy, Ministry of Regional Development and EU Funds and the Central Finance and Contracting Agency. In order to increase the efficiency of the country in the terms of public-private partnership, the benefits of a public-private partnership model should be recognized and the limitations should be reduced by providing the set of standards for the co-financing the model of public-private partnership for each sector separately (education sector, public transport, healthcare, environment, public order and safety, energy and etc.).

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CURRENT ACCOUNT SUSTAINABILITY IN SUB-SAHARAN AFRICAN COUNTRIES: A PANEL COINTEGRATION TEST WITH FOURIER COMPONENT

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Withdrawn

ABSTRACT

This paper examines the trade account sustainability for sub-Saharan African (SSA) countries over the period 1960-2014. It addresses three important issues econometrically in the sustainability literature: i) nonlinearity, ii) structural breaks and iii) cross-sectional dependence. By incorporating these three stylized facts jointly in the modelling and estimation procedure, we refute the erstwhile view that the SSA countries violate their intertemporal budget constraints and challenge the position that these countries may not be able to control their external imbalances. This puts in perspective that the observed unsustainable current accounts in many of these countries are not necessarily failure to control the imbalances between exports and imports but exogenously driven by policy somersaults leading to mean shifts in relationship.

Purpose. *The purpose of this paper is premised on the need to understand the reality of current account sustainability among the sub-Saharan African countries, update the understanding since the last papers were published by Arize (2002), Narayan and Narayan (2005) and Razafimahefa and Hamori (2007), and to study the implications of nonlinearity as well as structural breaks.*

Design/Methodology/Approach. *We develop a smooth break stationarity technique that accounts for the unknown number of breaks in the series thereby overcoming the bias due to using sharp structural break stationarity techniques that require predetermined number of break points. In particular, utilize the Fractional Frequency Flexible Fourier Form (FFFFF) and Integer Frequency Flexible Fourier Form (IFFFF). We solve the problem of cross-sectional dependence by utilizing bootstrap method.*

Findings And Implications. *Using the methodology outlined above we find that it seems that the sub-Saharan African countries are unable to time the convergence between exports and imports not because of any inherent inability but because of the exogenous factors major breaks in policy milieu that threaten their ability to ensure the intertemporal budget constraints are not violated. This puts in perspective that the observed unsustainable current accounts in many of these countries are not necessarily failure to control the imbalances between exports and imports but exogenously driven by policy somersaults leading to mean shifts in relationship. The policy implications therefore include ensuring more tranquil policy environment in the sub-Saharan Africa. Interestingly, lack of stability in policy environment and policy continuity has been one of the most bedeviling problems facing sub-Saharan Africa.*

Limitations. *A major limitation of the present study is that the approach used to investigate is based on unit root testing. Bohn (2007) highlights the limitations of using this approach. However, the literature on sustainability has not seen a significant decline in the number of studies using the approach. Therefore, this study belongs to the class of studies that deduce sustainability from the stationarity property rather than from the error-correction response function.*

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1. INTRODUCTION

As a measure of performance and stability, current account sustainability concerns whether a country will eventually lose control on the divergence between its imports and exports, which might then degenerate into macroeconomic instability. For instance, external debts and trade imbalance can be so intricately linked that understanding the nature of the mismatch between exports and imports is consistent with understanding the way external debts evolve and, thus, the way they can be curtailed. Thus, trade imbalance can compound into sovereign debts and exchange rate misalignments and consequently diminish credit-worthiness of a country. For instance, Narayan and Narayan (2005) and Arize (2002) noted that the violation of the intertemporal budget constraint is a precursor to the international indebtedness, a situation that can lead to the explosion of the difference between exports and imports. It is immediately clear then that we need a careful analysis of this relationship. One reason this is interesting is that trade liberalization will affect imports and exports most probably asymmetrically so that it is as likely to generate trade surplus as it is to generate trade deficit. In fact, curtailing imports alone without regard to the movements in exports deserves only a scant attention because movements in imports alone are not responsible for the imbalance (Narayan and Narayan, 2005).

Investigating this relationship in the context of cross-section of countries immediately brings into focus some other important considerations. Although panel data analysis overcomes the problem associated with small sample, it immediately imposes the problem of whether countries in the panel are cross-sectionally correlated. First, as most studies employ panel data, the presence of cross-section correlations among the countries raises the question of how to deal with cross-sectional dependence. Since first observed by O'Connell (1998), dealing with the cross-sectional dependence has become a routine in recent panel-data studies. Basically, cross-sectional dependence surfaces when a cross-section of countries share similarities because of, say, globalization effects or trade integration agreements (Pesaran, 2004, 2007), the possibility that heightens in the trade balance analysis. The proximity or neighbourhood effects can also lead countries to exhibit cross-sectional dependence as they experience bandwagon effect. Pesaran (2004, 2007) thus advances statistics to complement the extant Lagrange multiplier (LM) test of the Breusch and Pagan (1980) in testing for the presence of cross-sectional dependence. It is interesting that most of the influential papers on trade balance on SSA - including Arize (2002), Narayan and Narayan (2005) and Razafimahefa and Hamori (2007) - do not account for this obvious possibility among these countries that are bounded by similar historical antecedents as well as regional groupings enhancing cohesion among them. Indeed, the literature on this relationship has implicitly imposed a common factor restriction, which unties interesting long-term links. In ad-

dition, we tackle the possibility of nonlinear relationship as well as structural breaks as these issues affect the unit-root and cointegration inferences.

The present attempt therefore presents a distinctively different approach to studying trade balance series and resolving the inconclusiveness of trade balance stationarity for sub-Saharan Africa, and a way to uncover cointegration in the presence of nonlinearity and smooth structural shifts. Our results present more interesting dimensions to the question of cointegration in the imports-exports relationship than have been previously observed. We observe that trade balance in sub-Saharan African countries is not necessarily non-stationary. The fact is that lack of current account sustainability has more to do with structural shift and asymmetry. Thus, this paper accounts for three issues together: (i) cross-sectional dependence, (ii) structural breaks and (iii) nonlinearity. The rest of this paper is organized as follows. Section 2 introduces the model subsequently analyzed in the paper. In Section 3, we discuss the main method of analysis, namely, the (Fractional) Frequency Flexible Fourier Form (FFFFF) adapted to deal with nonlinearity and structural breaks together. We subsequently tackle the cross-sectional dependence within the residual-based stationarity bootstrap framework. Tests for nonlinearity and structural breaks are conducted in Section 4. Also, in Section 4, we discuss the empirical results and check for their robustness. Section 5 concludes.

2. MODEL

Based on Husted (1992), Arize (2002) and Irandoust and Ericsson (2004), we [illegible] the intertemporal budget constraint and analyze the dynamics of the trade balance. Following Haliio and Bush (1991), Husted (1992) provides a simple framework that implies a long-run relationship between exports and imports. The individual current-period budget constraint is:

$$B_t = C_t + I_t - Y_t + (1+r_t)B_{t-1} = -\zeta_t + (1+r_t)B_{t-1} \quad (1)$$

where C_t, I_t, Y_t, B_t and r_t are current consumption, investment, output, international borrowing, and a one-period interest rate respectively. $\zeta_t = Y_t - C_t - I_t (\equiv EX_t - M_t)$ and $(1+r_t)B_{t-1}$ is the initial debt size. We can rewrite Eq. (1) recursively to obtain the intertemporal budget constraint. First, note that Eq. (1) can be written as

$$B_t = (1+r)B_{t-1} - \zeta_t + (r_t - r)B_{t-1}$$

where $r = E_t r_t = E_t r_{t+1}$. The third term $\eta_t = (r_t - r)B_{t-1}$ represents the deviation of stochastic interest rate valued debt repayment from the constant interest rate valued debt repayment and can be treated as random error. Next, we recursively update Eq. (1), arriving at the following intertemporal budget constraint. Taking expectation, we obtain the following:

$$(1+r)B_{t-1} = -\sum_{t=0}^{\infty} E_t \frac{\zeta_{t+i}}{(1+r)^i} + \lim_{i\to\infty} E_t\left[(1+r)^{-i} B_{t+i}\right]$$

Following Ahmed and Rogers (1995), we difference the intertemporal budget constraint above using the fact that Eq. (1) implies

$$B_t - B_{t-1} = (1+r_t)B_{t-1} - (1+r_{t-1})B_{t-2} = r_t B_{t-1} - \zeta_t$$

to obtain:

$$rB_{t-1} - \zeta_{t-1} - E_t \sum_{i=0}^{\infty} \frac{\Delta\zeta_{t+i}}{(1+r)^i} = \lim_{i\to\infty} \Delta E_t[(1+r)^{-i} B_{t+i}].$$

In this case, the transversality condition guarantees that $\lim_{i\to\infty} \Delta E_t[(1+r)^{-i} B_{t+i}] = 0$. The term $E_t \sum^{\infty} \Delta\zeta_{t+i}/(1+r)^i$ will be stationary if imports and exports are both I(1) variables. Thus, $rB_{t-1} - \zeta_{t-1}$ will be stationary. Defining $M_t = IM_t + rB_t$, we arrive at the Husted (2002) necessary condition for intertemporal budget constraint given by the following testable model:

$$X_t = \beta_0 + \beta_1 M_t + \upsilon_t \qquad (2)$$

where X_t, M_t and u_t are the exports of goods and services, the imports of goods and services plus net interest payments and net transfer payments and disturbance at time t respectively. Under the null hypothesis, for an economy that satisfies its intertemporal budget constraint (i.e., for a sustainable current account deficit), it is expected that $b_1=1$ and u_t is a stationary process, implying a necessary and sufficient condition for the intertemporal budget constraint to hold (Narayan and Narayan 2005, and Baharumshah et al., 2002).

3. METHODOLOGY

3.1. Motivation for econometric choice

One way of understanding the sustainable relationship between exports and imports and thus the satisfaction of the intertemporal budget constraint is to examine the stationarity property of trade balance, the approach that agrees with the implication of the modern inter-temporal model in current account analysis (Obstfeld and Rogoff, 1996 p. 90). Although the stationarity of trade balance is not necessary to ensure the sustainability of external debts (Bohn, 2007), it is important in that it implies that the divergence will eventually taper off and revert to its steady state, and thus give the policymakers the comforting condition to establish tendency for mean-reversion during short-term tur-

bulence. While this important concept has been investigated for sub-Saharan Africa, the existing results suggest there is no stationarity in trade balance for a number of countries in the sub-region. In Narayan and Narayan (2005), for instance, only 6 countries of 22 SSA countries they investigated exhibit cointegration and, in Arize (2002), of the 9 SSA countries included in the study, 5 exhibit cointegration. The implications of this are obvious in view of what has been discussed above: most SSA countries, having tendency to violate their intertemporal budget constraints, cannot control their external imbalances at least in the short run, and the potential for sovereign defaults and thus difficulty in securing foreign funds for development is high. However, most of the results suggesting unsustainability are based on methods that are currently being reviewed and refined, and it has been suggested that those methods omit a number of material issues that must be factored in to fully understand the whole gamut of trade sustainability. This methodological inadequacy means that literature on trade balance is fraught with mixed and misleading results. Few sources of inadequacy and consequent misleading results can be pointed out in the literature. The present paper is making contributions in this direction.

It is instructive to note the observation made in Bohn (1998, 2005, 2007): he observed that the fiscal variables (the close cousins of series on exports and imports in our case) will necessarily satisfy the intertemporal budget constraints after having differenced the series arbitrarily often. This observation questions the use of unit roots as the testing device for sustainability. The recent literature, however, has not seen a significant decline in the use of unit roots in testing for sustainability, although occasionally this is supplemented with the error-correction policy function as suggested by Bohn (2007). To give a comparable result to the vast literature, we will follow this practice of testing using the unit roots in the present paper. We need to caution, nevertheless, of the interpretation of the stationarity of trade account as the evidence of sustainability.

3.2. Panel cointegration testing via residual based bootstrap

From Eq. (2), if exports and imports are integrated of order one, i.e., I(1), then under the null hypothesis, they are cointegrated with a cointegrating vector (1, -1), implying the strong form of sustainability. Subsequently, in addition to testing this strong form of sustainability implied by $\beta_{0,i} = 0$ and $\beta_{1,i} = 1$, we will analyze the weak form of sustainability within the panel version of Eq. (2):

$$X_{i,t} = \beta_{0,i} + \beta_{1,i} M_{i,t} + \upsilon_{i,t} \tag{3}$$

where the error terms for country i, i, $\upsilon_{i,t}$, may be identically and independently distributed for all t, that is, $\upsilon_{i,t} \sim iid(0, \sigma^2_{\upsilon,i})$. Nevertheless, they could be cross-sectionally correlated. Bootstrap panel cointegration through residual re-sampling can then be adapted to account for this cross-sectional correlation. Bootstrap panel cointegration testing through residual re-sampling has become a standard approach to assessing

country-specific critical values while dealing with a panel data structure. Earlier novel applications can be found in Paparoditis and Politis (2001, 2003), Di Iorio and Fachin (2007), Westerlund and Edgerton (2007) and Olayeni and Tiwari (2014). Di Iorio and Fachin (2007) show that the Residual-based Stationarity Bootstrap (RSB) test proposed by Parker, Paparoditis and Politis (2006) is helpful in generating stationary pseudo series, which, for our purpose, has a clear advantage over the block bootstrap panel unit root test also shown to be asymptotically valid (Palm, Smeekes, Urbain, 2011). It should be noted that the RSB itself is a block bootstrap and so preserves autocorrelation structure embedded in the data set. This allows us to re-sample by chaining blocks of observations starting at random locations (Di Iorio and Fachin, 2007), the approach that contrasts with the block bootstrap typically of fixed block length. To proceed, it is important that we test for cross-sectional dependence using the Breusch-Pagan (1980) LM test, the first and second Pesaran (2004) CD tests and the Baltagi-Feng-Kao (2012) bias-corrected scaled LM test. The details of these test results are given in Subsection 3.4 and discussion of the approach in Appendix A. The null hypothesis of no cross-sectional dependence to test is $H_0 : \mathrm{cov}(\upsilon_{i,t}, \upsilon_{j,t}) = 0$ for all t and $i \neq j$ against the alternative $H_1 : \mathrm{cov}(\upsilon_{i,t}, \upsilon_{j,t}) \neq 0$ for some pairs $i \neq j$. If cross-sectional dependence is found, we then proceed to model the error term, $\upsilon_{i,t}$ in Eq. (3) for country i at period t, as an AR(1) process given by

$$\upsilon_{i,t} = \rho_i \upsilon_{i,t-1} + \varphi_{i,t} \tag{4}$$

Testing for cointegration between our variables therefore amounts to establishing that the estimated autoregressive coefficient ρ_i in Eq. (4) is less than unit. In other words, these variables are said to be cointegrated for unit i if there exists β_{1i} such that $\upsilon_{i,t}$ is stationary. It should be observed that stationarity of $\varphi_{i,t}$ does not imply the existence of cointegration as $\varphi_{i,t}$ is always stationary (Di Iorio and Fachin, 2007). Next, we account for cross-sectional dependence as detailed in the following residual-based bootstrap re-sampling algorithm:

1. Estimate Eq. (3) by OLS to obtain the residual series, $\{\hat{\upsilon}_{i,t}\}$;

2. Estimate Eq. (4) by OLS to obtain the AR(1) coefficient $\hat{\rho}_i$ and the associated residual series $\{\hat{\varphi}_{i,t}\}$, where $\hat{\varphi}_{i,t} = \hat{\upsilon}_{i,t} - \hat{\rho}_i \hat{\upsilon}_{i,t-1}$;

3. Construct the pseudo residuals $\{\ddot{\varphi}_{i,t}\}$ by applying the residual-based stationary bootstrap to $\{\hat{\varphi}_{i,t}\}$;

4. Obtain pseudo residual $\{\ddot{\upsilon}_{i,t}\}$ by cumulating $\{\hat{\varphi}_{i,t}\}$ to impose the null hypothesis of no-cointegration;

5. Compute $\ddot{X}_{i,t} = \hat{\beta}_{0,i} + \hat{\beta}_{1,i} M_{i,t} + \ddot{\upsilon}_{i,t}$ to obtain the pseudo series on $\ddot{X}_{i,t}$, where $\hat{\beta}_{0i}$ and $\hat{\beta}_{1i}$ are parameter estimates from Eq. (3);

6. Estimate the cointegrating regression on the dataset $\{\ddot{X}_{i,t}, M_{i,t}\}$: $\ddot{X}_{i,t} = \ddot{\hat{\beta}}_{0,i} + \ddot{\hat{\beta}}_{1,i} M_{i,t} + \ddot{\ddot{\upsilon}}_{i,t}$;

7. Estimate $\ddot{\rho}_i$ by applying Eq. (4) to the residuals $\{\ddot{\ddot{\upsilon}}_{i,t}\}$; and

8 Repeat 3-7 B (large enough) times (in our case, B is set to 1000).

We achieve this by applying the re-sampling procedure discussed above to the entire cross-sections at the same time and thus preserve the cross-sectional correlations. More precisely in Step 2 of the algorithm, we apply the re-sampling technique on the *NxT* matrix of residuals $\hat{\varphi}_{i,t}$ to produce $\varphi = [\ddot{\varphi}_1, \ldots, \ddot{\varphi}_N]$, where $\hat{\varphi}_i = [\hat{\varphi}_{1i}, \ldots, \hat{\varphi}_{Ni}]$. Group statistics can also be based on this sampling procedure, where, in our case, we compute three statistics, namely the mean, the median and the maximum statistics. These group statistics generally will mask the individual differences and are not ideal to investigate the specific and situational issues pertaining to each country in the cross-section.

In case nonlinearity and structural break turn out to be an issue, we modify the second step above as follows. To deal with the structural break in the data, we first partial out the effect of smooth structural shifts in the data by computing the residuals

$$\tilde{\upsilon}_{i,t} = \hat{\upsilon}_{i,t} - \hat{\alpha}_i - \hat{\chi}_i \sin\left(\frac{2\pi kt}{T}\right) - \hat{\phi}_i \cos\left(\frac{2\pi kt}{T}\right) \tag{5}$$

where $\hat{\chi}_i$ and $\hat{\phi}_i$ are the estimated amplitude and displacement of the frequency, and k is the frequency selected for approximation. If nonlinearity is not problematic at the same time, we can then compute the residuals $\hat{\varphi}_{i,t} = \tilde{\upsilon}_{i,t} - \hat{\rho}_i \hat{\upsilon}_{i,t-1}$ in Step 2. With non-negligible nonlinearity effects given the results from the BDS test (Brock et al. 1996), the residuals will be computed as $\hat{\varphi}_{i,t} = \tilde{\upsilon}_{i,t} - \hat{\rho}_i \hat{\upsilon}_{i,t-1} - \hat{\eta}_i \hat{\upsilon}^3_{i,t-1}$, thereby acknowledging the Kapetanios et al (2003) approach to solving nonlinearity. By cu[illegible] residuals, we implicitly impose unit root and at the same time ignore nonlinearity under the null: $H_0: \hat{\rho}_i = 1, \hat{\eta}_i = 0$. The rest of the steps then follow as detailed in subsection 3.2. It is important to emphasize that the approach developed in this paper does not require the stationarity of the variables of interest insofar as the country-specific critical values are computed for each of the countries through bootstrap resampling method. Thus, even if the procedures for determining the integratedness of the variables are wrong or inefficient, the results are largely robust to such methodological weaknesses.

3.3. The integer versus fractional frequency flexible Fourier form

The choice of the frequency is important and can be approached following Enders and Lee (2012a,b) using the integer frequency approach. However, Omay (2015) shows that enforcing an integer frequency against the fractional frequency data generating process will compromise the small sample properties in the Enders-Lee approach. While building on the work of Becker et al., (2004), Omay (2015) instead proposes the Fractional-Frequency-Flexible-Fourier-Form Dickey Fuller (FFFFF-DF-type) unit root test to approximate smooth breaks in unit root testing. In particular, rather than assuming k to be an integer as done in the Enders-Lee approach,

he assumes $k = k^{fr}$ to be a fractional quantity. Omay (2015) searches for the optimal fractional frequency on the interval $0.1 \leq k^{fr} \leq 2$. More practically, k^{fr} is estimated as:

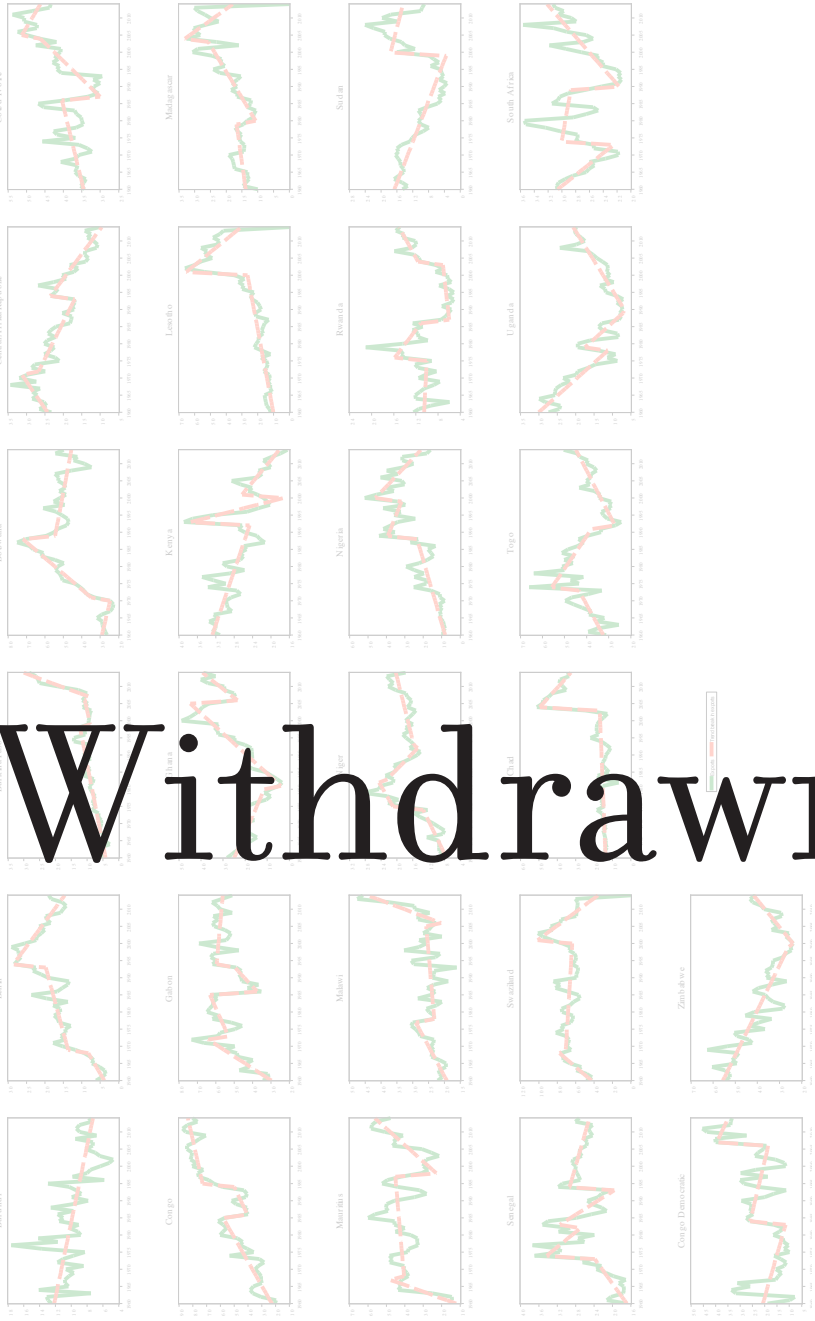
$$\hat{k}^{fr} = \arg\min_{k \in [0.1,2]} SSR(k)$$

where SSR is the sum of squared residuals. That is, the estimated fractional frequency is the one that minimizes the sum of squared residuals. By keeping to single frequency component, as done in this paper, he also avoids the over-filtration problem. In this paper, we will benchmark the findings based on the Enders-Lee integer frequency approach against those derived from the Omay fractional frequency approach for robustness check on the results.

3.4. Data sources, measurement and transformation

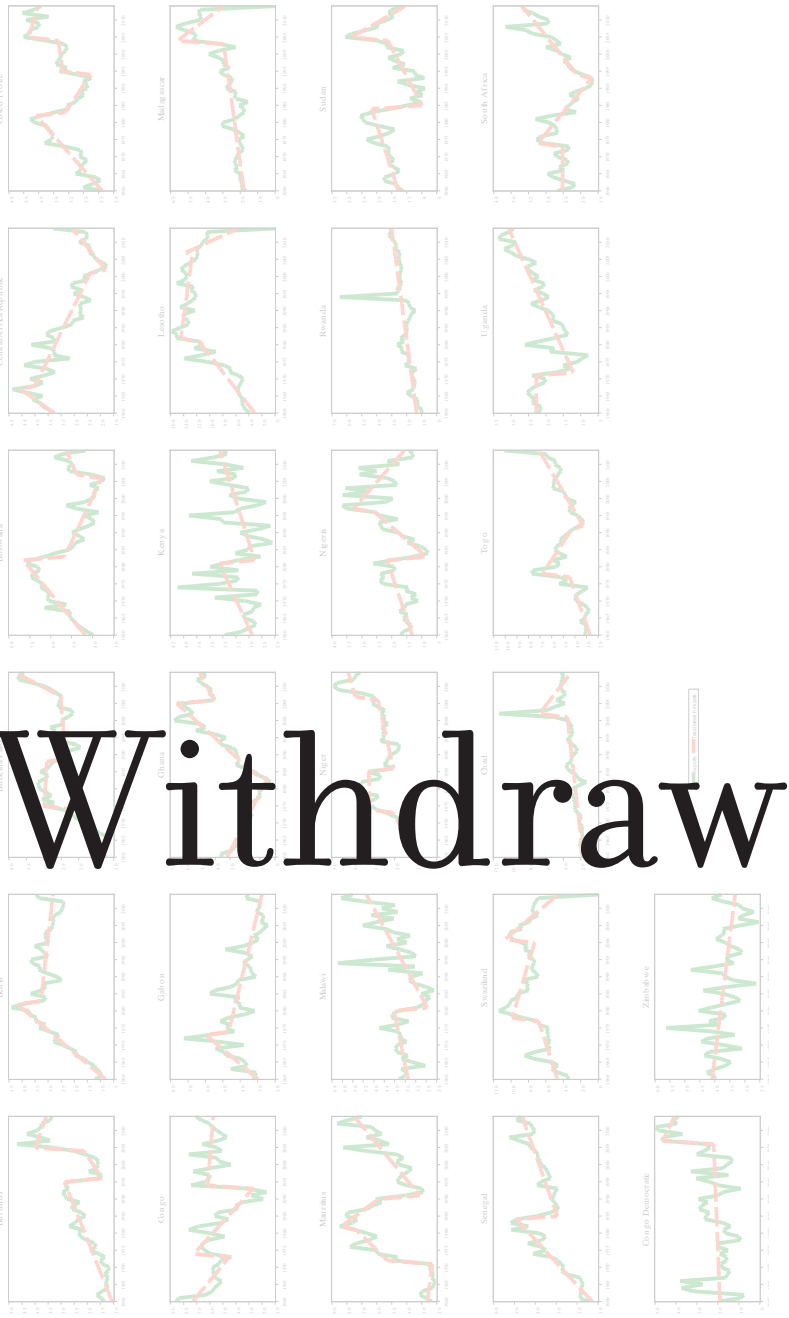
The study employs annual data for the period 1960-2014 and focuses on twenty-six (26) sub-Saharan African countries namely, Burundi (BDI), Benin (BEN), Burkina Faso (BFA), Botswana (BWA), Central Africa Republic (CAF), Chad (TCD), Côte d'Ivoire (CIV), Congo Republic (COG), Congo Democratic Republic (ZAR), Gabon (GAB), Ghana (GHA), Kenya (KEN), Lesotho (LSO), Madagascar (MDG), Mauritania (MRT), Malawi (MWI), Niger (NER), Nigeria (NGA), Rwanda (RWA), Senegal (SEN), Sudan (SUD), Swaziland (SWZ), South Africa (ZAF), Togo (TGO), Uganda (UGA) and Zimbabwe (ZMB). The selection of which country is included [illegible] availability of the data for the study period. Data on exports and imports are obtained online from the World Bank's World Development Indicators (WDI) 2015. The plots for exports and imports are displayed in Figures 1 and 2 respectively. For each country, the plot shows the series and the estimated trend with breaks. By merely eyeballing these plots, we note that the series are not generally stationary as the trend tends to shift periodically, showing that the mean seems to depend on time. However, as this is not a formal test, we will conduct a test of stationarity in Subsection 4.1. As a first check to find out the extent of cross-sectional dependence, we report in Panel (A) of Table 1. four (4) cross-sectional dependence (correlation) tests: the Breusch-Pagan LM (Breusch and Pagan, 1980), the Pesaran scaled LM (Pesaran, 2004), the bias-corrected scaled LM (Baltagi, Feng and Kao, 2012) and the Pesaran CD (Pesaran, 2004) tests. As the test results show, the data decisively reject the null of no cross-sectional dependence among the countries under investigation. The results are also robust to small sample size as indicated by the Pesaran CD statistic, which, even though small, is still significant at 1 percent. Our analysis must therefore incorporate this finding.

Figure 1.: Plots of exports for sub-Saharan countries



Source: Author.

Figure 2.: Plots of imports for sub-Saharan countries



Source: Author.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Cross-sectional dependence and unit root tests

As cross-sectional dependence is an inexcusable feature of the panel data under study we need to account for such a feature in subsequent analysis. Since O'Connell (1998) originally observed the implications of cross-sectional correlations for panel data results, many studies have emerged using systematic approaches to test for and deal with this phenomenon especially in relation to the unit root and cointegration tests. The first generation tests fail to account for the presence of cross-sectional dependence. They are therefore not adequate in the present study given the results in Panel (A) of Table1. Specifically, we opt for the second generation unit root tests because under cross-sectional dependence the first generation unit root tests suffer size distortions (Pesaran, 2004 and 2007; Jöets and Mignon, 2011). Panel (B) of Table 1. reports the results for the second generation panel unit root tests.

Following Jöets and Mignon (2011), we employ the Pesaran (2007) CIPS test, the Moon and Perron (2004) (MP) test and the Choi (2002, 2006) tests. The CIPS is based on the Dickey-Fuller regression augmented with averages of the lagged levels and first differences of the individual series. The MP test is constructed on de-factored observations - deviations from the common components - and the factor loadings are estimated by principal component analysis while the Choi (2002, 2006) test relies on an error-components panel model and removes the cross-sectional dependence by eliminating (i) individual effects using the Elliott et al. (1996) methodology (ERS), and (ii) the time trend effect by centering on the individual means (see Jöets and Mignon, 2011, p.172, Hurlin, 2010 and Awokuse and Bessler, 2003 for details on panel unit root tests). From the table it is found that both exports and imports are stationary at levels. Thus, cointegration can be ensured even if they are linearly combined at levels. Besides, OLS can be applied. One has to be cautious of these findings given the plots in Figures 1. and 2., where it can be seen that the series tend to follow a time-dependent mean.

Table 1.: Cross-section dependence and second generation unit root tests

The cross-section dependence tests		
Test	Statistic	p-value
Breusch-Pagan LM	159.439	0.000
Pesaran scaled LM	20.281	0.000
Bias-corrected scaled LM	20.217	0.000
Pesaran CD	6.583	0.000

Second-generation panel unit root tests									
	CIPS		Moon-Perron				Choi		
	(a)	(b)	tα	tβ	tα (bart)	tβ (bart)	Pm	Z	L*
Imports	-3.630	-3.602	-5.946	-5.068	-6.081	-4.772	16.935	-9.948	-11.793
	(0.010)	(0.010)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exports	-2.614	-2.614	-4.073	-3.140	-4.149	-3.176	11.583	-7.598	-8.458
	(0.075)	(0.075)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)

Notes: In Panel B, the p-values are reported in parentheses
Source: Author.

4.2. Checking for nonlinearity and structural breaks

It is hasty to submit that there is homogeneity in the cross-section of the countries under investigation, and that the second generation unit root tests confirm cointegration does not preclude this submission. To that end, so much is lost by way of panel unit root tests as reported in Panel (B) of Table 1. We therefore need to investigate the individual country's mean reversion. Two issues can be potentially problematic in this investigation. First, we need to check for the presence of nonlinearity to be sure that the inference does not suffer from lower power and size distortion (Koop and Potter, 2001). If a series is characteristically nonlinear, inference [illegible] linear approach will be misleading. In Balke and Fomby (1997), Enders and Granger (1998) and Enders and Siklos (2001) it is understood that unit root tests have low power in the presence of asymmetric adjustment. We adopt the BDS test proposed by Brock et al. (1987, 1996) to test for nonlinearity in exports and imports. The BDS statistic is planned to test whether that a time-series observations are independent and identically distributed (i.i.d). Time-series observations exhibit nonlinearity if the null of i.i.d is rejected thereby confirming a nonlinear dependence among them. The BDS statistic defines a correlation integral over m-dimensional time-series and is given by

$$C_{m,n}(e) = \frac{2}{(n-m+1)(n-m)} \sum_{s=1}^{n-m+1} \sum_{t=s+1}^{n-m+1} \prod_{j=0}^{n} I_e(Y_{s+j}, Y_{t+j})$$

where $I_e(Y_{s+j}, Y_{t+j})$ is the indicator function defined as 1 if the Euclidian distance between the series at $s + j$ and $t + j$ lies within a specified maximum-norm distance e, that is, $\left\| Y_{s+j} - Y_{t+j} \right\| < e$, and is 0 otherwise. The BDS test statistic is a two-sided test statistic:

$$\frac{\sqrt{n-m+1}[C_{m,n}(e) - C_{1,n-m+1}(e)^m]}{\sigma_{n,m}(e)} \to N(0,1)$$

Table 2.: The BDS test for linearity

Country	Exports			Imports			Net-exports [i.e., (a)-(b)]		
	Statistic	p-value a	p-value b	Statistic	p-value a	p-value b	Statistic	p-value a	p-value b
Burundi	4.766‡	0.000	0.001	14.337‡	0.000	0.000	15.017‡	0.000	0.000
Benin	15.535‡	0.000	0.000	13.241‡	0.000	0.000	11.628‡	0.000	0.000
Burkina Faso	6.638‡	0.000	0.000	17.093‡	0.000	0.000	13.596‡	0.000	0.000
Botswana	17.367‡	0.000	0.000	18.249‡	0.000	0.000	22.468‡	0.000	0.000
Central Africa Republic	14.735‡	0.000	0.000	19.566‡	0.000	0.000	2.251*	0.024	0.075
Cote d'Ivoire	12.669‡	0.000	0.000	20.302‡	0.000	0.000	5.117‡	0.000	0.000
Congo	24.861‡	0.000	0.000	8.093‡	0.000	0.000	13.104‡	0.000	0.000
Gabon	10.143‡	0.000	0.000	6.826‡	0.000	0.000	14.101‡	0.000	0.000
Ghana	15.686‡	0.000	0.000	22.097‡	0.000	0.000	16.291‡	0.000	0.000
Kenya	11.721‡	0.000	0.000	0.052	0.959	0.837	8.615‡	0.000	0.000
Lesotho	16.127‡	0.000	0.000	21.228‡	0.000	0.000	25.824‡	0.000	0.000
Madagascar	12.979‡	0.000	0.000	11.328‡	0.000	0.000	9.370‡	0.000	0.000
Mauritius	13.402‡	0.000	0.000	23.134‡	0.000	0.000	12.510‡	0.000	0.000
Malawi	3.439‡	0.001	0.009	2.922‡	0.004	0.025	2.924†	0.004	0.021
Nigeria	15.353‡	0.000	0.000	15.499‡	0.000	0.000	7.680‡	0.000	0.000
Niger	17.118‡	0.000	0.000	4.313‡	0.000	0.003	4.547‡	0.000	0.004
Rwanda	8.358‡	0.000	0.000	12.051‡	0.000	0.000	-0.149	0.881	0.868
[illegible]	7.513‡	0.000	0.000	7.488‡	0.000	0.000	10.508‡	0.000	0.000
[illegible]	7.943‡	[illegible]	[illegible]	15.[illegible]‡	[illegible]	[illegible]	15.[illegible]‡	[illegible]	[illegible]
[illegible]	9.409‡	[illegible]	[illegible]	11.527‡	0.000	0.000	14.[illegible]	0.000	0.000
[illegible]	11.895‡	[illegible]	[illegible]	11.[illegible]‡	[illegible]	[illegible]	-0.[illegible]	0.881	[illegible]
Togo	5.276‡	0.000	0.001	8.879‡	0.000	0.000	5.489‡	0.000	0.000
Uganda	21.031‡	0.000	0.000	10.170‡	0.000	0.000	19.277‡	0.000	0.000
South Africa	11.327‡	0.000	0.000	7.994‡	0.000	0.000	10.921‡	0.000	0.000
Congo Democratic	6.610‡	0.000	0.000	7.265‡	0.000	0.000	4.185‡	0.000	0.006
Zimbabwe	17.619‡	0.000	0.000	0.797	0.426	0.433	6.893‡	0.000	0.000

Notes: [a] and [b] denote the asymptotic and the bootstrap p-values respectively. ‡, † and * stand for the levels of significance at 1, 5 and 10 percent respectively. Statistic is annotated based on the bootstrap p-value computed from 1000 draws.

Source: Author.

where $\sigma_{m,n}(e)$ is the standard deviation given m embedding dimensions. Thus, the rejection of the null of the i.i.d. assumption is indicated by the large negative or positive value. In Table 2., the BDS statistic for the exports, imports and net-exports is reported and indicates that the null of i.i.d is decisively rejected for exports in all the countries. With the exception of Kenya and Zimbabwe, the null is equally

decisively rejected for imports in all the countries. For the net-exports, the time series exhibits nonlinearity for all the countries except for Central African Republic (where it is marginally nonlinear at 10 per cent), Rwanda and Chad where it is an outright rejection of nonlinearity. Broadly speaking, the panel data enormously portrays nonlinearity, a feature that casts a serious doubt on the capability of the linear approach. In general, nonlinearity is a feature of the data generating process for both exports and imports and their derivative, net-exports, and a proper modelling approach will account for nonlinearity as it is an inalienable characterization of the data.

Apart from the problem of nonlinearity, we also shine our searchlight on the possible manifestation of structural breaks that may also affect inference. The confirmation and sanctity of cointegration results seem to rest on the absence of structural breaks in the data as this feature is not distinguishable from, and could confound, the presence of stochastic trend in the data generating process. A number of authors have submitted that the presence of structural breaks may lead to the acceptance of unit root even when the data generating process can be particularized as stationary (Gregory and Hansen, 1996a,b; Gregory, Nason and Watt, 1996). Thus, this is an important confirmation test because if structural breaks are not factored into the specification - when they exist - misleading results are bound to ensue. Looking in the direction of these two potential sources of drawback - structural breaks and nonlinearity - will therefore allow for a more flexible specification than either of these features. For instance, it is commonplace to accept the null of unit root in the presence of structural breaks when there is none. To test for structural breaks, we employ the Bai-Perron test to sequentially determine the breaks (Bai and Perron, 1998, 2003a,b). Table 3 reports the Bai-Perron structural breaks respectively for exports, imports and net-exports.

Table 3: Multiple break test using the Bai-Perron (2003) test of L sequentially determined breaks

	Exports			Imports			Net-exports		
	0 vs. 1	1 vs. 2	2 vs. 3	0 vs. 1	1 vs. 2	2 vs. 3	0 vs. 1	1 vs. 2	2 vs. 3
Burundi	11.061			29.552*	31.254*	4.394	23.939*	15.907*	9.285
Benin	12.935			27.863*	10.493		19.292*	12.828	
Burkina Faso	36.234l*	11.730		10.953			15.106*	17.047*	15.621
Botswana	24.211*	7.383		19.516*	12.630		14.317*	7.844	
Central Africa Republic	17.240*	17.466*	7.118	16.556*	6.587		23.727*	10.680	
Cote d'Ivoire	10.341			18.549*	18.349*	9.928	14.054*	9.459	
Congo	10.567			21.301*	14.306		8.049		
Gabon	11.385			18.888*	4.164		6.493		
Ghana	14.548*	10.564		23.075*	20.707*	9.336	20.041*	15.114	

	Exports			Imports			Net-exports		
Kenya	6.257			12.682			16.849*	8.119	
Lesotho	34.277*	3.697		22.173*	10.830		22.897*	8.396	
Madagascar	22.983*	6.747		28.364*	5.698		29.753*	4.625	
Mauritius	8.048			19.752*	12.008		31.868*	15.430	
Malawi	21.351*	13.886		15.274*	9.580		8.983		
Nigeria	13.898			12.302			15.084*	9.953	
Niger	24.838*	19.568*	5.591	20.796*	6.226		14.217*	11.977	
Rwanda	21.292*	12.414		11.865			24.358*	41.778*	1.197
Sudan	23.570*	30.501*	4.575	12.200			17.403*	7.134	
Senegal	14.524*	12.301		37.861*	4.341		15.981*	8.092	
Swaziland	30.404*	10.082		15.265*	3.593		16.468*	12.915	
Chad	102.441*	13.488		25.927*	1.137		57.295*	166.472*	7.127
Togo	41.293*	6.522		12.772			15.579*	10.783	
Uganda	13.631			17.899*	12.600		23.675*	5.681	
South Africa	12.570			16.952*	9.811		12.510		
Congo Democratic	14.508*	6.020		16.669*	4.426		25.494*	19.136*	10.926
Zimbabwe	20.092*	7.938		5.712			16.641*	8.822	

Notes: The critical values are 13.98, 15.72 and 16.83 for 0 vs. 1, 1 vs 2 and 2 vs. 3 break tests. The statistic reported is the scaled F-statistic.
Source: Author.

The results of the structural break tests provide confirmatory evidence that the [illegible] must be carefully done. From Table 3., we find that in general the data generating process is driven by structural breaks. In fact, only in very few cases do we observe absence of structural breaks. The case for imports include Burundi, Benin, Cote d'Ivoire, Congo, Gabon, Kenya, Mauritius, Niger, Uganda and South Africa, and, in case of exports, Burkina Faso, Kenya, Nigeria, Rwanda, Sudan, Togo and Zimbabwe. For net-exports, only for Congo, Gabon, Malawi and South Africa do we fail to observe structural breaks. Therefore, there is a need to account for structural breaks in addition to nonlinearity when testing either for unit root or cointegration.

4.3. Sequential panel selection method (SPSM) and nonlinear unit root testing

The two drawbacks identified above can be dealt with following specification advanced by Enders and Lee (2004, 2009). As the form and number of unknown breaks are difficult to determine, fixing the structural breaks using the conventional dummy variable strategy can be arbitrary. Using wrong specification for structural breaks can be as detrimental as the failure to account for them. This consideration makes the Enders-Lee approach to tackling structural breaks more appealing. In line with the flexible Fourier transform literature (see, Enders and Lee, 2004, 2009), we

overcome this problem by augmenting with Fourier function, which is capable of approximating absolutely integrable function to any degree of accuracy (Chang et al. 2014). In the same specification, we also account for the nonlinearity by using the following nonlinear specification due to Kapetanios et al. (2003). Similar specifications are used in Ucar and Omay (2009) and in Emirmahmutoğlu and Omay (2014). In Kapetanios et al. (2003), the unit root test aims at testing the null of non-stationarity against a nonlinear but globally stationary exponential smooth transition autoregressive (ESTAR) process (Chang et al. 2014):

$$\Delta y_{it} = G_t(\theta_i, y_{it-d})\rho_i y_{it-1} + \varepsilon_{it} \tag{6}$$

where $G_t(\theta_i, y_{it-d}) = 1 - \exp(-\theta_i y_{it-d}^2)$ with $\theta_i \geq 0$, and ε_{it} is the error term with mean zero and constant variance. Because ρ_i is not independently identified, Kapetanios et al. (2003) take the Taylor series approximation of Eq. (6) to obtain the following nonlinear unit root test specification:

$$\Delta y_{it} = \alpha_i + \beta_i t + \gamma_i y_{it-1}^3 + \varepsilon_{it} \tag{7}$$

To account for unknown number and functional form of structural breaks as well as the serial correlation, we specify an order *p* nonlinear ADF unit root test augmented with smooth structural shift in the spirit of Enders and Lee (2004, 2009):

$$\Delta y_{it} = \alpha_i + \gamma_i y_{it-1}^3 + \sum_{j=1}^{p} \eta_{ij} \Delta y_{it-j} + \chi_i \sin\left(\frac{2\pi kt}{T}\right) + \phi_i \cos\left(\frac{2\pi kt}{T}\right) + \varepsilon_{it} \tag{8}$$

The results in Panel (A) of Table 1, are not indicative of the individual series that are stationary when the null hypothesis is rejected. This calls for a systematic approach to evaluating the stationarity in a panel data structure such that non-stationary series are sieved out (Chortareas and Kapetanios, 2009; Smeekes, 2011; Westerlund, 2013). The sequential panel selection method (SPSM) is a useful approach to separating the cross-section of series into the groups of stationary and non-stationary series, which in addition exploits the benefit of the panel data to increase the power of the unit-root testing. We address two important aspects of our data in this study. First, we tackle the problem of structural breaks in the data by adopting a non-linear unit root tests of Kapetanios et al. (2003). This is in the spirit of Ucar and Omay (2009), who extend the approach to the Fourier specification of Im et al. (2003) in detecting the mean reversion in the panel data. The procedure for executing the SPSM is straightforward. Chortareas and Kapetanios (2009) state the following steps:

(1) We first estimate the Fourier augmented panel with nonlinear unit-root specification in Eq. (8) and test for stationarity at levels. If the null of unit root cannot be rejected, the procedure is stopped and it is concluded that all the series in the panel are nonstationary. If the null is rejected, we proceed to the next step;

(2) We remove the series with the minimum KSS statistic as that indicates such series is stationary; and

(3) We repeat the process in Steps 2 and 3 or stop the procedure in case all the series have been removed.

Table 4.: SPSM for imports, exports and net-exports without structural breaks

Sequence	Imports				Exports				Net-exports [i.e., (a)-(b)]			
	UO statistic	p-value	Min. KSS	Series	UO statistic	p-value	Min. KSS	Series	UO statistic	p-value	Min. KSS	Series
1	-2.749	0.000	-5.193	TCD	-2.118	0.000	-3.723	KEN	-2.849	0.000	-8.105	TCD
2	-2.651	0.000	-4.608	KEN	-2.054	0.000	-3.584	ZAF	-2.638	0.000	-5.810	MRT
3	-2.570	0.000	-4.425	RWA	-1.990	0.000	-3.572	GAB	-2.506	0.000	-5.119	CIV
4	-2.489	0.000	-4.410	COG	-1.922	0.000	-3.247	SDN	-2.393	0.000	-4.316	TGO
5	-2.402	0.000	-4.320	ZMB	-1.861	0.000	-3.205	MRT	-2.305	0.000	-4.068	CAF
6	-2.310	0.000	-3.709	BDI	-1.797	0.000	-3.044	CIV	-2.221	0.000	-3.764	RWA
7	-2.240	0.000	-3.489	GAB	-1.735	0.002	-2.818	RWA	-2.144	0.000	-3.380	ZAR
8	-2.175	0.000	-3.410	NGA	-1.678	0.002	-2.801	GHA	-2.079	0.000	-3.114	NGA
9	-2.106	0.000	-3.113	SEN	-1.616	0.003	-2.774	BDI	-2.022	0.000	-3.103	COG
10	-2.047	0.000	-3.085	BEN	-1.548	0.005	-2.769	SEN	-1.958	0.000	-3.047	GAB
11	-1.982	0.000	-3.056	GHA	-1.471	0.012	-2.638	CAF	-1.890	0.000	-2.837	MWI
12	-1.910	0.000	-2.907	ZAF	-1.393	0.016	-2.635	ZAR	-1.827	0.000	-2.779	SEN
13	-1.839	0.000	-2.727	MRT	-1.305	0.025	-2.527	TCD	-1.759	0.000	-2.755	BDI
14	-1.771	0.000	-2.411	MWI	-1.211	0.042	-2.319	MDG	-1.682	0.000	-2.485	ZAF
15	-1.691	0.000	-2.317	[illegible]	-1.119	0.058	[illegible]	[illegible]	[illegible]	0.000	[illegible]	[illegible]
16	-1.620	0.000	-2.302	CIV	-1.021	0.082	-2.216	COG	-1.548	0.000	-2.[illegible]	GHA
17	-1.553	0.000	-2.[illegible]	[illegible]	-0.[illegible]	[illegible]	[illegible]	[illegible]	-1.477	0.000	[illegible]	[illegible]
18	-1.475	0.000	-2.226	MDG	-0.791	0.240	-2.030	TGO	-1.406	0.002	-2.098	BWA
19	-1.381	0.000	-2.158	BWA	-0.636	0.350	-1.938	NGA	-1.320	0.004	-1.892	MDG
20	-1.270	0.001	-2.066	NER	-0.450	0.479	-1.920	BEN	-1.238	0.007	-1.788	UGA
21	-1.137	0.010	-2.021	UGA	-0.205	0.647	-1.016	SWZ	-1.146	0.011	-1.741	NER
22	-0.961	0.028	-1.724	CAF	-0.043	0.685	-0.957	LSO	-1.027	0.028	-1.541	BFA
23	-0.770	0.080	-1.418	TGO	0.186	0.762	-0.840	UGA	-0.899	0.047	-1.206	ZMB
24	-0.554	0.157	-1.086	ZAR	0.528	0.849	-0.594	ZMB	-0.797	0.059	-1.136	SDN
25	-0.287	0.282	-0.616	SWZ	1.089	0.925	1.046	MWI	-0.627	0.090	-0.919	LSO
26	0.041	0.402	0.041	LSO	1.132	0.765	1.132	BFA	-0.334	0.166	-0.334	KEN

Notes: The p-values are the empirical probability based on 1000 bootstrap draws.
Source: Author.

Tables 4. and 5. show the UO statistic (Ucar and Omay, 2009), the associated probability value, the individual minimum KSS and the excluded series. The results in Table 4. reveal that without accounting for the structural breaks in the model through

the Fourier specification and thus ignoring smooth structural shifts, imports for most countries are not stationary. In the first sequence, the null hypothesis of unit root is rejected for the whole panel data at 10 percent level of significance, with the SPSM procedure confirming that this is largely attributed to the stationarity of imports of Chad producing the minimum KSS of -5.193. We thus exclude Chadian imports and move to the second sequence. In the second sequence, the minimum KSS of -4.608 is attributable to stationarity of Kenya. Proceeding this way, 23 of the 26 countries are classified as having stationarity. Subsequently, the p-value is greater than 10 percent for the three remaining countries in the panel, confirming we cannot reject the null of unit root for these three countries in the cross-section. Thus, without accounting for smooth structural breaks in the data, Chad remains the leader of the countries with stationary imports at the minimum KSS. When smooth structural shifts in the data are accounted for, the number of countries in the panel showing stationarity remains the same, although the three countries exhibiting non-stationarity at 10 percent level of significance are no longer the same. Zambia therefore takes the lead with the minimum KSS of -6.367 after accounting for smooth structural breaks in the data. It is followed closely by Burundi with the minimum KSS of -5.986. Thus, for individual countries, accounting for smooth structural shifts in imports makes a big difference between stationary and non-stationary series in the spirit of unit-root testing with structural breaks.

Export series, on the other hand, are stationary with the p-values being generally less than 10 percent for 15 of the 26 countries. The stationarity among this group is largely attributable to the likes of Kenya, South Africa, Gabon, Sudan and Mauritius. Others in this category are Cote d'Ivoire, Rwanda, Ghana, Burundi, Senegal, Central African Republic, Congo Democratic Republic, Chad, Madagascar and Niger. Burkina Faso has the highest KSS of -1.132 and fails to reject unit root at 10 percent. After accounting for smooth structural shifts, the number of countries exhibiting stationarity increases from 15 to 19. The seven countries for which exports series fails to reject unit root are Madagascar, Uganda, Sudan, Swaziland, Burkina Faso, Lesotho and Malawi. In the first sequence, the exports series for Central Africa Republic is excluded with the minimum KSS of -4.743. The positive minimum KSS value of 0.036 for Malawi is, however, indicative of non-stationarity.

Note that the results based on trade balance allude to the strong form of sustainability with proviso that $\beta_{0,i} = 0$ and $\beta_{1,i} = 1$. The results in Table 4. show that the trade balance, represented by net exports, is stationary for 25 of the 26 countries with the exception of Kenya that fails to reject unit root at 10 percent level. Chad leads the panel with the minimum KSS of -8.105 and Kenya has the minimum KSS of -0.334. In Table 5, more countries, including Botswana, Congo Democratic Republic, Uganda, Zambia, Madagascar, Kenya, Sudan, Niger and Ghana, fail to reject unit root. After accounting for the smooth structural shifts, the net-exports series for Uganda, South Africa and Kenya are not stationary. Structurally, however, the borderline in the minimum KSS ranking of the panel remains similar, with the minimum KSS of -8.225 for Chad.

Table 5.: SPSM for imports, exports and net-exports with structural breaks

Sequence	Imports				Exports				Net-exports [i.e., (a)-(b)]			
	UO statistic	p-value	Min. KSS	Series	UO statistic	p-value	Min. KSS	Series	UO statistic	p-value	Min. KSS	Series
1	-3.522	0.000	-6.397	ZMB	-2.653	0.003	-4.743	CAF	-3.066	0.000	-8.225	TCD
2	-3.407	0.000	-5.986	BDI	-2.569	0.004	-4.049	ZAF	-2.860	0.000	-5.844	CAF
3	-3.300	0.000	-5.565	TCD	-2.507	0.003	-3.827	KEN	-2.736	0.000	-5.194	MRT
4	-3.201	0.000	-5.408	ZAF	-2.450	0.003	-3.755	MRT	-2.629	0.001	-5.173	CIV
5	-3.101	0.000	-5.261	KEN	-2.391	0.004	-3.596	CIV	-2.513	0.002	-4.303	TGO
6	-2.998	0.000	-4.433	RWA	-2.333	0.006	-3.424	SEN	-2.428	0.003	-3.983	RWA
7	-2.927	0.000	-4.412	COG	-2.279	0.007	-3.310	GAB	-2.350	0.004	-3.619	LSO
8	-2.848	0.000	-4.195	MRT	-2.225	0.008	-3.173	BDI	-2.283	0.004	-3.569	SEN
9	-2.774	0.000	-4.095	NGA	-2.172	0.009	-3.152	NGA	-2.212	0.005	-3.363	BDI
10	-2.696	0.000	-3.944	SEN	-2.114	0.009	-2.976	BWA	-2.144	0.006	-3.267	NGA
11	-2.618	0.000	-3.698	BEN	-2.060	0.010	-2.947	ZAR	-2.074	0.007	-3.137	COG
12	-2.546	0.000	-3.597	CAF	-2.001	0.010	-2.929	NER	-2.003	0.010	-3.058	GAB
13	-2.471	0.000	-3.565	BFA	-1.935	0.011	-2.886	TCD	-1.928	0.011	-2.986	SWZ
14	-2.387	0.000	-3.377	GHA	-1.862	0.015	-2.866	GHA	-1.846	0.023	-2.931	MWI
15	-2.304	0.000	-3.296	MWI	-1.778	0.021	-2.787	COG	-1.756	0.034	-2.763	BFA
16	-2.214	0.000	-3.265	GAB	-1.686	0.030	-2.690	RWA	-1.664	0.048	-2.687	ZAF
17	-2.109	0.000	-3.026	UGA	-1.586	0.046	-2.517	BEN	-1.562	0.077	-2.666	BEN
18	-2.007	0.000	-2.948	CIV	-1.483	0.059	-2.476	ZMB	-1.439	0.125	-2.219	BWA
19	[illegible]	0.001	-2.816	NER	-1.358	[illegible]	-2.465	TGO	-1.342	0.144	-2.085	ZAR
20	[illegible]	0.007	[illegible]	TGO	-1.200	[illegible]	-2.382	MDG	-1.236	0.178	-1.921	UGA
21	[illegible]	[illegible]	[illegible]	LSO	[illegible]	[illegible]	[illegible]	UGA	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	-1.266	0.054	-1.980	ZAR	-0.483	0.420	-1.164	SWZ	-0.972	0.177	-1.368	KEN
24	-1.028	0.117	-1.947	SDN	-0.256	0.460	-0.427	BFA	-0.840	0.189	-1.131	SDN
25	-0.568	0.300	-1.057	SWZ	-0.171	0.393	-0.378	LSO	-0.694	0.198	-0.864	NER
26	-0.079	0.461	-0.079	MDG	0.036	0.377	0.036	MWI	-0.524	0.197	-0.524	GHA

Notes: The p-values are the empirical probability based on 1000 bootstrap draws.
Source: Author.

4.4. Linear cointegration test without structural shifts

We now turn to testing for cointegration between the between exports and imports. Having established cross-sectional dependence for the cointegrated relation, we proceed to study cointegration by incorporating the cross-section correlation using the bootstrap approach highlighted in Section 3.2. Table 6. reports the results for cointegration between exports and imports based on the model in Eq. (3) for each country. Three tests namely the Dickey-Fuller GLS detredend unit root (DF-GLS) (Elliot, Rothenberg and Stock, 1996), the Phillips-Perron (PP) (Phillips

and Perron, 1988) and the modified Phillips-Perron (MZT) (Perron and Ng, 1996) tests are employed. It is clear from Panel (A) of Table 6. that not all the countries exhibit cointegration between exports and imports and thus sustainability of trade balance. Depending on the test statistics used, the number of countries showing cointegration between exports and imports in the baseline model is either 6 or 7 of the 26 countries under study. In particular, the following countries are found to show sustainability: Cote d'Ivoire, Madagascar, Malawi, Nigeria, Niger, Senegal and Congo Democratic (using DF-GLS); Côte d'Ivoire, Madagascar, Nigeria, Niger, Senegal and Congo Democratic (using MZT); and Burundi, Côte d'Ivoire, Ghana, Madagascar, Niger, Togo, and Congo Democratic (using PP). Irrespective of the test used however four countries exhibit sustainability: Côte d'Ivoire, Madagascar, Niger and Congo Democratic. The results of linear cointegration tests are largely similar to those reported in Arize (2000), Narayan and Narayan (2005), and Razafimahefa and Hamori (2007).

Despite the fact that the majority of the countries do not exhibit sustainable current accounts based on the three tests employed, the group statistics especially the Dickey-Fuller GLS detrended and the Phillips-Perron unit-root tests indicate that the countries as a group have sustainable current account. Specifically, Panel (B) of Table 6. reports the group statistics (mean, maximum and median) based on the Dickey-Fuller GLS, the Phillips-Perron (PP) and the modified Phillips-Perron cointegration tests. The mean statistic indicates that the rejection of the null hypothesis of no-cointegration against the alternative of cointegration implies that for most of the countries, the mass of the distribution should be significantly far from unit. Thus same interpretation can be given to the median statistic. The max statistic on the other hand requires that the rejection of the null hypothesis of no-cointegration depend on finding cointegration for *all* the cross-sections, meaning that the autoregressive parameters be less than unit, that is, $\rho_i < 1$, in all cases (Di Iorio and Fachin, 2011). These results show how group statistics can conceal the individual characteristics given that only six or seven of these countries (depending on the statistic used) actually exhibit cointegration individually. Indeed, based on the results reported in Panel (B), the mean statistic suggests that the null of no cointegration be rejected given that the mass of the distribution is significantly far from unit as implied by the GLS and PP statistics and their associated p-values, the interpretation that can also be given to the median statistic. In addition, the max statistic indicates that we should reject the null of no cointegration. Thus, relying on the group statistics would, with a high probability, lead to wrong inference.

Table 6.: Bootstrap cointegration test of the trade balance (baseline model)

Individual country's cross-sectional-dependence cointegration tests												
	GLS				MZT				Phillips-Perron			
	Statistic	1%	5%	10%	Statistic	1%	5%	10%	Statistic	1%	5%	10%
Burundi	-2.585*	-3.793	-2.853	-2.521	-2.261*	-3.237	-2.527	-2.257	-5.031‡	-4.155	-3.467	-3.121
Benin	-1.890	-3.618	-2.814	-2.416	-1.785	-3.050	-2.484	-2.197	-1.787	-3.942	-3.160	-2.820
Burkina Faso	-0.719	-3.726	-2.812	-2.396	-0.703	-2.964	-2.550	-2.183	-0.324	-4.254	-3.450	-3.072
Botswana	-1.088	-3.267	-2.688	-2.276	-0.954	-3.108	-2.405	-2.070	-1.966	-3.986	-3.408	-3.091
Central Africa Republic	-3.164*	-4.008	-3.305	-2.950	-2.522*	-3.081	-2.720	-2.502	-3.035	-4.683	-4.055	-3.641
Cote d'Ivoire	-3.505†	-3.689	-2.867	-2.381	-2.865†	-3.085	-2.467	-2.152	-3.602†	-4.138	-3.312	-3.004
Congo	-0.565	-3.088	-2.355	-1.998	-0.382	-2.631	-2.133	-1.845	-1.628	-3.614	-2.974	-2.552
Gabon	-2.290	-3.665	-2.887	-2.609	-2.038	-3.003	-2.513	-2.310	-3.494*	-4.058	-3.549	-3.283
Ghana	-2.389	-3.680	-2.840	-2.507	-2.150	-3.055	-2.470	-2.229	-4.100†	-4.398	-3.604	-3.295
Kenya	-1.440	-3.037	-2.402	-2.118	-1.333	-2.795	-2.155	-1.926	-1.612	-3.987	-3.079	-2.758
Lesotho	-1.415	-3.533	-2.778	-2.407	-1.375	-3.332	-2.478	-2.194	-1.540	-4.109	-3.132	-2.860
Madagascar	-3.156†	-3.266	-2.604	-2.221	-2.663†	-3.215	-2.371	-2.108	-3.607†	-3.769	-3.071	-2.822
Mauritius	-1.925	-3.310	-2.543	-2.209	-1.735	-3.233	-2.324	-2.069	-3.005*	-3.637	-3.136	-2.783
Malawi	-3.232†	-3.613	-2.998	-2.691	-2.569*	-2.919	-2.586	-2.361	-3.374*	-4.184	-3.526	-3.249
Nigeria	-2.969†	-3.902	-2.892	-2.523	-2.556†	-3.103	-2.532	-2.262	-3.047*	-4.035	-3.288	-2.999
Niger	-3.278†	-3.430	-2.804	-2.442	-2.723†	-2.875	-2.458	-2.206	-4.090†	-4.124	-3.442	-3.041
Rwanda	-2.543	-3.636	-3.074	-2.785	-2.273	-2.915	-2.610	-2.417	-2.644	-4.164	-3.571	-3.303
Sudan	-2.426*	-3.394	-2.587	-2.194	-2.167*	-2.820	-2.302	-2.011	-2.854	-3.847	-3.206	-2.899
Senegal	-3.349†	-3.772	-2.896	-2.549	-2.779†	-3.353	-2.546	-2.270	-3.353*	-4.105	-3.432	-3.046
Swaziland	-1.909	-3.088	-2.495	-2.182	-1.747	-3.060	-2.346	-2.070	-2.007	-3.386	-2.853	-2.539
[illegible]	-2.4[illegible]	-3.[illegible]09	-3.097	-2.793	-2.191	-3.[illegible]30	-2.615	-2.437	-2.427	-5.281	-3.667	-3.262
To[illegible]	-1.[illegible]74	-3.490	-2.536	-2.[illegible]26	-1.033	-2.[illegible]22	-2.[illegible]30	-2.[illegible]16	-4.447‡	-4.177	-3.091	-2.782
Uga[illegible]	-2.288	-3.[illegible]00	-2.[illegible]001	-2.[illegible]683	-1.[illegible]	-2.[illegible]25	-2.[illegible]587	-2.[illegible]344	-2.[illegible]	-3.[illegible]	-3.[illegible]	-3.[illegible]02
Soutl[illegible]	-2.690*	-3.[illegible]92	-2.[illegible]785	-2.[illegible]410	-2.[illegible]	-3.[illegible]20	-2.[illegible]496	-2.[illegible]	-3.05[illegible]	-3.[illegible]	-3.[illegible]	-3.[illegible]11
Congo Democratic	4.697‡	-3.527	-2.862	-2.564	-3.343‡	-2.867	-2.471	-2.276	4.663‡	-4.018	-3.529	-3.204
Zimbabwe	-1.020	-3.210	-2.629	-2.350	-0.971	-2.819	-2.357	-2.128	-3.006*	-3.823	-3.239	-2.920

(B) Group cross-sectional cointegration test

	GLS		MZT		Phillips-Perron	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
Mean	-2.273	0.094	-1.947	0.156	-2.920	0.060
Max	-4.697	0.000	-3.343	0.011	-5.031	0.000
Median	-2.407	0.069	-2.159	0.103	-3.021	0.047

Notes: In Panel (A), ‡, † and * refer to 1, 5 and 10% significance levels respectively. The results are based on 1000 re-drawings with replacement. In Panel (B), the p-values are reported in parentheses. The p-values in all cases are based on the 1000 re-drawings computed as the proportion of re-drawings for which the computed statistics (mean, median or maximum of the statistics for the cross-sections) is greater than the bootstrap statistics.
Source: Author.

Table 7.: Specification test for sustainability test

	Multiple break testing via the Bai-Perron (2003a)			BDS test of nonlinearity					
				Without structural breaks			With structural breaks		
	0 vs. 1	1 vs. 2	2 vs. 3	Statistic	p-value a	p-value b	Statistic	p-value a	p-value b
Burundi	14.342	12.167	4.394	4.238‡	0.000	0.002	1.101	0.271	0.341
Benin	17.334	6.974		15.295‡	0.000	0.000	2.613†	0.009	0.038
Burkina Faso	12.611			7.242‡	0.000	0.000	2.329*	0.020	0.095
Botswana	24.692	7.841		17.965‡	0.000	0.000	6.690‡	0.000	0.000
Central Africa Republic	29.128	10.802		1.211	0.226	0.286	1.345	0.179	0.227
Cote d'Ivoire	11.366	18.349	9.928	5.627‡	0.000	0.000	-0.474	0.636	0.831
Congo	7.937	14.306		25.581‡	0.000	0.000	10.142‡	0.000	0.000
Gabon	10.947	4.164		11.054‡	0.000	0.000	6.881‡	0.000	0.000
Ghana	10.565	20.707	9.336	1.520	0.129	0.249	0.725	0.468	0.522
Kenya	9.012			12.465‡	0.000	0.000	6.338‡	0.000	0.000
Lesotho	37.541	10.981		14.514‡	0.000	0.000	5.787‡	0.000	0.000
Madagascar	6.879	5.698		5.121‡	0.000	0.000	4.339‡	0.000	0.001
Mauritius	16.731	6.994		16.571‡	0.000	0.000	14.412‡	0.000	0.000
Malawi	16.499	10.475		2.313*	0.021	0.078	-0.079	0.937	0.915
Nigeria	28.832	3.546		5.584‡	0.000	0.000	1.896	0.058	0.110
Niger	12.871	6.226		4.007‡	0.000	0.005	-0.838	0.402	0.601
[illegible]	[illegible]	12.320		8.81‡	0.000	0.000	6.832‡	0.000	0.000
Sudan	26.299	[illegible]		13.463‡	0.000	0.000	2.865†	0.004	0.030
Senegal	9.07[illegible]	[illegible]341		[illegible]519	0.000	0.000	4.[illegible]61	0.000	0.000
Swaziland	14.5[illegible]	[illegible]963		[illegible]082	0.000	0.000	7.[illegible]	0.000	0.000
Chad	65.402	40.876	3.994	8.392‡	0.000	0.000	2.609†	0.009	0.036
Togo	26.765	10.628		5.458‡	0.000	0.001	3.229†	0.001	0.015
Uganda	25.329	6.468		18.295‡	0.000	0.000	2.313*	0.021	0.076
South Africa	10.102	9.811		9.072‡	0.000	0.000	7.130‡	0.000	0.000
Congo Democratic	21.552	22.313	1.892	2.938‡	0.003	0.029	3.612†	0.000	0.019
Zimbabwe	21.108	9.195		11.946	0.000	0.000	5.390‡	0.000	0.001

Notes: In Panel (A), ‡, † and * refer to 1, 5 and 10% significance levels respectively. The results are based on 1000 re-drawings with replacement. In Panel (B), the p-values are reported in parentheses. The p-values in all cases are based on the 1000 re-drawings computed as the proportion of re-drawings for which the computed statistics (mean, median or maximum of the statistics for the cross-sections) is greater than the bootstrap statistics.
Source: Author.

4.5. Nonlinear cointegration test with smooth structural shifts

The analysis in the previous section shows that most of the countries in the cross-section do not exhibit sustainable current accounts as evidenced by lack of cointegration between exports and imports. In particular, we found that 19 countries namely Burundi, Benin, Burkina Faso, Botswana, Central Africa Republic, Congo, Gabon, Ghana, Kenya, Lesotho, Mauritius, Rwanda, Sudan, Swaziland, Chad, Togo, Uganda, South Africa and Zimbabwe do not exhibit sustainable current accounts at 5 percent using the Dickey-Fuller GLS-detrended unit root test, the results largely corroborated by other two tests. This finding prompts us to investigate the data for the presence of two possible drawbacks, possibly overlooked in the previous studies on sub-Saharan Africa: the structural breaks and nonlinearity. In Panel (A) of Table 7., we report the results of the Bai-Perron test of L+1 vs. L sequentially determined breaks and find that except for Kenya all the countries have at least one break in the data span used for this study. With and without accounting for structural breaks, we also find from Panel (B) of the same table using the BDS test that most of these countries exhibit nonlinearity. With a view to fixing these problems, we employ the strategy highlighted in section 3.2 correcting for both of these problems. The results are shown in Tables 8. and 9. In Table 8. reporting the three unit-root tests, namely the Dickey-Fuller GLS-detrended, the modified PP and the PP unit root tests, we account for the smooth structural shift only and find that all the countries display strong cointegration between exports and imports confirming the sustainability of current accounts in all the countries. Except for the MZT statistic in the case of Senegal, the results are all significant at 5 percent. Thus, lack of sustainability in trade balance discussed above can be largely addressed to structural shifts in the data. In other words, in the countries studied sustainability of trade balance has been mauled by factors driving level shifts. The results in Table 9. also point in the same direction marginally improving on the results reported in Table 8. However, we observe that the MZT statistic for Ghana and Rwanda is not very robust to factoring nonlinearity as the results for these countries become insignificant at 5 percent contrasting with the results for structural breaks alone.

Table 8.: Bootstrap cointegration test with smooth structural shift [the IFFFF-DF-type test (Enders-Lee, 2012b)]

Individual country's cross-sectional-dependence cointegration tests												
	GLS				MZT				Phillips-Perron			
	Statistic	1%	5%	10%	Statistic	1%	5%	10%	Statistic	1%	5%	10%
Burundi	-6.101‡	-3.673	-2.913	-2.541	-3.566‡	-2.984	-2.520	-2.278	-7.654‡	-4.044	-3.407	-3.099
Benin	-6.564‡	-3.462	-2.704	-2.399	-3.621‡	-3.311	-2.381	-2.189	-6.501‡	-3.688	-3.078	-2.721
Burkina Faso	-6.840‡	-3.342	-2.602	-2.335	-3.490‡	-2.788	-2.333	-2.112	-7.026‡	-4.191	-3.289	-2.923
Botswana	-6.629‡	-3.221	-2.634	-2.279	-3.624‡	-2.849	-2.433	-2.078	-6.584‡	-3.918	-3.327	-3.076
Central Africa Republic	-6.689‡	-4.036	-3.264	-2.870	-3.127‡	-3.069	-2.688	-2.466	-7.217‡	-4.623	-3.962	-3.599
Cote d'Ivoire	-6.083‡	-3.636	-2.862	-2.437	-3.583‡	-3.178	-2.512	-2.239	-7.151‡	-4.191	-3.425	-3.017
Congo	-6.245‡	-2.858	-2.202	-1.865	-3.528‡	-2.505	-2.027	-1.736	-7.309‡	-3.219	-2.772	-2.458
Gabon	-5.606‡	-3.454	-2.941	-2.594	-3.513‡	-2.978	-2.545	-2.312	-7.815‡	-4.168	-3.531	-3.272
Ghana	-3.647‡	-3.634	-2.897	-2.445	-2.549†	-3.017	-2.521	-2.187	-7.524‡	-4.193	-3.595	-3.322
Kenya	-5.418‡	-3.147	-2.380	-2.070	-3.420‡	-2.736	-2.148	-1.900	-6.351‡	-3.817	-3.065	-2.724
Lesotho	-4.089‡	-3.569	-2.752	-2.377	-2.917†	-3.220	-2.444	-2.193	-4.062‡	-3.724	-3.059	-2.751
Madagascar	-5.940‡	-3.289	-2.519	-2.204	-3.363‡	-3.012	-2.389	-2.091	-6.194‡	-3.753	-3.086	-2.765
Mauritius	-4.688‡	-3.230	-2.563	-2.224	-3.313‡	-2.989	-2.307	-2.034	-5.716‡	-3.683	-3.112	-2.767
Malawi	-6.888‡	-3.635	-2.997	-2.695	-3.542‡	-2.928	-2.572	-2.358	-7.066‡	-4.177	-3.538	-3.241
Nigeria	-6.800‡	-3.592	-2.821	-2.490	-3.609‡	-2.946	-2.463	-2.244	-6.897‡	-3.937	-3.212	-2.953
Niger	-6.546‡	-3.432	-2.726	-2.382	-3.613‡	-3.003	-2.408	-2.164	-7.282‡	-3.910	-3.276	-2.974
Rwanda	-7.316‡	-3.513	-2.996	-2.755	-3.634‡	-2.935	-2.558	-2.407	-7.511‡	-4.304	-3.531	-3.255
Sudan	-6.164‡	-3.463	-2.586	-2.241	-3.589‡	-3.230	-2.313	-2.040	-6.744‡	-3.755	-3.261	-2.847
Senegal	-2.9[illegible]	-3.592	-2.880	-2.577	-2.294*	-3.[illegible]0	-2.498	-2.292	-8.001‡	-3.932	-3.337	-2.970
Swaziland	-3.8[illegible]‡	-3.[illegible]30	-2.[illegible]42	-2.[illegible]10	-2.894‡	-3.[illegible]38	-2.[illegible]38	-2.[illegible]10	-5.[illegible]‡	-3.[illegible]47	-2.[illegible]8[illegible]	-2.[illegible]22
Chad	-5.[illegible]04‡	-3.[illegible]98	-2.[illegible]107	-2.[illegible]842	-4.[illegible]‡	-3.[illegible]29	-2.[illegible]00	-2.[illegible]48	-3.54[illegible]	-3.[illegible]47	-3.[illegible]5	-3.[illegible]24
Togo	-5.593‡	-3.[illegible]51	-2.[illegible]69	-2.361	-3.5[illegible]‡	-3.[illegible]18	-2.[illegible]63	-2.[illegible]17	-7.009‡	-3.[illegible]91	-3.2[illegible]	-2.[illegible]72
Uganda	-7.019‡	-3.612	-2.826	-2.580	-3.624‡	-3.158	-2.490	-2.267	-7.041‡	-4.151	-3.377	-3.067
South Africa	-4.550‡	-3.535	-2.708	-2.391	-3.262†	-3.448	-2.480	-2.196	-5.903‡	-3.944	-3.268	-2.938
Congo Democratic	-6.992‡	-3.485	-2.936	-2.585	-3.637‡	-3.046	-2.529	-2.307	-7.187‡	-4.133	-3.359	-3.089
Zimbabwe	-6.905‡	-3.244	-2.478	-2.222	-3.621‡	-2.742	-2.234	-2.020	-6.935‡	-3.563	-3.128	-2.834

(B) Group cross-sectional cointegration test

	GLS		MZT		Phillips-Perron	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
Mean	-5.884	0.000	-3.438	0.005	-6.743	0.000
Max	-7.316	0.000	-4.855	0.002	-8.001	0.000
Median	-6.204	0.000	-3.554	0.004	-7.017	0.000

Notes: In Panel (A), ‡, † and * refer to 1, 5 and 10% significance levels respectively. The results are based on 1000 re-drawings with replacement. In Panel (B), the p-values are reported in parentheses. The p-values in all cases are based on the 1000 re-drawings computed as the proportion of re-drawings for which the computed statistics (mean, median or maximum of the statistics for the cross-sections) is greater than the bootstrap statistics. IFFFF refers to the integer frequency of Enders and Lee (2012b).
Source: Author.

Table 9.: Bootstrap cointegration test with smooth structural shift and nonlinearity [the IFFFF-DF-type test (Enders-Lee, 2012b)]

Individual country's cross-sectional-dependence cointegration tests												
	GLS				MZT				Phillips-Perron			
	Statistic	1%	5%	10%	Statistic	1%	5%	10%	Statistic	1%	5%	10%
Burundi	-6.398‡	-3.825	-2.951	-2.545	-3.598‡	-3.105	-2.548	-2.289	-7.487‡	-4.192	-3.398	-3.084
Benin	-6.443‡	-3.460	-2.735	-2.454	-3.615‡	-3.108	-2.406	-2.203	-6.419‡	-3.680	-3.060	-2.768
Burkina Faso	-6.889‡	-3.421	-2.640	-2.329	-3.496‡	-2.822	-2.341	-2.118	-7.045‡	-4.156	-3.300	-2.918
Botswana	-6.659‡	-3.295	-2.584	-2.257	-3.629‡	-2.827	-2.378	-2.041	-6.605‡	-3.906	-3.324	-3.035
Central Africa Republic	-6.328‡	-3.697	-3.196	-2.865	-3.147‡	-2.998	-2.650	-2.441	-6.493‡	-4.563	-3.908	-3.569
Cote d'Ivoire	-5.913‡	-3.380	-2.736	-2.342	-3.563‡	-2.867	-2.401	-2.128	-6.826‡	-3.909	-3.320	-3.019
Congo	-5.860‡	-2.957	-2.251	-1.910	-3.486‡	-2.571	-2.068	-1.788	-7.492‡	-3.345	-2.851	-2.453
Gabon	-5.574‡	-3.450	-2.927	-2.602	-3.508‡	-2.976	-2.522	-2.303	-7.781‡	-4.167	-3.541	-3.257
Ghana	-3.625‡	-3.585	-2.860	-2.435	-2.538*	-4.067	-2.541	-2.199	-7.525‡	-4.252	-3.613	-3.324
Kenya	-5.484‡	-3.086	-2.408	-2.070	-3.432‡	-2.770	-2.173	-1.907	-6.333‡	-4.010	-3.104	-2.745
Lesotho	-4.011‡	-3.698	-2.722	-2.387	-2.891†	-3.268	-2.473	-2.188	-4.000‡	-3.997	-3.085	-2.794
Madagascar	-5.853‡	-3.298	-2.517	-2.238	-3.340‡	-3.026	-2.364	-2.082	-6.222‡	-3.868	-3.094	-2.771
Mauritius	-4.670‡	-3.232	-2.605	-2.232	-3.307‡	-3.088	-2.360	-2.055	-5.779‡	-3.666	-3.160	-2.808
Malawi	-6.630‡	-3.420	-2.960	-2.713	-3.609‡	-2.864	-2.560	-2.380	-7.164‡	-3.963	-3.427	-3.106
Nigeria	-6.801‡	-3.401	-2.785	-2.514	-3.608‡	-3.038	-2.454	-2.232	-6.834‡	-3.827	-3.233	-2.889
Niger	-7.312‡	-3.564	-2.855	-2.491	-3.636‡	-2.890	-2.491	-2.223	-7.870‡	-4.008	-3.414	-3.105
Rwanda	-3.124†	-3.524	-2.981	-2.771	-2.017	-2.887	-2.555	-2.410	-7.891‡	-4.203	-3.648	-3.331
[illegible]	[illegible]	-3.481	-2.549	-2.231	-3.557‡	[illegible]	-2.356	-2.038	-6.514‡	-3.861	-3.209	-2.848
Senegal	-3.04[illegible]	-3.500	-2.968	-2.552	-2.402†	-3.[illegible]73	-2.574	-2.279	-7.755‡	-3.904	-3.382	-3.037
Swaziland	-3.[illegible]5‡	-3.[illegible]95	-3.[illegible]66	-3.[illegible]31	-2.91[illegible]4	-4.[illegible]0	-3.[illegible]91	-3.[illegible]63	-6.[illegible]6‡	-4.[illegible]2	-3.[illegible]6	-3.[illegible]3
Chad	-5.[illegible]08‡	-3.[illegible]41	-2.[illegible]167	-2.[illegible]868	-5.6[illegible]	-4.[illegible]0	-3.[illegible]73	-2.[illegible]	-7.215‡	-3.[illegible]	-3.[illegible]	-3.[illegible]3
Togo	-7.491‡	-3.[illegible]0	-2.[illegible]8	-2.3[illegible]5	-3.[illegible]5	-3.[illegible]	-2.[illegible]	-2.[illegible]	-7.66[illegible]	-3.[illegible]	-3.[illegible]	-3.[illegible]5
Uganda	-7.121‡	-3.542	-2.882	-2.565	-3.620‡	-3.192	-2.583	-2.284	-7.076‡	-4.042	-3.376	-3.091
South Africa	-4.919‡	-3.595	-2.792	-2.439	-3.371†	-3.378	-2.509	-2.208	-6.089‡	-3.982	-3.410	-3.009
Congo Democratic	-7.440‡	-3.570	-2.882	-2.560	-3.628‡	-3.008	-2.529	-2.283	-7.465‡	-4.192	-3.450	-3.110
Zimbabwe	-6.833‡	-3.284	-2.483	-2.200	-3.624‡	-2.758	-2.229	-2.017	-6.791‡	-3.648	-3.113	-2.830

(B) Group cross-sectional cointegration test

	GLS		MZT		Phillips-Perron	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
Mean	-5.782	0.000	-3.413	0.005	-6.803	0.000
Max	-7.440	0.000	-5.625	0.001	-7.891	0.000
Median	-6.121	0.000	-3.532	0.004	-6.939	0.000

Notes: In Panel (A), ‡, † and * refer to 1, 5 and 10% significance levels respectively. The results are based on 1000 re-drawings with replacement. In Panel (B), the p-values are reported in parentheses. The p-values in all cases are based on the 1000 re-drawings computed as the proportion of re-drawings for which the computed statistics (mean, median or maximum of the statistics for the cross-sections) is greater than the bootstrap statistics. IFFFF refers to the integer frequency of Enders and Lee (2012b).
Source: Author.

Table 10.: Test for cointegration, break date estimation and long-run parameter estimation (Hatemi-J, 2008)

$$X_{it} = \sum_{j=1}^{3} a_j D_{j,it} + \sum_{j=1}^{3} b_j D_{j,it} M_{it} + e_{it}; D_{1,it} = 1$$

	ADF						Zt	Long-run parameter estimates					
	Statistics	k	Brk1	Brk2	Statistics	Brk1	Brk2	b1	pv1	b2	pv2	b3	pv3
BDI	-8.67‡	0	1976	1997	-8.75‡	1976	1997	-0.21	0.44	-0.18	0.11	0.05	0.26
BEN	-5.03	1	1992	2003	-4.58	1991	2005	0.47	0.00	0.82	0.01	0.40	0.08
BFA	-7.56‡	1	1987	2004	-7.13‡	1985	2005	0.22	0.00	0.24	0.04	1.47	0.00
BWA	-5.28	0	1975	1990	-5.34	1975	1990	0.32	0.07	-0.77	0.00	-0.31	0.07
CAF	-7.17‡	0	1993	2005	-7.23‡	1993	2005	0.62	0.00	0.86	0.00	-0.24	0.26
CIV	-6.88‡	0	1973	1986	-6.95‡	1973	1986	0.23	0.58	-0.80	0.01	1.09	0.00
COG	-7.19‡	2	1977	1997	-6.52£	1975	1996	-0.34	0.05	0.18	0.06	0.03	0.87
GAB	-5.76*	0	1979	1987	-5.80*	1979	1987	0.96	0.00	-0.58	0.05	-0.61	0.01
GHA	-6.59‡	0	1977	2006	-6.65‡	1977	2006	0.42	0.00	0.65	0.00	1.40	0.00
KEN	-4.70	4	1973	2001	-4.24	1983	1996	0.10	0.61	1.11	0.00	0.06	0.83
LSO	-7.13‡	0	1992	2001	-7.64‡	1993	2001	0.05	0.00	0.30	0.01	0.43	0.00
MDG	-5.30	3	1981	2004	-5.22	1982	2004	0.14	0.41	0.90	0.00	0.53	0.00
MRT	-5.05	2	1996	2005	-4.40	1971	1982	-2.60	0.00	-0.13	0.47	0.36	0.00
MWI	-5.10	0	1972	2002	-6.90‡	1977	2006	0.62	0.01	0.17	0.04	1.00	0.00
NER	-7.54‡	0	1976	1989	-7.61‡	1976	1989	0.42	0.00	0.31	0.00	0.21	0.00
NGA	-6.70‡	0	1988	2001	-6.77‡	1988	2001	0.61	0.03	0.13	0.65	0.76	0.00
RWA	-6.75‡	0	1986	2004	-6.81‡	1986	2004	0.32	0.00	-0.01	0.82	0.33	0.22
SDN	-5.94*	0	1978	1999	-6.20$	1977	1999	-0.25	0.31	0.41	0.00	0.63	0.00
SEN	-6.73‡	0	1979	1993	-6.79‡	1979	1993	0.67	0.00	0.51	0.00	0.01	0.87
SWZ	-5.17	2	1971	1993	-4.63	1968	1991	0.63	0.00	-0.05	0.53	0.95	0.00
[illegible]	-5.76[illegible]	0	1994	200[illegible]	-6.20†	1981	2001	0.25	0.27	0.33	0.12	-0.38	0.00
TG[illegible]	-9.3[illegible]‡	0	1969	198[illegible]	-10.11‡	1967	1988	0.46	0.68	0.20	0.02	0.40	0.00
UG[illegible]	-7.[illegible]7‡	0	198[illegible]	199[illegible]	-7.[illegible]‡	[illegible]981	1995	0.9[illegible]	0.0[illegible]	[illegible]	0.40	[illegible]	[illegible]
ZAF	-5.15	3	197[illegible]	199[illegible]	-4.[illegible]3	[illegible]976	1993	-0.10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ZAR	-6.79‡	[illegible]	1979	200[illegible]	-6.[illegible]	[illegible]	[illegible]	[illegible].86	[illegible]	0.9[illegible]	[illegible]	[illegible]	[illegible]
ZMB	-5.76*	0	1974	2006	-5.88*	1974	2005	-0.82	0.04	0.44	0.02	0.91	0.02

Notes: Critical values at 1%(‡), 5%(†) and 10%(*) for ADF and Zt:-6.503,-6.015,-5.653; b1, b2 and b3 represent the estimated cointegrating coefficients at the first, second and third regimes while pv1, pv2 and pv3 as the corresponding p-values. Brk1 and Brk2 refer to the break dates for each of the statistics employed

Source: Author.

4.6. Robustness check

The robustness check carried out in this section reevaluates some aspects of our results for consistency along the method of analysis, the estimation technique and the assumption regarding the frequency parameter used in the Fourier function. First, because our approach counters previous results by focusing on the existence of breaks in the data, we now put in perspective how our results compare with those obtained from a different modelling strategy that deals with structural breaks without factoring in cross-sectional dependence. To achieve this, we employ the Hatemi-J (2008) approach to

cointegration with two structural breaks. Hatemi-J (2008) develops this cointegration approach as an extension of the Gregory-Hansen (1996b) cointegration approach, which caters for only one break in the data. The results reported in Table 10. provide an estimate of the long-run cointegration coefficient for each regime, the estimated break dates as well as the computed cointegration test statistics. At 5 percent level of significance, the null of no cointegration under (two) structural breaks is rejected for14 of the 26 countries using the ADF test statistic, whereas it is rejected for 17 of the 26 countries using the Zt test statistic. The long-run coefficient estimates across regimes are based on the Zt test statistic. In other words, between 14 and 17 sub-Saharan African countries do not violate their intertemporal budget constraints. This can be seen to align largely with the previous results especially those emanating from Narayan and Narayan (2005) and Razafimahefa and Hamori (2007). Our take on this result is that the dummy-variable approach to estimating structural breaks may not be able to capture all the structural breaks that occur in the data but only the significant ones. However, in the presence of many non-significant structural breaks, it may not be an adequate approach to deal with unknown number and functional forms of such breaks. That is where smooth structural shifts captured through the Fourier function may well outperform the dummy-variable approach. However, before concluding on the praises of the smooth structural shifts, its evaluation is in order particularly with respect to the integer frequency assumption underlying our analysis.

Although our analysis has avoided over-filtration by focusing on single component frequency, the assumption of integer frequency, fixed at 1 (the value known to provide good approximation of structural change (Omay, 2015)) but also examined for value of 2 [illegible] is not entirely defensible. As part of the robustness check, therefore, we employ the FFFFF-type unit root test of Omay (2015) exposited in Subsection 3.3. Tables 11. and 12. report the results for nonlinear unit root with functional form structural breaks using the FFFFF-DF type. Each country allows different fractional frequency but the results do not deviate too much from those reported in Tables 9. and 10. respectively for the integer frequency as all the countries reject the null of no cointegration as before. Lastly, while estimating Eq. (3) using OLS, we recognize the effectual implications of the regressors not being strictly exogenous, a possibility with greater tendency to hold true in the relationship under study. The presence of endogeneity is known to distract from the estimated parameters and consequently from the inferences because the estimation of the cointegration vector is no longer efficient as the limiting distribution depends on nuisance parameters (Carrion-i-Silvestre and Sansó, 2006). Thus, we employ two estimators that tackle the problem of endogeneity inherent in OLS, namely, the dynamic OLS (DOLS) (Saikkonen, 1992) and (Stock and Watson, 1993) and the fully modified OLS (FMOLS) (Phillips and Hansen, 1990), which differ in the way they solve the endogeneity problem but are asymptotically similar in their limiting distributions. The results[1] largely mirror those reported in this paper for OLS.

1 The DOLS and FMOLS results are not reported to conserve space but are available on request.

Table 11.: Bootstrap cointegration test with smooth structural shift [the FFFFF-DF-type test (Omay, 2015)]

Individual country's cross-sectional-dependence cointegration tests													
		GLS				MZT				Phillips-Perron			
	k	Statistic	1%	5%	10%	Statistic	1%	5%	10%	Statistic	1%	5%	10%
Burundi	1.1	-3.037†	-3.725	-2.877	-2.551	-2.424*	-3.026	-2.522	-2.283	-7.748‡	-4.062	-3.476	-3.112
Benin	1.2	-6.435‡	-3.547	-2.778	-2.415	-3.609‡	-3.332	-2.474	-2.219	-6.566‡	‡-3.699	-3.181	-2.844
Burkina Faso	0.8	-6.934‡	-3.283	-2.539	-2.198	-3.525‡	-2.731	-2.288	-2.022	-7.278‡	-3.998	-3.296	-2.806
Botswana	1.4	-7.028‡	-2.986	-2.224	-1.856	-3.583‡	-2.568	-2.020	-1.719	-7.055‡	-4.099	-3.248	-2.971
Central Africa Republic	1.9	-6.092‡	-3.872	-3.033	-2.748	-3.094‡	-3.060	-2.581	-2.362	-6.384‡	-4.595	-3.903	-3.534
Cote d'Ivoire	1.1	-6.009‡	-3.726	-2.868	-2.447	-3.573‡	-3.167	-2.524	-2.220	-7.277‡	-4.163	-3.405	-3.083
Congo	0.5	-5.898‡	-3.024	-2.364	-2.078	-3.552‡	-2.825	-2.139	-1.917	-6.887‡	-3.348	-2.907	-2.579
Gabon	1.9	-5.626‡	-3.414	-2.909	-2.514	-3.514‡	-2.821	-2.507	-2.236	-7.432‡	-4.053	-3.488	-3.225
Ghana	1.1	-7.175‡	-3.516	-2.831	-2.461	-3.542‡	-3.953	-2.467	-2.197	-7.524‡	-4.155	-3.578	-3.317
Kenya	0.1	-5.794‡	-3.102	-2.373	-1.980	-3.505‡	-2.601	-2.149	-1.821	-6.091‡	-3.804	-3.128	-2.749
Lesotho	1.2	-4.243‡	-3.467	-2.723	-2.367	-3.025‡	-3.259	-2.456	-2.159	-4.375‡	-3.711	-3.092	-2.746
Madagascar	1.9	-6.077‡	-3.239	-2.650	-2.334	-3.464‡	-3.031	-2.410	-2.163	-6.121‡	-3.687	-3.150	-2.854
Mauritius	1.9	-4.447‡	-3.282	-2.538	-2.183	-3.235†	-3.348	-2.313	-2.025	-5.855‡	-3.592	-3.079	-2.767
Malawi	1.6	-6.852‡	-3.518	-2.948	-2.619	-3.552‡	-2.971	-2.528	-2.315	-6.816‡	-4.134	-3.529	-3.158
Nigeria	1.1	-6.945‡	-3.463	-2.773	-2.402	-3.602‡	-3.047	-2.425	-2.165	-6.942‡	-4.059	-3.207	-2.900
Niger	0.8	-7.012‡	-3.444	-2.517	-2.172	-3.636‡	-2.813	-2.235	-1.977	-7.530‡	-3.718	-3.144	-2.797
Rwanda	1.5	-5.773‡	-3.402	-3.033	-2.805	-3.536‡	-2.805	-2.566	-2.431	-7.567‡	-4.108	-3.461	-3.272
Sudan	1.2	-6.688‡	-2.994	-2.222	-1.767	-3.628‡	-2.722	-2.031	-1.631	-6.979‡	-4.222	-3.200	-2.653
[illegible]	[illegible]	[illegible]	-3.309	[illegible]	-2.496	-3.292	[illegible]922	-2.466	-2.240	-8.002‡	-3.946	-3.308	-3.005
Swaziland	1.8	-4.765‡	-3.125	-2.442	-2.167	-3.017‡	[illegible]110	-2.326	-2.033	-5.281‡	-3.385	-2.833	-2.530
Chad	0.8	-6.127‡	-3.736	-3.0[illegible]	-2.[illegible]	-5.[illegible]	[illegible]040	[illegible]	[illegible]	-5.[illegible]	-3.[illegible]	-3.[illegible]	-2.[illegible]
Togo	1.2	-5.953‡	-3.45[illegible]	-2.7[illegible]	-2.[illegible]	-3.[illegible]95‡	[illegible]307	-2.530	[illegible]	-7.0[illegible]	[illegible]	-3.[illegible]	-2.[illegible]
Uganda	1.9	-6.904‡	-3.04[illegible]	-2.[illegible]	-2.[illegible]	-3.[illegible]	[illegible]751	-2.218	[illegible]	-5.824‡	[illegible]	-3.[illegible]	-2.[illegible]
South Africa	1.9	-4.470‡	-3.407	-2.685	-2.400	-3.222‡	-2.993	-2.405	-2.159	-6.078‡	-3.929	-3.319	-2.973
Congo Democratic	1.5	-6.719‡	-3.487	-2.830	-2.536	-3.613‡	-2.879	-2.518	-2.261	-7.997‡	-3.866	-3.310	-3.041
Zimbabwe	0.8	-7.168‡	-2.772	-2.231	-1.939	-3.640‡	-2.454	-2.035	-1.786	-7.128‡	-3.293	-2.809	-2.558
Group cross-sectional cointegration test													
		GLS				MZT				Phillips-Perron			
Mean		-5.851	0.000			-3.436	0.004			-6.817	0.000		
Max		-7.389	0.000			-5.380	0.001			-8.286	0.000		
Median		-5.967	0.000			-3.547	0.003			-6.933	0.000		

Notes: In Panel (A), ‡, † and * refer to 1, 5 and 10 % significance levels respectively. The results are based on 1000 re-drawings with replacement. In Panel (B), the p-values are reported in parentheses. The p-values in all cases are based on the 1000 re-drawings computed as the proportion of re-drawings for which the computed statistics (mean, median or maximum of the statistics for the cross-sections) *is greater than the bootstrap statistics. FFFFF refers to the fractional frequency flexible Fourier form of Omay (2015) and k is the estimated fractional frequency.*
Source: Author.

Table 12.: Bootstrap cointegration test with smooth structural shift and nonlinearity [the FFFFF-DF-type test (Omay, 2015)]

Individual country's cross-sectional-dependence cointegration tests													
		GLS				MZT				Phillips-Perron			
	k	Statistic	1%	5%	10%	Statistic	1%	5%	10%	Statistic	1%	5%	10%
Burundi	1.1	-6.010‡	-3.597	-2.909	-2.576	-3.553‡	-3.026	-2.536	-2.330	-7.596‡	-4.178	-3.436	-3.098
Benin	1.2	-6.377‡	-3.530	-2.879	-2.470	-3.606‡	-3.195	-2.554	-2.235	-6.415‡	-4.028	-3.168	-2.873
Burkina Faso	0.8	-6.923‡	-3.254	-2.545	-2.184	-3.524‡	-2.743	-2.299	-2.021	-7.284‡	-4.090	-3.291	-2.782
Botswana	1.3	-7.248‡	-3.031	-2.013	-1.635	-3.634‡	-2.608	-1.865	-1.530	-7.279‡	-3.935	-3.223	-2.930
Central Africa Republic	1.9	-5.785‡	-3.680	-3.029	-2.694	-2.974‡	-2.912	-2.561	-2.308	-5.917‡	-4.626	-3.888	-3.544
Cote d'Ivoire	1.0	-5.913‡	-3.380	-2.736	-2.342	-3.563‡	-2.867	-2.401	-2.128	-6.826‡	-3.909	-3.320	-3.019
Congo	0.5	-5.906‡	-2.946	-2.399	-2.086	-3.553‡	-2.789	-2.169	-1.922	-6.875‡	-3.337	-2.905	-2.591
Gabon	1.9	-5.638‡	-3.425	-2.862	-2.511	-3.517‡	-2.846	-2.492	-2.227	-7.421‡	-4.023	-3.506	-3.202
Ghana	1.1	-7.116‡	-3.520	-2.855	-2.473	-3.541†	-3.662	-2.508	-2.218	-7.516‡	-4.153	-3.594	-3.330
Kenya	0.1	-5.818‡	-3.044	-2.356	-1.998	-3.505‡	-2.596	-2.129	-1.851	-6.056‡	-3.696	-3.101	-2.736
Lesotho	1.2	-4.176‡	-3.461	-2.716	-2.370	-3.004†	-3.323	-2.429	-2.149	-4.332‡	-3.794	-3.090	-2.762
Madagascar	1.9	-5.889‡	-3.331	-2.633	-2.291	-3.463‡	-2.990	-2.411	-2.108	-6.338‡	-3.656	-3.101	-2.827
Mauritius	1.9	-4.495‡	-3.258	-2.514	-2.168	-3.252‡	-3.194	-2.338	-1.982	-5.734‡	-3.569	-3.042	-2.703
Malawi	1.6	-6.979‡	-3.537	-2.965	-2.643	-3.579‡	-2.968	-2.553	-2.332	-6.991‡	-4.183	-3.570	-3.208
Nigeria	1.1	-6.896‡	-3.457	-2.733	-2.428	-3.600‡	-2.790	-2.404	-2.187	-6.858‡	-3.802	-3.227	-2.913
Niger	0.8	-7.389‡	-3.215	-2.608	-2.270	-3.636‡	-2.881	-2.313	-2.050	-7.718‡	-4.033	-3.190	-2.874
Rwanda	1.5	-2.221	-3.500	-3.053	-2.821	-1.697	-2.841	-2.586	-2.449	-7.804‡	-4.304	-3.524	-3.294
Sudan	1.3	-6.127‡	-2.905	-1.846	-1.480	-3.586‡	-2.514	-1.770	-1.368	-6.640‡	-3.858	-2.942	-2.546
[illegible]	[illegible]	[illegible]	-3.352	[illegible]	-2.507	-2.475*	[illegible]085	-2.500	-2.241	-7.714‡	-3.895	-3.298	-2.992
Swaziland	0.8	-2.046	-3.181	-2.441	-2.188	-2.977†	[illegible]196	-2.336	-2.037	-5.198‡	-3.350	-2.841	-2.551
Chad	1.8	-6.695‡	-3.[illegible]	-3.[illegible]	-2.[illegible]	-3.[illegible]	-2.911	-2.[illegible]	-2.[illegible]	-7.[illegible]	-3.[illegible]	-3.[illegible]	-2.[illegible]8
Togo	[illegible]	-5.925‡	-3.4[illegible]	-2.7[illegible]	-2.[illegible]	-3.[illegible]0‡	-2.926	-2.482	-2.[illegible]	-7.1[illegible]	-3.[illegible]	-3.[illegible]	-2.[illegible]1
Uganda	[illegible]	-6.604‡	-3.1[illegible]	-2.[illegible]	-2.[illegible]	-3.[illegible]7‡	-2.644	-2.187	-1.[illegible]	-8.280‡	-4.[illegible]	-3.[illegible]	-2.[illegible]5
South Africa	1.9	-4.898‡	-3.594	-2.738	-2.431	-3.354‡	-3.151	-2.402	-2.182	-6.401‡	-3.955	-3.374	-2.976
Congo Democratic	1.6	-6.672‡	-3.554	-2.763	-2.445	-3.615‡	-2.893	-2.398	-2.202	-7.253‡	-3.786	-3.233	-2.930
Zimbabwe	0.8	-7.150‡	-2.859	-2.254	-1.928	-3.640‡	-2.504	-2.046	-1.775	-7.138‡	-3.280	-2.802	-2.574
Group cross-sectional cointegration test													
		GLS				MZT				Phillips-Perron			
Mean		-5.851	0.000			-3.436	0.004			-6.817	0.000		
Max		-7.389	0.000			-5.380	0.001			-8.286	0.000		
Median		-5.967	0.000			-3.547	0.003			-6.933	0.000		

Notes: In Panel (A), ‡, † and * refer to 1, 5 and 10 % significance levels respectively. The results are based on 1000 re-drawings with replacement. In Panel (B), the p-values are reported in parentheses. The p-values in all cases are based on the 1000 re-drawings computed as the proportion of re-drawings for which the computed statistics (mean, median or maximum of the statistics for the cross-sections) *is greater than the bootstrap statistics. FFFFF refers to the fractional frequency flexible Fourier form of Omay (2015) and k is the estimated fractional frequency.*
Source: Author.

4.7. Comparison to existing findings on SSA

The existing studies have a consensus that many sub-Saharan African countries have strong propensity to violate their intertemporal budget constraints. By dint of these consensus findings, the sub-region is deemed not creditworthy as lack of sustainability implies inability to forestall sovereign default individually when the difference between imports and exports begins to explode. Take for instance the findings that only 6 countries of 22 SSA countries investigated in Narayan and Narayan (2005) or 5 of the 9 SSA countries investigated in Arize (2002) exhibit cointegration. Although these studies test and establish parameter stability for the countries exhibiting cointegration between imports and exports, the findings from the present paper clearly show that if parameter instability or structural breaks are directly modelled as an inherent feature of the data generating process, many more SSA countries, erstwhile wrongfully classified as not having tendency to rein in on the difference between imports and exports, may well exhibit mean-reversion in their trade balance. In other words, the previous studies, including Arize (2002), Narayan and Narayan (2005) and Razafimahefa and Hamori (2007), fail to accommodate structural breaks or nonlinearity, which are now established to be present in the data generating process for the SSA countries. Failure to accommodate these features makes previous studies inadequate to tackle convincingly the issue of current account sustainability in the sub-region. As the present findings show, however, there is no inherent tendency in the sub-region for budget constraint violations. Rather, the violations are a short-run response to factors that modulate the structures of the trade balance in these economies. Thus unlike the previous studies, our findings suggest that unsustainable current accounts can be reoriented by stabilizing the policy environments and restructuring framework that minimizes policy shifts and arbitrariness.

5. CONCLUSION

In this paper we have examined the sustainability of current accounts in the presence of three phenomena: cross-sectional dependence (or correlation) among the sub-Saharan African countries, structural breaks and nonlinearity, having formally detected the presence of these problems in the data. As the previous studies have failed to account for all these problems *together*, and given that these problems are inalienable stylized facts in the data often used, the present study presents more robust results than have emerged from the previous studies. The previous studies have come to the conclusion that many countries in the sub-Saharan Africa do not experience sustainable current accounts, the findings suggesting among other implications that these countries are not potentially credit-worthy as they will violate their intertemporal budget constraints. It thus means that development may well be funded mainly through domestic resources (in case fiscal sustainability is equally es-

tablished). In this study we have established that this may not be an inherent feature of the data but rather a consequence of unexpected and arbitrary shifts or breaks attributable to policy summersaults and socio-economic upheavals in the sub-region as well as precariously changing global environment.

We submit that the influence of structural breaks and to some degree of non-linearity in the attainment of sustainable current accounts in most countries in sub-Saharan Africa especially those studied in the paper points to the necessity of keeping the rein on arbitrary policy shifts capable of destabilizing the macroeconomic environment.

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REVERSE LOGISTICS AND MANAGEMENT OF WASTE PRODUCTS: THE NIGERIAN MANUFACTURING FIRMS EXPERIENCE

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ABSTRACT

Purpose. *The paper explores reverse logistics activities such as product return, reuse of materials, and waste disposal impacts on the management of waste products in the Nigerian manufacturing companies. This is with a view to examining the awareness of reverse logistics to the management of waste products in Nigeria and determines the importance of reverse logistics activities and process to the management of waste products of Nigeria manufacturing firms.*

Methodology. *Using a cross-sectional survey research design, 300 staff of selected manufacturing firms that deal with waste product were selected in Lagos and a well-structured and validated questionnaire was administered. From this, 250 copies were returned, while 246 were valid for the purpose of analysis. Data generated were analysed using descriptive statistics, analysis of variance test of significance and Friedman rank test.*

Findings and Implication. *The findings revealed that the respondents convinced that their reverse logistics activities arising from return of goods may be as very important to developing efficient and effective management of waste products of Nigeria manufacturing firms. The results also indicates that reverse logistics is highly significant in achieving the organizational goals ($p < 0.05$), company's future success ($F = 8.18$, $p < 0.05$), the functioning of a manufacturing company ($p < 0.05$) and strategically positioning the company. The study therefore recommends the need for a growing focus on various sections of reverse logistics processes in waste products' management of manufacturing company in order to achieve organisational goal and enhances sustainable business performance.*

1. INTRODUCTION

The importance of good environment cannot be overemphasized as it contributes to the healthy living of the people in any society. Nigeria as a developing country cannot be an exception to the green environment campaign globally since it is an advocacy for ensuring healthy living for people. Waste, on the other hand, is inevitable wherever human and material resources interact or where human being uses material resources. However, the need to live in a clean and healthy environment is *sine qua non* for an average citizen in the country.

Manufacturing companies transport goods to their customers through various modes (air, land, rail and water). Implied in the movement of goods from one place to another is an economic activities aimed at satisfying human needs and wants profitably. Oftentimes, they dome firms do not give consideration to the backward movement of goods otherwise known as "reverse logistics". This may be due to the fact that the returns would stand for substantial cost, rather than profit. A few chief executives even consider return as a major failure of their system (Dowlatshahi, 2000; Meyer, 1999).

As a process, reverse logistics has to do with companies becoming more conscious and committed to the environment, especially in the way they engaged in recycling, reusing and cutting down on the number of material used. Taken together, reverse logistics means reducing materials in forward system such that few materials flow-back; there is this possibility of the reuse of materials and the facilitation of recycling. The steps taken to reduce waste in the environment start from the product design phase and cover the entire product life cycle. In turn, this will make for the minimization of downstream waste and giving rooms for product to go backwards along the business chain for product remanufacture, reuse and resale to market.

In Nigeria, most manufacturing companies focus essentially on the sales of products to the final consumer. Primarily, they do this from an opinion that after the sales or use of product, responsibilities are taken-off these companies or manufacturers on the return of the product. In most cases, the used products are discarded thereby causing harmful effects to the environment. The used products were either discarded or destroyed causing negative effects to the environment. Evident and common in this regard are sachet, plastics water, bottles/can drinks which are common to most Nigerian as well as other industrial products.

In this 21st century, it is not enough for organizations to engage in marketing but more importantly, societal marketing is good for both the organization and all its stakeholders in which the reverse logistic framework preaches. There is need to encourage our companies or manufacturers to develop environmentally friendly products with their consumers, therefore companies should be more involved in collecting, dismantling and upgrading used products and packages materials. If there are more advanced systems and processes, goods returned can be recorded and properly

managed. Even so, they can be put for sale at liquidation centers. Alternatively, the goods can be broken down into different major parts, which can possibly lead to the cutting down of costs, increase in profit and improvement of consumer service.

Reverse logistics processes are not part of the core processes of companies that are still starting up a reverse chain, and therefore the necessary capabilities are yet to be acquired and developed. In order to develop these capabilities, one must first know which capabilities are of importance to the reverse activities. Furthermore, companies that want to gather these specific reverse logistics capabilities, need to invest resources, in learning is important as well as a commitment to learning which will foster a learning orientation within the company (Normann, 1985).

When there is an atmosphere of knowledge building and sharing, the company will more easily to build capabilities. As a result, learning will have an impact on the company's ability to acquire and develop capabilities and will have an effect on the reverse logistics activities. To realize the goal of sustainable development in organizations especially manufacturing companies that focus on the environmental and economic goals, there is a necessity for the implementation of reverse logistics (Dowlatshahi, 2010).

Lau and Wang (2009) posited that engaging in reverse logistics can help reduce waste and increase profit through an effective recycling process in the developing countries. Furthermore, the increase in awareness on environmental issues and the benefit of recycling places more pressure on firms to create a better reverse logistics strategy. Leite (2009) made the assertion that in order to have a good goodwill among their customers or corporate citizenship, it is essential for the firms to abide by the extant regulations and emphasize the protecting of the environment.

In view of the above analysis, this study aims at examining the impact of reverse logistics on the Management of Waste Products in selected Nigerian Manufacturing Companies. While the specific objectives are to;

(1) examine the awareness of reverse logistics to the management of waste products in Nigeria

(2) examine the importance of reverse logistics activities and process to the management of waste products of Nigeria manufacturing firms.

(3) determine the challenges of reverse logistics on the management of waste products for Nigeria manufacturing firms

(4) evaluate the impact of reverse logistics in managing waste products in the Nigerian Manufacturing Companies.

The remainder of this paper is structured as follows: Section 2 defining forward and reverse logistics, its major differences, its importance and summaries of relevant works on reverse logistics; Section 3 describes the methodology used. Succeeding this is the data analysis and discussion of results in Section 4 and lastly, Section

5 discusses the conclusion based on the findings from the study. Recommendations were made for policy implications.

2. LITERATURE REVIEW

The literature review focuses on issues relating to reverse logistics and management of waste products.

2.1.Definition of forward logistics and its difference to reverse logistics

Stock (1992) defines logistics as the capacity to manage materials from where they originate to the point of consumption. Tibben-Lembke and Rogers (2002) later expanded this definition as management of information flow and not only the management of physical flow. This process of direct logistics has been widely regarded as Forward Logistics. Also, there is what is regarded as reverse logistics process. This process is similar to forward logistics process, only that it is concerned with movement of materials from the point of consumption to the point of origin where product are been produced. This reverse order flow is what has be regarded Reverse Logistics.

The known areas of dissimilarities between forward and reverse logistics can be found in high cost and complexity of reverse logistics. Da, Hua & Zhang, (2004) and Parvenov (2005), identified popular issues connected to reverse logistics such as:

- Operating with a small or sub-standard and warehouse facilities;
- Uncertainty in the recovery system; and
- Inability of tracking incoming merchandise, which does not allow for cross docking;

Additionally, the poor method of placing products into a warehouse hinders the possibility of returned merchandise to be adequately allocated and shipped. Other factors include;

- High cost of setting up the reverse logistics process to aid the repackaging of returned goods for resale;
- Cost of disposing of unserviceable items and others;

Usually, these are the challenges of reverse logistics. However, these problems can be surmounted and converted to competitive advantage, if there is an efficient reverse logistic system (Ravi & Shankar, 2005; Bernon & Cullen, 2007).

2.2. Definitions of reverse logistics

Over the years, the concept of reverse logistics has continued to change. In the 1980s, it was taken to be the movement goods from the consumer to the producer through a recognized distribution channel. However, in the 1990s, new approaches to conceiving the concept were initiated by other scholars (Stock, 1992; Carter & Ell-

ram, 1998). In their new approaches, reverse logistics was projected as the returned materials focusing not only on technical and economic benefits, but environmental efficiency as well. In their approach, the interest on environmental efficiency is to guarantee the right consumption by reusing and recycling of industrial goods.

Reverse Logistics (RL) or Reverse Distribution (RD) is defined as "the logistics management skills and activities involved in reducing, managing, and disposing of hazardous waste from packaging and products." It includes reverse distribution, which causes goods and information to flow in the opposite direction from normal logistic activities (Kroon & Vrijens, 1995; Pohlen & Farris, 1992).

The Council of Management (CLM) defines reverse logistics as "the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal" (Rogers & Tibben-Lembke, 1998).

Subsequently, Stock and Lambert (2001) revealed that reverse logistics is the area of business logistics concerned with adding economic and environmental values to industrial goods so as to enable the reintegration of product lifecycle as secondary materials. Also reverse logistics is seen as the movement of goods and services in a contrary position in the supply chain, for the purpose of enabling proper disposal. This process usually involves the processing of returned merchandise caused by damage, restocking, seasonal inventory, salvage recalls and excess inventory. It is also involves packaging and shipment materials from the consumer to the seller. A process like this would involve recycling programs, hazardous material programs and disposition of obsolete material and asset repossession (Rogers & Tibben-Lembke, 2001). According to Kleindorfer, Singhal, Van and Luk (2005), reverse logistics involves re-use and recovery of products, so as to limit the negative effects on the environment and waste disposal.

2.3. Importance of reverse logistics

Reverse logistics as important environmental dimensions and a few aspects dealing with value reclamation (Carter & Ellram, 1998). Reverse logistics can be of immense value in remanufacturing, repair, reconfiguration and recycling, which can translate to profitable business opportunities (Giunti & Andel, 1995; South, 1998). Reverse logistics also affords firms a huge opportunity to distinguish their roles from that of customers, and indicates how the handling of a company` s returns is often assessed by customers as an important consideration, when a future purchase takes place (Daugherty, Myers, & Richey, 2002). To these scholars, a well-planned reverse logistic system can promote long-lasting relationship for mutual benefits (satisfying needs of consumers and profit for the producers). In like manner, customers are more likely to patronise retailers who perform above other retailers on the handling of returns.

Essentially, logistics is major factor that enhances a company`s achievements in different as aspects of business. It is widely acknowledged that reverse logistics plays a key role in a company`s performance and customer relations (Daugherty, Richey, Genchev & Chen, 2005). However, as pointed out by Autry, Daugherty and Richey (2001), it is often under-considered as a strategic option firms to gain economic and environmental benefits, with its strategic value neglected. Businesses' reluctance in executing reverse logistics program can be attributed the following:

The traditional preoccupation of companies with limited logistics and the tendency to hide inventory mistakes are pointed out as potential factors that can hinder a company from committing substantial resources to reverse logistics. Another factor is inability to recognise areas where there are potential benefits (Daugherty *et al.*, 2001; Saccomano, 1997).

Moreover, Richey, Stefan and Patricia (2005) stated that physical process usually requires "a series of intricate multilayered steps" involving raising returns authorization, printing label, determining appropriate product handling and disposition, and organising transportation.

The unwillingness to commit resources to returns in the chain of supply gives rise to opportunity for the companies to establish their business strategies. In regard to this, Stock, Speh, & Shear (2002) reason that though reverse logistics is often viewed as "costly sideshow" to the regular business operations, it should receive much more awareness than it is now. It is also proposed that reverse logistics should "be seen as an opportunity to build competitive advantage".

Similarly, Richey, *et al.* (2005) advised companies to strengthen their competiveness through operational performance and financial benefits gained from commitment of more resources to reverse logistics. Moore (2005) avers that many benefits can be derived from effective an effective logistic program. Such benefits include: reuse or packaging, reduction of excess inventory of raw materials and old equipment disposal.

2.4. Waste Management

Waste management decisions that dwell on matters that need urgent attention and matters that may arise that and needs strategic planning and implementation. Setting up and making facilities to run efficiently to enable collection, recycling, treatment and disposal of waste local communities can be quite expensive. For instance, it requires large financial investments, considerable operation and maintenance cost to run sanitary landfills and incinerator plants. Thus, community solid waste management can be very costly but not avoidable. For example, building and operating sanitary landfills and incineration plants require huge investments and incur substantial operation and maintenance costs. Companies are hereby advised to adopt and integrate waste management that emphasizes prevention, reduction,

and recycling of waste. As this is better than authorities having to meet-up with the demand of managing the increase number of waste through method of treatment and disposal. By way of the state resources that could be used for other equally important citizen welfare activities (education, health and security) not to be wasted (Manual, 2010). When applied, the financial burden of cities in the management of waste will be reduce, likewise the demand on landfill requirements. In our world today, resources are scarce. There are limited natural resources from raw materials. Same way, financial resources are often not enough. There is also difficulty of getting land for waste disposal especially in urban setting like Lagos, Nigeria. In light of these, man must think of alternative procedures for managing waste. Authorities in cities are enjoined to generate and implement policies that take care of resources efficiently and remanufacturing if need be. This is necessary in order to provide a clean and safe environment for their citizens and future generations.

In short, the best practices for waste minimization are by waste avoidance, waste recycling, waste treatment and waste disposal. Similarly, the key principles governing hazardous waste disposal are polluter pays, the duty of care, avoidance and minimization and best practicable environmental option (Chandak, 2005).

2.5. Empirical review on reverse logistics

Early researchers on reverse logistics appear to focus more on an extensive view. Many works of researchers engaged in the whole process of reverse flow. Krupp (1993) for instance, looked at bill-of-materials (BOM) restructuring and the development of bills of material to serve challenges of remanufacturing. Suggested in Krupp`s study is sale forecasting, which, to him, has to be constructed to show the uncertainty and variety of core returns for both old and net parts. Usually, after the sales of products to consumers, manufacturers are no longer responsible for products. Most products dump causing damage to the environment. Now, consumers and government authorities hope that manufacturers would reduce the wastes that are derived from their products. In this 21st century, waste disposal and management are beginning to gain substantial attention. Emphasis is now placed on recovery, due to high cost and burdens that come with disposal. Firms are now more involved in collecting and dismantling and upgrading of waste products and packaging of materials (RevLog, 1998).

Furthermore, Webb (1994) drew attention to the idea of "green movement". He pointed out that environmental concerns have in determining the direction of activities of reverse logistics; such activities as packaging regulation and customer preferences are few of the reverse logistics activities that deal with environmental considerations.

A few other studies focused on reverse logistics, particularly issues regarding transportation, distribution and inventory management. Similarly, others like White (1994) accounted for the relevance of reverse logistics for handling of material. To

him, these consist of moving, storing, protecting and controlling materials. In addition, he noted that protection is key to handling material system. On the other hand, Dave (1995) considered return management as the most reliable way of differentiating consumer service and firm` s competitive advantage. Following this he posited that most required re-engineering factors are return process and warehouse operations. On their part, Fuller & Allen (1996) assert that waste is an indispensable by-product of resource-conversion processes in any economy searching for success. As one of the programs that compliment sustainable development, efforts have been made to recycle waste. To aid this endeavour, systematic procedure of using information is very important. This will enable the development of reverse channels for recycling materials and lobbying efforts to support the passage of recycling bill in a nation.

Some scholars consider reverse logistics as practical quantitative models especially that of Clegg, Williams and Uzsoy (1995), came up with a linear programming model. They did this so as to ascertain the effects of recycling and remanufacturing on the operation of manufacturing firms. Further, they advised firms to apply this in analyzing the viability of parts recovered during operations involving remanufacturing.

In the above, there exist a range of quantitative models that have been developed by scholars (Fleischmann *et al.*, 1997; Guide Jr, Srivastava, & Spencer, 1996; Kroon & Vrijens, 1995). The developed models can be deployed to various kinds of logistics practices, like extension of product life cycle, protecting product and so on. Also, it is important to note that the application of reverse logistics is another area of logistic that is popular other developed and developing nations. Kroon and Vrijens, (1995) averred that "a change in attitude towards the environment is an absolute necessity". On this basis, they suggested a whole process of "collection, recycling and reuse of products and materials".

Cespón, Castro and Lundquist (2009) identified a generic configuration of reverse logistic strategies in manufacturing companies from the Cuban central area. As a result, their research detected the existence of three generic reverse logistic strategies which are: recapturing value, environmental and commercial strategies.in which other manufacturing companies in other countries can adopt.

Starostka-Patyk and Grabara (2010) proposed an elaborated descriptive model of reverse logistics processes in enterprises managing industrial waste. The work was carried out in Poland in Silesia region on six different enterprises managing industrial waste, this particular model is based on reverse logistics literature studies and practical activities of waste management in enterprises managing industrial waste. Both scholars, in their paper presented a much-cleared role of reverse logistics processes in enterprises managing industrial waste. It revealed fascinating connection between logistics and waste, as well as an interesting element of sustainable development conception for achieving ecological goals.

Kinobe, Gebresenbet, and Vinneras (2012) reviewed a paper stating the procedure of reverse logistics and the present state of waste management in developing

countries using Uganda as their case study. They found out that in a relative sense, reverse logistics is a new area of research, dealing with condemned goods and recollection of products for onward return to manufacturers. It is practise generally in developed economies, than in developing ones. This is due to the fact that in developing countries, value is hardly placed on reverse products.

In the work of Silva, Reno, Sevegnani, Sevegnani and Truzzi (2013), they discussed reverse logistics, and in the process, accounted for a packaging strategy that will help to minimize waste generation and boost the competitive status of the firm they considered by managing cost and resource consumption and reducing the effects of waste products on the environment. The methods created helped to engender protection of products exported and reduce the generation of waste by consumers. In terms of environmental impact, the most reliable model was the returnable packaging. This is in view of the fact that it has a reduced environmental impacts, especially when placed side-by-side with disposal packaging model. As a model, reverse logistics has proven to be beneficial because it of impacts on technical, economic and environmental aspect of business sustainability.

A study that was carried out in Kenya by Kariuki & Waiganjo (2014) evaluated the factors affecting the implementation of reverse logistics in manufacturing businesses in Kenya. The study revealed legislation, economics, corporate citizenship and collaboration among supply chain partners are factors that can hinder the implementation of reverse logistics in manufacturing companies in Kenya. The study concluded that organizations that want to practice reverse logistics should put these identified factors into consideration so as to ensure organizational success.

Tepprasit and Yuvanont (2014) examined the different impacts of logistics management and how effective they can be, using the electronic industry in Thailand as a case study. In doing so, this study applies a mixed method of qualitative and quantitative research. Twenty directors were interviewed at different popular manufacturing firms. The questions focused on five basic elements of logistic management: - product design and choice of materials; transportation and movement; manufacturing; packaging; and communication. These five elements were studied in relation to their impacts on reverse logistics. In their investigation, they initiated a method that is entirely different from the traditional theory, highlighting the fact business environment in Thailand is more complex than many other countries. The results of their investigation turn out to be relevant to managers in the electronic manufacturing industry, because they aid in mapping out areas of relevance that can make them uplift the standard of logistic management in their various companies.

In light of this review, researchers are motivated then embarked on this work since studies have been done on reverse logistics in various aspects in developing and developed countries but there is limited or rarity of studies on reverse logistics in countries like Nigeria. This study sets out to investigate the reverse logistics practices on waste products of manufacturing companies in Nigeria.

3. METHODOLOGY

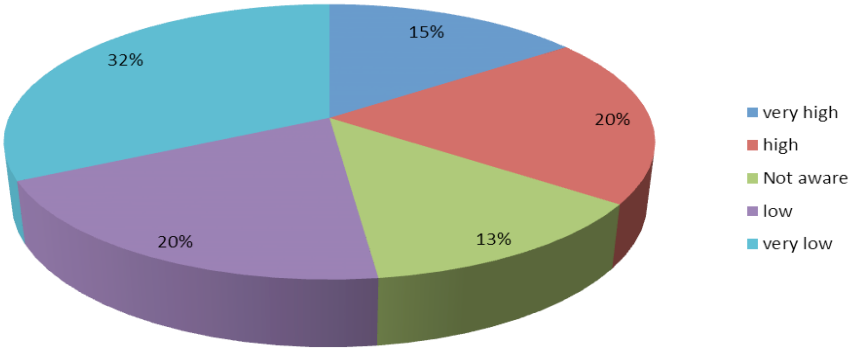
This study used a cross-sectional research design which will allow the researcher to investigate reverse logistics and companies' management of waste products. This study covers manufacturing firms in Nigeria. Simple random sampling technique was used to select 300 staff of manufacturing firms involve in waste products management in the sample firms. Primary data were collected with the aid of structured questionnaire. The population of the study comprises of all staff of manufacturing companies dealing with waste products in Nigeria. Lagos state was selected because; it is the center of all manufacturing activities in Nigeria. The sampling frame of this study is selected from the Manufacturing Association of Nigeria (MAN) which shows that over 2800 manufacturing companies were listed. Three sub-sectors of Manufacturing industry were randomly selected which include the Food and Beverages industry, Paper Processing industry and Automobile Industry. A well validated questionnaire was administered to respondents who include staff from various departments that are involved in the production and distribution activities of the sampled firms. Data were measured on 5-point Likert scale and analysed using descriptive statistics, analysis of variance test of significance and Friedman rank test. Level of awareness and importance of reverse logistics were analysed using percentages. Analysis of variance was used to test the significance of reverse logistics to Nigeria manufacturing industry while Friedman Test was used to rank the challenges to the management of waste products. Friedman is a non-parametric test useful in ranking observation with chi-square test statistics as the diagnostic criteria.

4. RESULTS AND DISCUSSION

Awareness of reverse logistics to the management of waste products in Nigeria

To find out the level of information on reverse logistics in managing waste products, the respondents were asked to choose between 5 options that represent 5 different levels from very high to very low level of awareness. The Figure 1 gives the distribution of the level of awareness of participants over the 5 levels. The results indicated that generally, a high percentage (52%) of respondents had a low level of awareness of reverse logistics in waste management processes. About 35% of respondents were highly aware of reverse logistics while 13% of respondents had no awareness. In the course of the discussion, most of the respondents, however, explained that although they had limited amount of information on the term, once the concept of reverse logistics became clear to them, they realized that they had involved themselves in at least certain activities relating to reverse logistics in their company.

Figure 1.: Level of awareness of reverse logistics by staff of manufacturing firms in Nigeria



Source: Autors.

The importance of reverse logistics activities and process to management of waste products of Nigeria manufacturing firms

Responses obtained showed that reverse logistics plays an important role in the overall success of an organization (see Table 1.). Achieving objectives within reverse logistics are central to the attainment of organizational goals. Very high percentage (83%) of respondents totally agreed to the importance of logistics framework to achieving goals and objective. In response to whether reverse logistic is relevant for success, 29% and 23% of respondents, respectively, strongly agreed and agreed that reverse logistics is important for company's future success. This represented about 52% level of agreement to the importance of reverse logistics. Meanwhile, about 40% disagreed that reverse logistics is important for future company's success. In any organization, proper functioning of operating system is paramount. Most (51.8%) of the respondents agreed that reverse logistics is important for the functioning of their manufacturing company and as well important (59%) in the strategy of the company. As the results suggest, most of the respondents believe that their reverse logistics process can be considered as very important to developing efficient and effective management of waste products of Nigeria manufacturing firms. This means there is a growing focus on various sections of reverse logistics processes in waste products' manufacturing company.

Table 1.: Description of importance of reverse logistics to Nigeria manufacturing industry

S/N	Questions	SA	A	U	D	SD
1	Achieving objectives within reverse logistics contributes to achieving the organizational goals (Imp 1)	45%	38%	2%	11%	6%
2	Reverse logistics is important for your company's future success (Imp 2)	29%	23%	8%	18%	22%
3	Reverse logistics is important for the functioning of your company (Imp 3)	29.6%	22.2%	9.7%	15.2%	23.3%
4	Reverse logistics plays an important role in the strategy of your company (Imp 4)	18.7%	40.3%	1.8%	13.4%	25.8%

Source: Authors Computation.

Results in Table 2. showed the statistical significance ($p < 0.05$) of measures of reverse logistics to the manufacturing company. The results indicated that reverse logistics highly significant to achieving the organizational goals ($p < 0.05$), company's future success ($F = 8.18$, $p < 0.05$), the functioning of a manufacturing company ($p < 0.05$) and strategically positioning the company. A good reverse logistics process will increase the overall success of firms and also the speed of delivery which in turn will improve the quality of service.

Table 2.: Significance test of strategic importance of reverse logistics to Nigeria manufacturing industry

Source	Partial SS	Df	MS	F	Prob > F
Model	208.06	16	13.003	13.09**	0.0000
Imp1	48.763	6	8.127	8.18**	0.0000
Imp2	10.392	3	3.464	3.49**	0.0166
Imp3	49.651	4	12.413	12.49**	0.0000
Imp4	54.875	3	18.292	18.41**	0.0000
Residual	228.532	230	0.9936		
Total	436.591	246	1.7747		
N = 246					

Source	Partial SS	Df	MS	F	Prob > F
Root MSE = 0.9968					
R squared = 0.4766					
Adj R-squared = 0.4401					

Source: Authors' Computation.

Challenges of Reverse Logistics on the management of waste products for Nigeria manufacturing firms

Various challenges were associated with reverse logistics in the management of waste products for Nigeria manufacturing firms. Using Friedman's rank test which was significant at 5% level, the results showed that customers' negative perception of returning the products ranked as the biggest challenge (4.06) followed by high cost associated with reverse logistics (3.74), Uncertainties relating to product returns (3.44), Lack of collaboration with supply chain partners in reverse logistics (3.40), Lack of top management awareness of the importance of reverse logistics (3.23) and Lack of information on its importance (3.13).

Table 3.: Challenges of Reverse Logistics on the management of waste products

Challenges	Mean rank
High cost associated with reverse logistics	3.74
Lack of information on its importance	3.13
Uncertainties relating to product returns	3.44
Lack of top management awareness of the importance of reverse logistics	3.23
Lack of collaboration with supply chain partners in reverse logistics	3.40
Customers' negative perception of returning the products	4.06
Chi-Square = 81.87	
Df = 5	
Asymp. Sig. = 0.000	

Source: Authors' Computation.

The impact of reverse logistics on the management of waste products in the Nigerian manufacturing companies

The impact of reverse logistics activities such as product return, reuse of materials, and waste disposal on the management of waste products in the Nigerian manufacturing companies was examined and the results were presented in Table 4. The overall model is significant suggesting that reverse logistics impact significantly ($p < 0.05$) on the management of waste products in the Nigerian manufacturing companies. Furthermore, the results showed that the activities of reverse logistics such as

product recovery ($p < 0.05$) and product reuse of materials ($p < 0.05$) have a significant impact on the management of waste products.

The findings align with Lindahl, Sundin, Östlin, and Björkman, (2006) who considered product recovery as one of the processes of reuse and recycling. An important objective of products recovery is to retrieving the value of the product when such product no longer fulfils the expected value. Product recovery has also been viewed as a joint activity involving remanufacture, reuse and recycling usually did to recover the economic value in materials and enhance solid waste management (Gungor & Gupta, 1999).

Table 4.: Overall model of impact of reverse logistics on the management of waste products

Source	Partial SS	Df	MS		F	Prob > F
Model	64.1101289	20		2.1370043	4.34	0.0000
Product recovery	6.32898843	7	1.26579769		2.57*	0.0276
Product reuse	19.2120768	5	4.80301921		9.75*	0.0000
Waste disposal	4.98012617	8	.830021028		1.69	0.1254
Residual	111.275085	226	.492367633			
Total	175.385214	246	.685098492			

Source: Authors' Computation.

5. CONCLUSION AND RECOMMENDATIONS

This study examines the impacts of reverse logistic activities on the management of waste products, reflecting the Nigeria manufacturing experience. Data were generated through questionnaire administration to staff of manufacturing companies dealing with waste products in Nigeria. The results of data analysed indicated an overall significant impact of reverse logistics on the management of waste products in the Nigerian manufacturing companies.

The study concludes that reverse logistics process is very important in developing efficient and effective management of waste products of Nigeria manufacturing firms. The study found reasons to conclude based on the results that reverse logistics is highly significant in achieving the organizational goals, company's future success, the functioning of a manufacturing company and strategically positioning the company especially in the face of current rising costs of manufacturing in Nigeria. The study therefore recommends the need for a growing focus on various sections of reverse logistics processes in the management of waste products' of manufacturing company in order to achieve organisational goal and enhances sustainable business performance. Proper implementation of reverse logistic activities as a National policy and in the Nigeria`s manufacturing industry in particular will positively affect the economic life of the firms, and the general well-being of the environment, thereby ensuring sustainable development of the country.

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MARKETING COMMUNICATION IN THE VISIT PHASE THROUGH GUEST.NET – AN IN-DESTINATION, LOCATION-BASED SYSTEM AT MAISTRA HOTEL CHAIN IN CROATIA

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ABSTRACT

Hoteliers have always endeavoured to retain guests within their facilities, to profit maximally by offering them additional services. Informing guests of various options is performed within in-house marketing techniques, whereas some are ICT based.

Purpose. *Hotel chain websites are aimed at the acquisition of guests and as such are inadequate for displaying detailed, service and current information that guests need during their stay in a tourist destination (e.g. happy hour offer at the lobby bar). What about information provided to guests once in the tourist destination? This paper will present one such solution: the Guest.net. It is an in-destination, location-based website accessible from all Maistra Inc. properties, representing a good solution for hotel chains with various nearby positioned tourism facilities aimed at retaining guests within chain facilities.*

Design/Methodology/Approach. *The approach used in this paper is the case study method.*

Findings and Implications. *Klante, Kroschel and Bolls theoretical information model (2004) was expanded by adding the planning in situ phase in tourism. Benefits of the application of similar guest services for hotel chains have been listed.*

Limitations. *Limitations steam from the case study method and relate to the minor geographical area researched.*

Originality. *There is an evident lack in research of customers in tourism during the visit phase, regarding their decision making process, especially in the evaluation of alternatives and their purchase decision in situ (Law, Buhalis, Cobanoglu, 2014), thus this paper broadens the identified gap in the information collection phase in the destination.*

1. INTRODUCTION

Information about the next holiday destination are not difficult to find. Websites of DMOs (Destination Marketing/Management Organisations), tourism providers, various forums etc. provide information from weather forecasts to attractions. But what happens to detailed and specific information in tourism once tourists reach the desired tourism destination? For instance, where is the cash register to buy the tickets of a certain tourist attraction, are credit card payments accepted or should one go to the ATM first and where is the nearest ATM? We have relied on passers-by or professional employees in tourism, the latter are however stationary based in their working places and we have to find them in the first place. The internet is ideal for the distribution of information on tourism products, and the emergence of mobile internet has given it a powerful momentum (Ružić, Turkalj, Biloš, 2014), resulting in an increase of Location based Services (LBS)[1] (Talaat, Fahmi, Marzouk, 2015). The "instant information support of smartphones enables tourists to more effectively solve problems, share experiences and 'store' memories" (Wang, Park, Fesenmaier, 2012).

This paper deals with in-destination information and how hoteliers can supply guests with such information. The success of the process of exchange of such information in marketing communication *in-situ* is also measured by achieved goals: the tourism providers should reach an increase of economic and non-economic measures, while tourist should satisfy thier information needs.

In-destination specific information at disposal of guests are an important factor affecting the whole tourist experience and future tourist behaviour. There is a significant difference between information that tourists need before deciding to purchase their holiday and information they need during their stay in the tourism destination. The latter do not primarily have only a promotional and acquisitional purpose but, are aimed at making tourists' stay easier by helping them orientate themselves, plan their daily movements and of course, aimed at increasing tourism spending beyond accommodation and F&B. Nevertheless, communication in a tourist destination is a neglected topic both in the scientific and professional tourism literature (Law, Buhalis, Cobanoglu, 2014), which is reflected in the frugal literature review that follows.

The aim of this paper is to present a case example of an in-destination system of Maistra Inc. Rovinj, which provides location-relevant information about the tourist offer of this hotel chain, as well as other relevant information to guests during their stay in the two nearby tourism destinations of Rovinj and Vrsar (Croatia) where the hotelier operates.

The paper is conceived in four parts, whereas the first is the introduction. The second chapter deals with relevant literature focusing on marketing information in

1 Location-based Services "as services are to provide information stored in a database. This information can be created, compiled, selected, or filtered in the light of the current location of the mobile use" (Essayad, 2011)

the destination and DMS (Destination Management System). The focus of this paper is on the importance of providing information to tourists during the stay in the destination rather than on the system itself or similar solutions (e.g. mobile applications, QR codes, etc.). The third part gives an overview of the case study - the Guest.net - followed by concluding remarks and discussion (forth chapter).

2. THEORETICAL REVIEW

2.1. Marketing communication

Marketing communication is the process of exchange of information[2] with the purpose of achieving certain effects (Kesić, 1997). The communication object is a product or service unlike in corporate-oriented communication. Its focus is mainly on generating and maintaining demand and product or service positioning, "persuading and reminding the target public" (Križman Pavlović, 2008); as opposed to corporate communications dealing with issues such as acquisitions and mergers, social responsibility etc.

The key elements of the marketing communication process are: the sender, the recipient, the message, the communication channel, and the effects (Schultz and Schultz, 2004:160). Communication channels usually are different media, although it may be the vendor itself. Medias which reach a wide audience in different geographic areas are known as mass media (e.g. radio, television and newspapers), while media which allow two-way communication, such as the Internet or the phone, are called interactive media. The expanded communication model includes other elements such as encoding, decoding, and noise / interference in communication (Schultz and Schultz (2004:160). For a more complete understanding of the communication process, „it is paramount to know the social context of the sender and the recipient; the symbolic and structural meaning of the message; the ability of the recipient to understand the message and the learned reactions; in order to be able to analyse, with an acceptable certainty, the results of the communication" (Kesić, 1997).

Within the message, as a communication element, there are three groups of factors affecting the ultimate outcome (Kesić, 1997):

(1) the structure of the message (content and form: arguments, making conclusions or releasing that audience, presentation order, colour / tone choice, typography / style of presentation, visual / clothing, etc.),

(2) choice of appeal (e.g. appeal to humour, sex, ecology) and

(3) choice of message or signage system (verbal and non-verbal). Communication effects can result in changes in the mind, attitude, and ultimate audience behaviour.

2 Every information is data, but only data useful in decision making for the receiver is called information.

One of the most well-known classifications of marketing communication is the mass one (indirect and one-way) and communication one-to-one, characterized by the „presence" of the recipient and the sender.

Another dual marketing communication division distinguishes: symbolic (promotional) marketing communication and functional (related to other components of the marketing mix), i.e. communication in the narrower and wider sense (Kesić, 1997, Garača, 2008). Thus, for instance, the packaging of the product has its own communication function, as well as the pricing policy, the choice of distribution partners, the arrangement of stores and other distribution elements - also play their role in forming the image of the company and its products.

There is a dispute weather promotion and marketing communications are synonyms (as promotion is defined as communication with the market). For some, promotion is a narrower concept of marketing communication and, according to a somewhat outdated understanding, focuses on persuasion, excluding the informative component. According to the key elements of the marketing communication mix, it includes: advertising, public relations, sales promotion, personal sales and direct marketing (Kesić, 1997:346). In fact, marketing communication includes all the four classic elements of the promotional mix to which direct marketing is added, as a new paradigm of two-way communication. In addition to the above elements of the communication mix, other communication tools such as events, sponsorships, fairs, personal recommendations etc. are also included (Kotler, Keller 2009).

As for tourism, marketing communications helps to establish a more complete and successful mutual relationship between tourism providers and tourists by (Senečić, Vukonić, 1997):

- establishing mutual relationships
- maintaining such flow of information that allows for exchange
- creating a conscious and informed buyer and seller
- improving the decision-making process
- making the whole process of exchange on the tourist market is as effective as possible.

Furthermore, it can be added also, according to UNESCO's World heritage sustainable tourism online toolkit, that the" ultimate goal of communication (i.e. in tourism) should be to move a potential visitor from knowing very little to a deeper understanding of people and place, actively behaving in a more sustainable manner while visiting, and ultimately becoming a champion of the destination". In order to achieve that, adequate *in-situ* information are an essential prerequisite.

2.2. Information in the destination

The goals of marketing communication are different in relation to the different phases of the customer journey. According to the WTO (2008), there are five key phases of the customer journey in tourism: 1) dream and select, 2) planning, 3) booking, 4) visit and 5) post visit recollection and recommendation. The first three phases can be summarised into the pre-buying phase. From the standpoint of the offer side, there are three key marketing communication activities performed by tourism providers according to the stage of the customer buying cycle: acquisition, in-destination provision and retention (Chaffey et al., 2006).

In the in-destination phase, there are three key moments to address (Klantel, Kroschel, Boll, 2004): the orientation phase (tourists acquire familiarity within the area), the movement phase (focused on finding the right way) and the information phase (discovering more deeply the reached amenity and absorbing information about it). The first critical moment is the provision of hard data (opening hours, modality of payment, transport options, parking availability, accessibility etc.) enabling decision making in order to move on from the orientation phase to the movement phase.

It is necessary to cherish the so-called "in-destination" communication as it provides information to tourists during their stay in the tourist destination. Special attention should be paid to ensure that the information provided are not the same as the tourist information available to them from their homes, prior to the visit, as they have already collected those information. Information in the destination must strive to expand the knowledge and experience of tourists about the attractions and events they are interested in. It is an imperative in order to make it easier for visitors to access their desired activities and facilities as to avoid the loss of time and physical effort they have to invest in satisfying their needs (Ortega and Rodrigues, 2007). Despite the lack of representation of this topic in tourism research, it has great significance from the point of view of tourist experience and satisfaction as well as in the creation of loyalty to a particular tourist destination. Accordingly, it can also be argued that information contribute greatly to the future increase in tourist demand, especially in the context of positive recommendations encouraging other prospect customers.

Ortega and Rodrigues (2007) analysed the importance of information about the destination offer and common information about hotel services available to tourists in Spain (over 3500 respondents). The variables used in the research included two forms of information sources: a) information about tourist destination offers (local attraction brochures available at the reception desk, and a 10/15 minute local attraction movie on the hotel TV and b) information about 13 common hotel services (e.g. value-saving safe in the hotel room, indoor gym, sauna, fitness spa, library, playroom, internet connection in the room, child care etc.). Guests paid most atten-

tion to information about the tourist destination, primarily presented in brochures, then to those presented in the video projection. The affective and cognitive effects of information use during a vacation were researched by Voght and Steward (1998). Namely, the same travel information may be used repeatedly before and during a vacation with different levels of satisfaction.

Travel is clearly an educational experience as tourists learn and discover more information about the destination and gain skills (Voght, Steward, 1998). Tourists are attracted to the destination by certain elements of attractiveness and during their stay they get to know about other tourism products and experience also other elements, thanks to various sources of information, which will be presented below.

There are numerous ways of getting in-destination information and these are divided into two groups: offline and online sources of information. For the sake of brevity, only some of the most commonly used tools and channels of communication will be mentioned.

2.3.Typical offline sources of information in the destination

Besides typical tools of promotion such as brochures, video etc., those specific in tourism will be mentioned further (Križman Pavlović, 2008, Slivar Tiganj, 2012, Vavrečka, Mezuláník, 2016):

- Tourist signalization
- Informing at reception / Guest relations and tourism offices / DMOs
- Tourist guides and locals
- Printed materials (brochures, posters, outdoor advertising etc.)
- Photo, Videos, (interactive) projections, Digital signage (a specialized form of information technology for displaying video or multimedia content in public places for informational or advertising purposes)
- Mass media besides Internet based ones
- In-house Promotion / POS (Poin of Sale) e.g. indoor television in hotel rooms
- satellite navigation (the most known system is GPS - Global Positioning System)

2.4. Typical online sources of information in the destination

Consumers are very skilled in collecting information independently. Among various online tools, some typical are listed (Slivar Tiganj, 2012, Ružić, Biloš, Turkalj, 2014, WTO, 2008, pp. 20.):

- Tourist information websites (whereas some have overgrown into DMS - Destination Management Systems)
- social media and web.2.0. travel websites etc.
- mobile applications

- QR (Quick Response) codes
- digital brochures, e-zines etc.
- timely, location-based offers sent to mobile devices by visitors, by SMS or by e-mail
- travel planners[3] (in various formats or as functionalities of websites)…
- info kiosks / interactive info points etc.

There are many techniques and methods which can be applied in combination to the above listed tools, such as the previously mentioned, location-based marketing. It implies the distribution of targeted marketing messages according to the location of users and has strongly evolved since the advent of mobile devices (Buckowski, 2011). The mix of mobile marketing, contextual marketing and location-based advertising, generated the concept of location-based marketing (Li 2011). A similar concept is proximity marketing, which refferers to the distribution of localized marketing messages to customers based on their proximity to the merchant (Levesque, Boeck, 2015) and in terms of delivery it might be push or pull based (Ojala, Kruger, Kostakos and Valkama, 2012). In the selected case study, Guest.Net was a location-based website using Wi-Fi to determine the location of the user. The approach was push based.

2.5. DMS (Destination Management System)

Tourist information systems are also known as Destination Marketing System, Destination database, Visitor Information System or simply DMS (Destination Management System) (Slivar Tiganj, 2013). These represent not merely a collection of information and products about the tourism destination, but make the latter available to purchase (Werthner and Klein 1999; O ' Connor and Frew, 1999).

The requirements of a DMS haven't essentially changed much over time and include (Gerdes, 1998, Wayne, 1991):

- the organization and consolidation of information about the tourist destination, its products and vacation packages,
- a service centre through which it is possible to enter and update information (or CMS),
- the standardization of displayed information in a variety of distribution interfaces,
- the integration of different products
- individual organization of information, depending on user's interests (filtering and sorting),
- booking accommodation and other tourism products and services.

The analyses of several DMS providers (e.g. New Mind, Tiscover, Gulliver, Co-

3 Travel planners are typical tools of destination marketing allowing users to plan what and when they will do during their holidays. (Slivar Tiganj, 2012)

degn, Desti.ne and Opera21) revealed three key common components of DMS: CMS (Content Management System)[4], CRM and online booking (Slivar Tiganj, 2013).

Not many DMS were developed to service guests' needs in the visit phase. Indeed one of the major criticisms of DMS is related to the lack of true information needs of the industry, since many were developed by publicly funded DMOs with poor collaboration with tourism services providers (Ritchie and Ritchie 2002, *Talaat, Fahmi and Marzouk, 2015*) as well as final users. The second key challenge in developing DMS systems refers to the ranking of information (*Talaat, Fahmi and Marzouk, 2015*). Some DMS might be privately owned, as it is the case in the following semi-DMS - Guest.net - more focused on economic effects than other sustainable goals.

Overall, DMS sets the information base of destination management by enabling to use destinations' information to support product development, promotion, online distribution and customer relationships. There are various directions to further develop in-destination systems into recommendation systems: based on demographics, content, collaborative filtering, knowledge, utility and hybrid systems (Noguera, Barranco, Segura, Martinez, 2012). For instance, the SoCoMo umbrella concept (Buhalis, Foerste, 2015) adds to mobile marketing also the social and contextual component, whereas the latter includes already location-based marketing principles.

In the main areas of GIS applications (mapping, measurement, monitoring, modelling and management), there are many influences of tourist activities (Stankov, Đurđev, Marković, Arsenović, 2012), such as DMO's. Whereas, according to Pahernik (2006) GIS in the narrowest sense is a computer tool for creating and analysing geographic objects, i.e. occurrences and events in space.

3. CASE STUDY: GUEST.NET AT MAISTRA INC

3.1. The context: Maistra Inc. promotional activities

Headquartered in Rovinj, Maistra Inc was established in March of 2005, having inherited 50 years of experience in the tourism business. The company owns 10 high quality hotels, 8 tourist resorts and 6 camping sites situated at prestigious locations in Rovinj and Vrsar, two Istrian tourist centres of exceptional natural and cultural/historic values. The total portfolio capacity amounts to nearly 34,000 guests, resulting in the figures of approximately 5 % of the tourist results of Croatia, and slightly more than 15 % of the tourist results of Istria (Maistra, 2018).

By continuously innovating and redesigning the tourist offer with the use of modern technology, Maistra attracts new clients and business partners, which makes it one of the most competitive on the Croatian tourism market. By cooperating with the DMOs and the city administration, Maistra contributes to a greater promotion

4 CMS enables the management of dynamic websites without the need of specific technical knowledge. It is also know as back-end, whereas websites that users see, are therefore, called front-ends.

of the company, but also of the tourist destinations of Rovinj and Vrsar, where the company operates. Maistra's marketing communication is primarily directed to increase revenue and demand, while striving to achieve a positive image and market recognition.

The prerequisite for the realization of its strategic and operational goals in the promotion is the optimization of internal communication among its departments mainly: operations, marketing, properties (hotels, resorts and campsites) and quality management functions and their continuous cooperation. The core responsibility of the marketing function is to support the function of operations as an expert service and to create all the prerequisites for a quality promotion of the total offer of additional services (e.g. F&B, excursions, Spa, etc.). [5]

Informing tourists about Maistra's offer, prior to their arrival to the destination, is primarily performed through official acquisitional websites (www.maistra.com, www.campingrovinjvrsar.com www.montemulinihotel.com and www.lonehotel.com). By participating in fairs and workshops on target markets, Maistra expands its communication with the interested public. Video clips provide a better insight into their own tourist offer and of the tourist destinations.

In order to ensure the high quality of its offer, Maistra performs various in-house promotion activities (e.g. flyers, internal television, sales staff in the form of guest relations, etc.) as part of providing information to guests within its facilities. The underlying goal of in-house promotion is to increase the sale of additional services within Maistra's facilities by providing timely and accurate information on the offer and special prices. The reliability of provided information is of critical importance, since verified sources of information eliminate the risk of getting inaccurate information.

The basic marketing tools used for the promotion of Maistra's properties and services are printed materials: various flyers, brochures, postcards and coupons with stimulating discounts, a corporate magazine, as well as interactive TV and a new media for in-house promotion - Guest.net. Printed promotional materials are divided into three groups: general promotional printed materials (image directory of hotels and resorts, directory catalogue of camping offers, Maistra Gourmet leaflet, congress brochure, Monte Mulini brochure, individual promotional brochures), standard propaganda-informational material (hotel standards for 4-star hotels, hotel standard for hotel Lone etc.) and other promotional materials (e.g. Maistra-Company magazine, cookbook Monte Mulini etc.). The first two groups of printed promotional materials relate to the promotion of hotel services, while the last group of (other) promotional materials include a wider area including the promotion of the tourist destinations.

MaistraCompany magazine represents a kind of in-house PR activity, and is available to guests in their hotel rooms. The magazine is a result of collaboration of journalists, photographers, translators and lecturers, publishers and others. The aim

5 Maistra: internal data.

of the magazine is to promote new services offered by Maistra, promote the destinations and events, culture and gastronomy. The journal is printed in two languages (Croatian and English) in three editions and printed in 25,000 copies.

As the gastronomic offer is one of the key elements of Maistra's overall offer, the marketing department is directly involved in the process of creating and defining products as well as programs of special interest which include gastronomy. The media plan defines advertising through specialized journals and reputable gastronomic guides, and advertising through local radio stations and specialized (gastronomy) portals. In addition to advertising in the media, the company advertises in the destinations they operate in.

3.2. Case study: Guest.net

With the development of internet access through various devices in the destination (via laptops, smartphones, info kiosks and similar), Maistra saw the opportunity to use the internet for the purpose of in-destination and in-house marketing communication. The company has therefore introduced a new media in its promotion - the so-called Guest.net system. It is an interactive in-house and in-destination information platform which provides Maistra's guests with more detailed information about tourist products at their disposal, as well as various service information. The focus is on the tourist products, services and events provided in Maistra's facilities, in the destinations of Rovinj and Vrsar and wider in the region of Istria.

Guest.net uses geolocation technology which recognizes the location from which a guest connects to the Internet (Wi-Fi based) and thanks to a modular homepage structure, provides guests those information which are most relevant to the micro location the guest is located in. The system is actually a website that search engines do not index (no index, no follow tag is set). Thus Guest.net can be accessed only from all Maistra's info points where it is set as a home page (push technique) and thought laptops and other guests' devices that use the property's wireless network to access the Internet. In both cases, Guest.net is the home page displayed. The use of Guest.net is free of charge.

Beyond Guest.net, Maistra's tourists can collect information through the television channel in all Maistre hotel rooms, in communication with reception staff and through various offline tools.

The content of Guest.net is organized by categories (sports, wellness, events, restaurants and bars) and available in several languages (English, German, Italian and Croatian). The search functionality is available also through Google Maps. Some content is collected in the form of automatic download of content from specialized services i.e. Content Partnerships (e.g. currency converter, weather forecast) also known as mash ups.

By further surfing within the website, guests will find information on events and services in other Maistra's facilities, primarily those located close to them, within

the destination they are in, and even in the whole region of Istria. The website design uses colours to intuitively reveal the proximity of certain contents, as the colours are pale if the content is more distant. Regarding the ranking issue identified by *Talaat, Fahmi and Marzouk (2015)*, in case of two same types of amenities, equally distant, the least frequented one is displayed to users first; in order to increase economic profitability and indirectly adequately affecting visit management. More contact options are also available to users.

Maistra presents content from its own offer as well as events organized in its properties. In addition, since Maistra, as a socially responsible company, participates in a number of projects in the destinations in which it operates, Guest.net also promotes events in which Maistra is involved as a co-organizer or sponsor in cooperation with DMOs, the towns it operates and other stakeholders. Beside those, it also provides service information such as ATMs, shops, gas stations, etc. connected to the interactive map at Guest.net.

"Unlike our main websites that are primarily intended to represent Maistra and its offer to attract guests to our properties, Guest.net is intended for those guests who already reside in Maistra's facilities. We will now be able to inform them more effectively. Moreover, they will be able to search, select and inform them about the services and events they are actually interested in. The goal of this project is to enrich the stay of guests with additional amenities because we believe that we will achieve that our guests feel even more comfortable and even more satisfied" they say in Maistra.

The Guest.net system initially functioned only for desktops and laptops, but quickly adapted to display via mobile phones, and plans to expand via the internal television channel in all rooms of Maistra's facilities. The development potential is also seen in customizing the site and displaying it on various info kiosks in the destination, involving the public sector (primarily the DMOs) and by including other public services and advertising other tourist products and services of the destination, in partnership with relevant tourism providers.

With the introduction of Guest.net, Maistra introduces a new quality in the communication with its guests. In addition to the existing forms of information, guests will also have access to fast, comprehensive, multi-media information with a range of accompanying content, continually, 24 hours a day, seven days a week.

The Guest.net project was launched on June 24, 2009, and the website was activated on July 1, 2010, after which the system was upgraded and updated. The marketing push technique was applied (guest.net is the homepage when accessing the internet from Maistra's facilities); therefore, a large bounce rate (a web metric that denotes the percentage of users who viewed only one page and then left the web site) of over 50% was expected. As opposed to the solution of travel planners tools in the form of mobile applications or web sites that users consciously visit / install (based on the principle of pull technique). On the other hand, given the push technique, the promotion of Guest.net to the guests of the Maistra hotel chain is not necessary.

Unfortunately, because of the reorganization of the business and the inadequacy of personnel resources, the Guest.net project is temporarily shut down.

4. DISCUSSION AND CONCLUSION

Marketing communication is associated with promotion in the pre-arrival phase mainly and lately with post staying behaviour, thus the set of tools and techniques used in the first and last phase of the consumer buying life cycle has been researched widely. The post-visit phase is having a revival thanks to social media and reviews. The middle phase, in-destination communication, however, remains quite neglected, although, location and proximity marketing and local search are improving this issue. In this phase, guests want to engage into experiencing the main motivation drivers hence collect information about the destination, its activities and attractions available on spot. Those information must be accurate, reliable and provided at the right moment. Traditionally, the most dominant sources of information were printed materials and human interactions. The widespread use of smartphones and mobile devices is switching content distribution to e-communication with users.

The sovereignty over trustworthy, complete and high quality information about the tourism destination should be provided by DMOs, as to avoid for tourists the hassle of visiting various platforms - apps and websites from different providers (comparing different data) and the loss of time and effort. Slowly, tourism providers are moving into communicating with guests during their stays. In the observed case study, the DMOs of the tourist destinations Rovinj and Vrsar did not provide any in-destination, local e-information to their guests. A hotel company (Maistra) has overtaken its role as a promoter of its own products and partially of the destinations as it has included in its system the distribution of information and content under the DMO's jurisdiction. In that sense, the Guest.net platform is almost a kind of DMS system for the destinations Rovinj and Vrsar where the hotel company Maistra operates. This situation is not unexpected nor uncommon, given major budgets of hotel chains compared to those of DMOs, having a financial interest and the opportunity to reach tourists.

Since preferences of users towards formats of information are different, ICT should not be the only option of informing tourists, it depends upon the target market. Creating unique regional information in different formats (Ritchie and Ritchie, 2002) with already offered itineraries according to the interests of tourists should enable the concentration of more detailed information in one place and thus reduce the effort of tourists.

A wider insight into existing attractions and the provision of adequate information at the destination allows tourists to visit more of such points of interest than they intended before reaching the destination. This might have a positive effect on the length of stay of tourists in order to visit all the attractions they did not know earlier,

on an increase in tourism expenditures, affect their willingness to revisit the destination, trigger loyalty and their propensity to recommend visiting it.

Given the identified hard information gap, Klante, Kroschel and Bolls model (2004) should thus be expanded by adding an additional step after the first (orientation) phase: *the organisation of the visit* which would support decision making by providing adequate information necessary for planning visiting a single or more POIs. In the latter case, the functionality of a trip planner is advisable. Another contribution to theory is the list of typical sources of information about a tourist destination to users during the visit phase.

In relation to the previously said, the topic of in-destination information should be more researched in order to make marketing professionals more helpful towards meeting the goals of tourists during the visit phase.

Guest.Net is an interactive in-house and in-destination information platform that provides Maistra's guests with more detailed information on tourist products and services at their disposal, as well as various service information. As soon as a Maistra's guest connects to the Internet, either via its own device either via a computer in an Internet Corner at Maistra's properties, the homepage tailored to the location will be displayed. The system will recognize the location from which the guest connects and the initial information provided will be referenced precisely to the property where these services and events are located in that facility. Solutions like Guest.net are desirable for hotel chains operating in a particular tourist destination, to target their guests persuading them to use chain's services based in nearby hotels, resorts, camping sites, restaurants, bars, entertainment centres, spas etc.

The contribution for practitioners is obviously reflected in gaining knowledge about providing location-based information to guests of tourist facilities during their stay, especially for chains with properties located within reach. Adequate assessment of tourist needs is a prerequisite for that as well as an effective use of such researches. Tourism providers should acknowledge the importance of mobile marketing and LBS (Location Based Services) and include them in promotional activities.

The main disadvantage of this study is the case study format, thus more research is advisable. The findings are reported on a guest service case study in a European context, hence should be repeated also elsewhere, to support generalisation. Although the efficiency of Guest.net scores well in terms of low cost promotion, faster and easier reach of tourists, as an additional feature of this research, it would be worth comparing the efficiency of other sources of information and other formats. Also, the study does not cover the attitudes of tourist demand, their information search process in the destination (crucial for adjusting to customers' needs) and the wider impacts - social and economic effects of Guest.net's in-destination distribution of information. Furthermore the quality of the solution was not explored i.e. the key factors affecting the level of usage of GIS in tourism were usefulness and playfulness (Chang, Caneday, 2011), the same could be further researched in relation to DMS.

The provision of *in-situ* information in the adequate depth, format and in time, will benefit all stakeholders in the tourism destination. Along with obvious benefits to tourists in terms of accommodation, satisfaction of stay, increase in extra-spending, it also helps in relieving the reception functions of informing guests. Since it's a push solution, it's not necessary to overburden the in-house promotion budget, as opposed to, for example, mobile apps formats or similar contents as a pull tools.

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ECONOMIC GROWTH AND MACROECONOMIC DYNAMICS IN NIGERIA

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ABSTRACT

Purpose. *The role of macroeconomic variables in shaping the economic status has been debated in the literature. The management of these factors has been epileptic and sometimes contradictory with consequential implications for sustainable economy. This study therefore examined the relative significance of macroeconomic factors (inflation rate, interest rate, exchange rate and unemployment rate) on current national income. In addition, it sought to ascertain the relative importance of prior income (past GDP) on current national income (current GDP) based on data obtained between 1975 and 2015.*

Methodology. *The study deployed pre-estimation descriptive statistics and stationarity tests using the Augmented Dickey Fuller test and Phillip Perron tests. Johansen cointegration test was applied for establishing the long run relationship of the variables. The final phase is the post estimation tests to confirm the robustness of the estimated model. These are the Breusch-Godfrey test to check for any form of auto correlation among the variables, the heteroskedasticity test and the Impulse Response analysis of the dependent variable with respect to shocks in the explanatory variables.*

Findings. *The result findings revealed that inflation contributes negatively to economic growth. Interest rate, exchange rate and unemployment impact economic growth positively. The entire explanatory variables have no short-run effect. The result of the Breusch-Godfrey LM and Breusch-Pagan-Godfrey test indicated the absence of serial correlation and heteroscedasticity respectively. In effect, by itself, macroeconomic stability does not guarantee sustainable high rates of economic growth in the absence of key institutional and structural measures. The study recommended diversification of the economy and the use of inflation targeting which would be commensurate with the level of economic growth should be pursued by policy makers*

Limitations. *This research examined the impact of the various macroeconomic variables on the economy over a period of 41 years. A structural break analysis of the impact before and after major policy shifts like Structural Adjustment Programme (1986), Financial Sector reform (2004), Global Financial Crisis (2007 - 2008) etc. should be explored by new studies.*

Originality. *This study is an original work. It has not been published in any other journal and is not being considered for publication by another channel*

1. INTRODUCTION

The debate on the key drivers of economic growth has been ongoing and it is still far from over (Nihat, Ali &Emrah, 2013; Mbulawa, 2015; Obrimah, 2015). Indeed, the role of macroeconomic stability through stable prices (low inflation), low levels of debt (whether foreign or domestic), free market economy, low levels of unemployment, is considered crucial in engendering sustainable economy (Mbulawa, 2015).

The macroeconomic variables have manifested epileptic variations. The inflation levels in Nigeria moved down from 18% in 2005 to about 12% in 2012, 11.92% in 2014 and 8.5% in 2013. However, interest rate in Nigeria which has the ability to impact on the level of investment and availability of credit in the country has averaged about 10.24% from 2010 to 2015 following a record low of 6% in July 2009 (Trading Economics, 2016). The increase in interest rates attracted the inflow of foreign capital into the country. The sustained dependence on foreign capital over a long period of time has been associated as one of the major causes of a decline in the value of the local currency, the Naira. The import dependency on consumables, machinery and spare parts, led to increased level of inflation.

The lack of synergy between the level of inflation and the cost of borrowing funds represented coupled with the value of the local currency contributed to the increased unemployment rate from 7.8% in 2014 to 9.0% in (Trading Economics, 2016). The increase in the level of unemployment has been associated to loss of jobs as various companies in different industries have been involved in massive retrenchments due to the uncertainty of the economic environment in the country.

The effect of the variations in unemployment rate, interest rate, exchange rate and inflation rate has had an impact on the environmental conditions of the household, firms and government. The result of the increase in the dependence on foreign capital coupled with the fact that Nigeria depends majorly on imports impacted on the ability of the household to buy goods and services as prices for commodities were high which thus reduced the purchasing power of the household. This also affected the level of savings of the domestic household, as increasing interest rates and its associated features discouraged consumption and thus impacted on the level of earnings of the firms as profit dropped which led to a mass retrenchment of workers in 2015.

Efforts by the monetary authority, the Central Bank of Nigeria (CBN) to curtail inflation by increasing interest rate shrinks the ability of the financial sector to create more money through loans and which thus contributed negatively to growth. In the same vein, the increasing level of interest rate has failed to suppress the level of inflation, as the Nigerian economy is largely import dependent. Efforts by the monetary authority to improve the value of Naira through increased interest rate has not strongly succeeded in attracting foreign investment into the Nigerian economy. These dynamics requires further investigation which necessitated the conduct of this research.

The objective of the study is therefore to evaluate the relative significance of macroeconomic factors (inflation rate, interest rate, exchange rate and unemployment rate) on current national income. In addition, ascertain the relative importance of prior income (past GDP) on current national income (current GDP). The balance of this study is as follows: In the next section, the review of previous works is presented. In the third and fourth sections, the methodology of research and the findings are discussed. The last section covers both recommendations and conclusions.

2. REVIEW OF LITERATURE

The review of previous works is in two parts: theoretical and empirical.

2.1.Theoretical Review

This section examines the theories upon which this research is predicated. There is a plethora of theories propounded with respect to the macroeconomic variables. The classical growth theory of Adam Smith and Malthus sees the rate of investment as the main factor that fosters economic growth. The Harrod-Domar growth theory carries implications for less economically developed countries (LDCs) for which Nigeria can be categorized, where labor is in plentiful supply in these countries, but physical capital is not, slowing down economic progress. The Augmented Solow theory (1956) posits that economic growth is a product of technological progress and is useful for estimating the separate effects of technological change, capital and labor on economic growth. Developing countries do not have sufficiently high incomes to enable sufficient rates of saving; therefore, accumulation of physical-capital stock through investment is low.

The endogenous growth theory articulated by Romer (1986 and 1990) and Lucas (1988) assumes that production function does not exhibit diminishing returns to scale due to the beneficial effect positive spillovers from capital investment to the economy as a whole or improvements in technology which leads to further improvements as a result of learning curve. Like the Solow model, it considers capital accumulation an important factor, technological advancement is seen as a key driver of economic growth within the economy. This theory however has not explained conditional convergence and the income differences between developed countries and developing countries.

The relevant theories of interest rate in the study include the loanable funds and the Keynesian theory of interest. The loanable fund theory holds that economic activities are guided by some invisible hands that is the self-interest and price mechanism (Wicksell, 1898). The relevance of this theory to this research is borne out of the need to explain movements in the general level of interest rates in Nigeria and

why interest rates among debt securities of a given country vary. The Marxist theory supports the Keynesian theory but suggests that the market system's propensity to cut wages and reduce labor participation on an enterprise level causes a requisite decrease in aggregate demand in the economy. This increases unemployment and increases the periods of low economic activity before the capital accumulation (investment) phase of economic growth can continue.

The post-Keynesian endogenous theory of money by Kaldor (1970) negates the contention of the monetarists that the Central Bank exogenously determined money supply and therefore its direct impact on the price level in the economy. For Kaldor, the dependent variable is actually the supply of money which is determined by the price level as dictated by the level of money wage rates. The rational expectation approach was postulated by Lucas (1972). It states that the forward-looking expectation adjustments of economic agents will ensure that the pre-announced policy fails where the people are able to anticipate such policy announcements.

The Phillips curve established a trade-off between unemployment and inflation. Prior to the emergence of the Phillips curve, both Keynesian and the Monetarists failed to examine the nexus between inflation and unemployment which were treated as different subjects. Specifically, the Phillips curve tried to determine whether the inflation-unemployment link was causal or simply correlational. However, Friedman (1956) disapproved Phillip's curve thesis, stating that the trade-off between unemployment and inflation only existed in the short-run and that in the long-run, the Phillips curve is vertical. This is because in the long run, workers and employers will take inflation into account, resulting in employment contracts that increase pay at rates near anticipated inflation. In Nigeria, rising inflation rate without a corresponding increase in the wage level of workers has led to a drop in the growth rate in the economy. This rise in inflation can be traced to high interest rates and the falling value of the naira against the dollar.

According to the Okun's law (1962), an increase in unemployment rate will lead to a decline in the potential growth which is to be achieved by the economy, thus an inverse relationship exists between unemployment and economic growth. The new Keynesian theory is however of the view that the labor union is allowed to determine the equilibrium employment level in the economy while the government acts as a moderator to activities in the labor sector. The Structural Inflation theory by *Myrdal* (1968) suggests that supply increases in relation to demand-push, even if abundant unemployment of production factor is impossible or slow.

The purchasing power parity propounded by Cassel (1918), states that the exchange rates between currencies are in equilibrium when purchasing power is the same in each of the two countries. The theory assumes that the actions of importers and exporters motivated by cross country price differences, induces changes in the spot exchange rate, and consequently the shifts in the term of trade, which ultimately influence economic growth. However, in practice the real exchange rates exhibit

both short run and long run deviations from this value, for example due to reasons illuminated in the Balassa-Samuelson theorem. The Keynesian absorption approach posits that devaluation increases exports and reduces imports thus impacting positively on the national income of a country which would affect positively the domestic consumption. This can further lead to the economic growth of a country. Within the context of the falling exchange rate in Nigeria which is linked to over-reliance on importation, the assumptions of the absorption approach may be adopted by promoting exportation and reducing importation which can help to stir growth in the economy.

These theories underline the dynamic nature of the variations in the various macroeconomic variables. The next discussion on previous studies is presented in the next section.

2.2. Review of Empirical Literature

2.2.1.Developed Countries

The study by Eichengreen (2008) examined real exchange rate and economic growth using descriptive analysis and panel data regression analysis obtaining data from 1985-2003 and found that real exchange volatility appears to have a significantly negative impact on employment growth. Similar study and method by Jinzhao (2012) confirmed same result in China. The unemployment hysteresis in the USA was studied by Rosoiu (2014) using the Kwiatkowski-Phillips- Schmidt-Shin (KPSS) tests in the confirmation of the Okun's Law.

Chang-Shuai and ZI-Juan (2012) carried out a study on the relationship among Chinese Unemployment rate, economic growth and inflation using the VAR and ECM between 1978 and 2010 and concluded that there is a long-term stable equilibrium relationship among the variables unemployment, inflation and economic growth. However, in the short term, economic growth is positive correlated with unemployment rate while inflation and unemployment rate are negative correlated with inflation. Evidence gathered by Qin and Wang (2013) in a study on inflation rate and unemployment rate points out that causal relationship between the inflation rate and unemployment rate in China is ineffective.

2.2.2. Developing and Emerging Economies

Antwi, Mills and Zhao (2013) studied the impact of macroeconomic factors on economic growth in Ghana. The researchers employed error correction model (ECM) and carried out tests such as Augmented Dickey Fuller (ADF), Johansen cointegration and found that long run economic growth in Ghana is explained by physical capital, foreign direct investment, foreign aid, inflation and government expenditure. Yet, Kira (2013) found that some variables were inactive such as Investment

and Imports indicating that their influence on GDP is not significant. While Taylan (2012) when examining macroeconomic variables and unemployment in Turkey, applied the Vector Autoregressive model (VAR). It found that positive shocks to growth, growth in exports and inflation reduce unemployment. Also, shocks to interbank interest rate, exchange rate and money supply increase unemployment. Contradictory results are obtained with the interbank interest rate shocks by Shatha, Thikraiat, and Ruba (2014) for a cross section of nine Arab countries comprising of Egypt, Tunisia, Algeria, Sudan, Morocco, Lebanon, Syria, Palestine and Jordan.

Thayaparan (2014) examined the impact of inflation and economic growth on unemployment in Sri Lanka using ADF and Granger causality tests. Results shows that coefficient of inflation is negative and statistically significant on unemployment whereas GDP although positive, has no significant effect on unemployment. Madito and Khumalo (2014) investigation of the nexus between economic growth and unemployment in South Africa using the vector error correction model (VECM) found reversed relationship between the variables in South Africa. This was contradicted by Al- Habees and Rumman (2012) in Jordan and Lavinia, Barbu, and Silvia (2013) in Romania.

Brigitta (2015) analyzed the impact of exchange rate regimes on economic growth sourcing data from seventy-four countries comprising majorly of developing countries. The researcher used a combination of both descriptive analysis and a multiple regression model to analyze his results and it was found that there is indeed a significantly positive correlation between fixed regimes and economic growth, by using inflation rate and gross capital formation as a percentage of GDP as the control variables. This evidence was in agreement with the findings in *Livio,* Elitza and Maurizio (2016) who carried out a review on the real exchange rate and economic growth using external instruments with data gotten from over a hundred and fifty countries comprising majorly of developing countries. Qaisir, and Kasim (2009) further investigated the non-linearity between inflation rate and GDP growth in Malaysia using autoregression (TAR) points to the fact that the relationship between inflation rate and economic growth is nonlinear.

Contrarian findings was recorded by Khan and Senhadji (2011). The Saymeh and Orabi (2013) review of the effect of interest rate, inflation rate, GDP on real economic growth rate in Jordan using the GARCH model indicated that inflation causes interest rate and that on the other hand all other variables (Real GDP, nominal GDP) are independent of each other. This is also different from Hussain and Shahnawaz (2011) evidence from Pakistan. Indeed, Limam (2015) found unidirectional causality running from inflation to economic growth in Mauritania. This was contradicted by the findings of Mbulawa (2015) in Zimbabwe. Other researches include Agalega and Antwi (2013) in Ghana, contradicted by the findings of Chugtai, Malik and Aftab (2015) in Pakistan. However, Tridico (2013) findings were different. While studying the determinants of economic growth in emerging economies using OLS, carrying

out the granger causality test and correlation matrix, he found both human capital and export capacity are important for economic growth.

2.2.3. Empirical Evidence in Nigeria

Adeniran, Yusuf and Adeyemi (2014) investigated the impact of exchange rate fluctuation on the Nigerian economic growth using OLS method, correlation and regression analysis and found that interest rate and rate of inflation have negative impact on economic growth, but this is not so significant. Also found was that exchange rate has positive but not significant impact on economic growth. This was supported by Rasaq (2013) and Obrimah (2015). Contrary findings were reported by, Azeez and Kolapo (2012) and Okorontah and Odoemena (2016).

However, Nwoye, Obiorah and Ekesiobi (2015) inquired about the effect of Nigeria's macroeconomic environment on the performance of the national economy. Using the OLS method and found that unique relationship exists between the country's national currency exchange rate to a US dollar, inflation rates, monetary policies, and the extent or level of GDP growth the country. Agwu (2014) obtained a different result while carrying out a survey on factors that contribute to economic growth in Nigeria with data for the period between 1981 and 2012 using the VECM model.

Omoke (2010) inquired on the effect of interest rate fluctuation on the economic growth of Nigeria between 1970-2010 using the OLS method and obtained evidence that there existed an inverse relationship between interest rate and economic growth in Nigeria. These findings were supported by Babalola, Danladi, Akomolafe and Ajiboye (2015), and Shuaib, Augustine and Ogedengbe (2015). Akeju and Olanipekun (2014) examined unemployment and economic growth in Nigeria through the use of ECM and Johansen Co-Integration test with data set from 1980-2010. The evidence of the study revealed a there is both the short and the long run relationship between unemployment rate and output growth in Nigeria. Yet, Arewa and Nwakanma (2012) and Oloni (2013) had come to a different conclusion.

Arising from the literature review, contradictions exist. Several researches considered the variables of interest individually in relation to economic growth and where such researches have considered an aggregation of these variables some did not capture all the variables of interest in their various researches. This study will bring the various variables of interest (inflation rate, interest rate, exchange rate, unemployment rate) with the aim of evaluating whether or not these variables drive economic growth measured by GDP or whether current growth (current GDP) is driven by past income (prior GDP).

3. METHODOLOGY

The ex-post facto design was adopted in evaluating the relationship amongst the macroeconomic variables (inflation, interest rate, exchange rate and unemployment) and the lagged economic growth in Nigeria. The study which covers forty years from 1976 to 2015 is broad enough to capture major economic trade cycles. Data was sourced from several CBN statistical bulletin and the World Bank data.

3.1. Theoretical Framework and Model Specification

Arising from the multiplicity of theories underlining the macroeconomic variables, as presented in section 2, this research is predicated on Keynesian IS-LM framework which links both the Augmented Solow growth theory and the endogenous growth theory. The former considers investment in human capital as a driver for economic growth which can be achieved through capital accumulation. For capital to be acquired however, the decisions made as regards to interest rate have to be reasonable as it determines the kind of capital that is existent in an economy (whether it is domestic or foreign). Reduction in interest rates triggers inflation and affects the level of investment as people have more capital to purchase goods and services and employment level. This is captured in the liquidity and price puzzles of the Keynesian IS-LM framework. The endogenous growth model also follows a similar manner as the augmented Solow growth model. According to this model, capital accumulation is key for economic growth, but much emphasis is placed on technological progress. The Solow growth model and its augmented version as denoted by Mankiw, Romer and Weil (1992) is presented as:

$$lnY_t - ln\,Y_0 = -lnY_0\left(1 - e^{-\lambda t}\right) + lnA_t\left(1 - e^{-\lambda t}\right) + \left(1 - e^{-\lambda t}\right)\frac{\alpha}{1-\alpha-\beta} lns_k + \left(1 - e^{-\lambda t}\right)\frac{\beta}{1-\alpha-\beta} lns_h - (1 - e^{-\lambda t})\frac{\alpha+\beta}{1-\alpha-\beta} ln\,(n + g + \delta) \quad (1)$$

Where: economic growth as measured by differences in output (Y) is determined by the level of technology (A_t), the rate of technological progress (g), the initial output per worker ($y_\circ$), the savings rate (s_k), the share of capital in output (α/β), the rate of convergence to the steady state (λ), the depreciation rate (δ), the growth of labor force (n) and investment in human capital (s_h).

The applied estimation model for this research is adapted from the work of Onakoya, Fasanya and Agbojuale (2013). The original model made use of the Keynesian IS-LM framework with consideration given to the liquidity puzzle, the price puzzle and the exchange rate puzzles. The original model used in the work is given as:

$$\Delta GDP = \alpha_0 + \alpha_1 \Delta GDP_{t-1} + \alpha_2 \Delta M2_{t-1} + \alpha_3 \Delta IR_{t-1} + \alpha_4 \Delta INF_{t-1} + \alpha_5 \Delta REER_{t-1} + \alpha_6 \Delta ER_{t-1} + Ut \quad (2)$$

Where $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6$ are parameters for GDP, money supply, interest rate, inflation rate, real exchange rate and external reserve.

The adapted model eliminates external reserve and money supply and incorporates unemployment rate. For the purpose of this research, the model to be adopted is specified as

$$lnGDP_t = \beta_0 + \beta_1 lnINF_{t-1} + \beta_2 lnINT_{t-1} + \beta_3 lnEXC_{t-1} + \beta_4 lnUNEMP_{t-1} + Ut \quad (3)$$

Where β_0, β_1, β_2 β_3, β_4 and β_5 are parameters of the model which are economic growth (GDP), interest rate (INT), exchange rate (EXC) and unemployment rate (UNEMP) respectively; U_t is the disturbance term.

3.2. Method of Data Analysis

This study deployed a three-prong approach in the estimation process. The first step is the determination of the distribution normality of the variables using descriptive statistics. This is followed by the testing of the stationarity. A stochastic process is said to be stationary if its mean and variance are constant over time and the value of covariance between two time periods depends only on the distance or lag between two time periods and not on the actual time at which the covariance is computed. The Augmented Dickey Fuller (ADF) and Phillip-Perron (PP) tests are applied in order to avoid spurious regression results.

The second phase is to determine the presence of long-term cointegrating equation among the variables specified in the model using the Autoregressive Distributed Lag (ARDL). This is after determining the appropriate Lag Length using the likelihood ratio (LR) test. The selection of appropriate lag length ensures that the residuals do not have significant autocorrelation which may lead to inconsistent least square estimates (Enders, 1995). The study will deploy the LR test with Schwarz Information Criterion (SIC) as well as Akaike Information Criterion (AIC) statistics. These lag selection criteria enable one to select the smallest lag order without impairing on the degrees of freedom. The Vector Error Correction Model will be estimated to determine the short-run relationship. The Bounds test will be conducted to know the long run relationship of the variables. The Toda Yamoto Causality test to understand the direction of causality

The final phase is the post estimation tests to confirm the robustness of the estimated model. These are the Breusch-Godfrey test to check for any form of auto correlation among the variables, the heteroskedasticity test and the Impulse Response analysis of the dependent variable with respect to shocks in the explanatory variables. Given the possibility of existence of multicollinearity because of the nature of time series, which may affect the validity of the estimated result, the study will strive to reduce its effect by using the centered values of the variables. This will be done by computing the mean of independent variable, and then replacing each value with the difference between it and the mean ($Y-\bar{Y}$). The use of the E-views as an estimation

tool will be deployed to remove the collinear variable from the analysis. Results obtained was tested for compliance with economic theory

4. FINDINGS AND DISCUSSIONS

4.1. Preliminary Analyses

This section covers the descriptive statistics and stationarity test which are presented in turns.

4.1.1. Descriptive Statistics

The series descriptive statistics are presented in Table 1.

Table 1.: Descriptive Statistics of the Variables

STATISTIC	LNGROSSDP	INF	INTR	LNEXC	UNEMP
Mean	31.04	19.89	13.29	3.75	10.89
Median	30.82	11.90	10.28	4.67	11.15
Maximum	31.88	72.84	43.57	5.54	27.40
Minimum	30.36	5.38	0.37	0.11	1.80
Std. Dev.	0.51	18.66	11.19	1.52	7.65
Skewness	0.42	1.57	1.25	-0.82	0.65
Kurtosis	1.60	4.044	3.95	2.53	2.34
Jarque-Bera	3.52	14.56	9.51	3.92	2.81
Probability	0.171	0.001	0.008	0.141	0.245

Source: Authors' computation using E-views 8.0 (2018).

The preliminary data and summary of the statistics of the variables were presented in Table 1. The large difference between the minimum and maximum values of the series gave the result that there is a significant variation in the trends of the variable over the period of consideration. Also, the results based on the statistical distribution of the series shows that the series are positively skewed except exchange rate.

The values, Exchange Rate, Gross Domestic Product, and Unemployment Rate are platykurtic in nature since their values for kurtosis is 2.53,1.60 and 2.34 respectively and are less than 3 thus indicates a higher than normal distribution. The variable, Inflation Rate and Interest rate has 4.04 and 3.95 as a result which signifies that it is leptokurtic because it is greater than 3 indicating a flatter than normal distribution. The Jacque-Bera statistics is a goodness of fit to check whether the sample data have the skewness and kurtosis matching a normal distribution. The result shows

that there is non-normality in all the variables because all the variables are greater than the standard threshold of 2.

4.1.2. Stationarity Test Results

The unit root test results are presented in Table 2.

Table 2.: Unit Root Test Results: Augmented Dickey Fuller Test and Phillip Perron est

Series	Augmented Dickey Fuller		Phillip Perron		Order of integration
	Critical Value 5%	Test at first difference (Prob.)	Critical Value 5%	Test at first difference (Prob.)	
LNGDP	-2.96	-4.31 (0.00)	-2.96	-4.98 (0.00)	I(1)
INF	-2.98	-3.64 (0.01)	-2.96	-6.10 (0.00)	I(1)
INT	-2.98	-4.95 (0.00)	-2.95	-6.60 (0.00)	I(1)
LNEXC	-2.97	-4.99 (0.00)	-2.96	-12.07 (0.00)	I(1)
UNEMP	-2.96	-5.47 (0.00)	-2.96	-4.27 (0.00)	I(1)

Source: Authors computation using E-Views 8.0 (2018).

The application of Augmented Dickey Fuller test and Phillip Perron test shows all the variables stationary at first the difference meaning the use of the Ordinary Least Square (O.L.S) estimation technique is unsuitable. The Johansen cointegration test is applied for determining the long-run relationship amongst the variable. This method as designed by Johansen (1988) and Johansen and Juselius (1990) are based on an unrestricted vector autoregressive (VAR) model which is specified in the form of error-correction model. Prior to this estimation, the optimal lag length will have to be calculated because the cointegration technique is lag sensitive.

4.2.Estimation Results

4.2.1. Optimal Lag Length Selection

The lag selected length expounds the consequential implication of the previous year's result of previous year on the current year. The result is provided in Table 3.

Table 3.: Optimal Lag Length Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-375.30	NA	70.548.03	25.35	25.59	25.43
1	-261.73	181.71*	197.70*	19.45*	20.85*	19.90*
2	-242.38	24.52	335.22	19.83	22.39	20.65

** indicates lag order selected by the criterion*
HQ = Hannan- Quinn information criterion

AIC = Akaike information criterion
LR = sequential modified LR test statistic (each test at 5% level)
SC = Schwarz information criterion
FPE = Final prediction error
Source: Authors computation using E-views 8.0(2018).

The different criterion selected disparate optimal levels. As advised the lowest lag length as prescribed by the Schwarz information criteria (1) is selected. The next step in the estimation process - the Co-integration is presented in the next section.

4.2.2. Cointegration Test Result

Two kinds of tests considered under the Johansen cointegration technique are the Eigenvalue and Trace statistic tests. The Trace statistics in examining the null hypothesis assumes that the number of distinct cointegrating vectors (r) is more than the (*r*) against a general alternative. On the other hand, the maximal eigenvalue tests measures (r) against the alternative of r+1 cointegrating vectors. The respective equations are as follows:

$$\lambda\text{trace} = -\text{T} \sum_{i=r+1}^{n} \ln (1 - \lambda_i^2) \quad (4)$$

$$\lambda\text{max} = -\text{T} \ln (1 - \lambda_{r+1}) \quad (5)$$

Where:
λ_i = the estimated values of the ordered eigenvalues
T = the number of the observations after the lag adjustment.

The Johansen Co-integration result based on hypothesized 5 percent level of acceptance is reported Table 4.

Table 4.: Result of Johansen Co-integration test based on Trace Statistic and Max Eigenvalue

No. of CE(s)	Trace Statistic				Max. Eigen Value		
value	Eigen	Trace Statistic	Critical Value 0.05	Prob.**	Max-Eigen Value	Critical Value	Prob.**
None *	0.79	86.11	69.82	0.00	44.84	33.88	0.00
At most 1	0.53	41.28	47.86	0.18	21.76	27.58	0.23
At most 2	0.39	19.51	29.80	0.46	14.14	21.13	0.35
At most 3	0.14	5.38	15.50	0.77	4.38	14.27	0.82
At most 4	0.03	1.00	3.84	0.32	1.00	3.84	0.32

*Notes:*Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
Max-eigenvalue test indicates 1 cointegration at the 0.05 level
** denotes rejection of the hypothesis at the 0.05 level,**MacKinnon-Haug-Michelis (1999) p-values.*
Source: Authors computation using E-views 8.0 (2018).

The Johansen co-integration test was optimized at none using both the Trace statistic and Max-Eigen Value respectively which means the absence of a long-run connection between the gross domestic product and inflation rate, interest rate, exchange rate and unemployment rate. The result of the estimated long-run relationship is presented in Table 4.

4.2.3. Vector Error Correction Model

In order to know the existence of possible short-term relationship, the Vector Error Correction Model is estimated. This is done by integrating the multi-variate time series, the dynamics of which assists the maintenance of the equilibrium in the long-run. The result is reported in Table 5.

Table 5.: Vector Error Correction Model (VECM) Result.

Error Correction:	D(LNGDP)	D(INF)	D (INTR)	D(LNEXC)	D(UNEMP)
CointEq1	-0.10	-10.39	17.67	-0.15	4.36
s.e.	(0.04)	(12.52)	(9.58)	(0.22)	(2.88)
T-stat (Cal)	[-2.35]	[-0.83]	[1.85]	[-0.67]	[1.51]

Source: Authors computation using E-views 8.0 (2018).

The null hypotheses are accepted since the tabulated absolute T-stats value (2.04) is greater than the calculated absolute value INF (0.83), INTR (1.85), LNEXRATE (0.67) and UNEMP (1.51). This means that no short run association exists among Real Gross Domestic Product and Inflation Rate, Interest Rate, Exchange Rate and Unemployment rate. After normalization with respect to the independent variable, the result of the VECM is presented in Table 6.

Table 6.: Result of Vector Error Correction Model Regression Test

Variable	Co-Efficient (After Normalization)	Standard Error	T-Statistic
LnGDP	1.00		
INF	-0.01	0.00	-3.42
INTR	0.02	0.01	2.70
LnEXC	0.02	0.05	0.34
UNEMP	0.06	0.01	6.30

Source: Authors Computation using E-Views 8.0(2018).

The estimated model is shown in equation 6

$$= -0.01\text{INF} + 0.02\text{INT} + 0.02\textit{LnEXC} + 0.06\text{UNEMP} \quad (6)$$

R-squared: 0.41 Adjusted R-squared: 0.03

The equation (6) means that a negative relationship exists between *LnGDP* and inflation rate. This relationship is statistically significant at 5 percent since the absolute calculated t statistic (3.42) is greater than tabulated t-statistics (2.04). A percentage increase in inflation rate would result in a reduction in *LnGDP* which corresponds with the apriori expectation and both variables were statistically significant. However, a positive relationship existed amongst *LnGDP, INTR, LnEXC and UNEMP* and all the variables were statistically significant *with LnGDP* except *LnEXC*.

The R-squared is 0.41 means that approximately 41% of the variations in *LnGDP* is explained by *INF, INTR, LnEXC*and *UNEMP*. The next in the estimation phase is the conduct of some post-estimation tests to check the validity of the model.

4.3. Post-Estimation Tests

The results of serial correlation, autocorrelation of the residuals and heteroscedasticity tests are presented in the next sub-sections

4.3.1. Serial Correlation (Breusch-Godfrey Lm) Test

The result of the serial correlation test between the variables using the Breusch-Godfrey Lm test is in Table 7.

Table 7.: Serial Correlation (Breusch-Godfrey LM) Test

F-statistic	5.30	Prob. F (2,25)	0.00
Obs*R-squared	0.00	Prob. Chi-Square (2)	1.00

Source: Authors computation using E-views 8.0 (2018).

The absence of serial correlation is confirmed since the chi-square probability value of 1.00 is greater than the 5% significance level.

4.3.2. Heteroscedasticity (Breusch-Pagan) Tests

The absence of heteroscedasticity is one of the basic assumptions of OLS. The result of the heteroscedasticity is presented in Table 8.

Table 8.: Result of Breusch-Pagan-Godfrey Heteroscedasticity Test

F-statistic	0.20	Prob. F (4,26)	0.94
Obs*R-squared	0.92	Prob. Chi-Square (4)	0.92
Scaled explained SS	2.22	Prob. Chi Square (4)	0.70

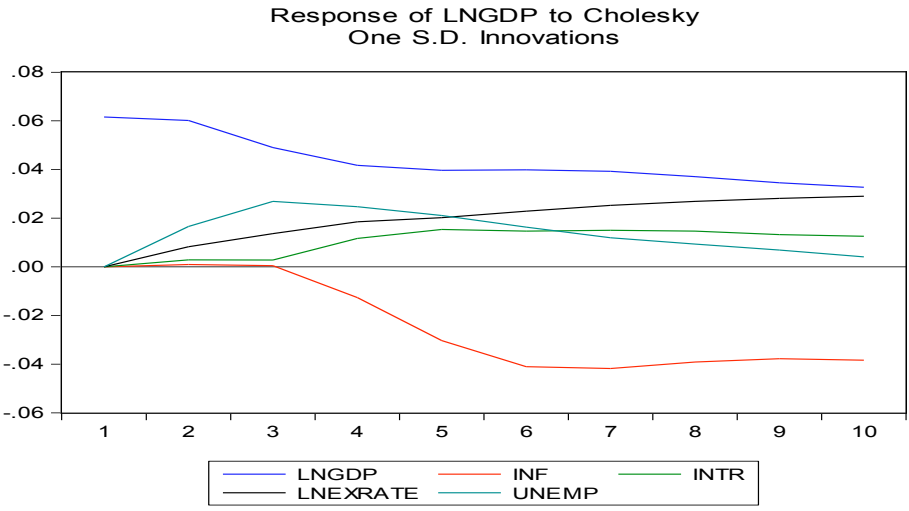
Source: Authors computation using E-views 8.0 (2018).

After estimation, result shows that the Probability or P Value of the Obs* R-squared is 0.94 which is greater than 5% significance level. In effect, this is the absence of heteroscedasticity.

4.3.3. Impulse Response Function

The response of variables to the introduction of shocks assailing the economic system is captured by the impulse response function which describes the impact along a specified time horizon. The response on GDP shock is presented in Figure 1.

Figure 1.: Response of LNGDP to Cholesky One S.D. Innovations



Source: Authors.

The Impulse Response function in Figure 1. corroborates the findings of the Johannsen cointegration test that except for inflation rate, all other macroeconomic variables responded positively to economic shock. One standard deviation positive shock of GDP caused inflation level to fall from the first year and drastically from the third year.

4.4. Discussion of Findings

The review of each of the macroeconomic variables reveals mixed results. Whereas a negative relationship existed between inflation and economic growth, the contrary nexus obtained for interest, exchange and unemployment rates. The underlining theories for the research are the Augmented Solow growth and the

Endogenous growth theories. Both theories were linked to the Keynesian IS-LM framework which was the original theory for which the model adapted for this study was based on.

In the case of Inflation, the influence of inflation economic growth is widely debated. Contrary to the findings of Mallik and Chowdhury (2001) and Ojonye (2015) but in line with the findings of Babalola et al (2015) the presence of inflation negatively influences the growth of an economy. The inflation-growth effect is however non-linear. As postulated by Gillman, Harris and Mátyás, (2000) when the level of the rate of inflation rises above a certain high threshold, the impact falls monotonically until the effect is nil. Thereafter, the effect turns positive. In essence, the impact of rising inflation becomes marginally stronger at zero nominal rate of interest and increasingly manifest in small magnitude with it rises.

The inflation rate as the last quarter of 2016 stood at about 18.3% as a result of the target level of inflation by the Central Bank of Nigeria. Indeed, this high level of inflation is coupled with high unemployment rate. The latter was 10.63% on the average from 2006 until 2016. The unemployment rate reached an all-time height of 19.70% 2009 Q4 and lowest value of 5.10% in 2010Q4 (Trading Economics, 2016). This stagflation condition of simultaneous increase in both inflation and unemployment provides explanation for the deleterious impact of inflation on the economic growth.

The results of the study conform to the predictions of the Augmented Solow growth and Endogenous growth theories on interest rate, as the current value of interest rate, its two to three past period values impacted positively on the growth of the Nigerian economy. (Figure 1 - Impulse Response Function). The one period value contributed positively on economic growth to the tune of 0.02%. The result of the study thus confirms that increasing level of interest rate is desirable but needs to be synchronized with other monetary and fiscal policies to drive economic growth.

In the case of exchange rate, it is viewed that in the short run, increasing level of exchange rate has no effect on the growth of the economy. The impact is positive and significant in the long-run. The appreciation of local currency value was indeed a boost for economic growth as per the findings of this study. This scenario is explained by the fact that although attempts have been made by the Central Bank of Nigeria to liberalize the foreign exchange market, the lack of export depth and autonomous foreign currency sources has forced the monetary authority to largely settle for managed float. The government is dependent of the crude oil and gas oil sector which although contributes about 10.29% of total real GDP (National Bureau of Statistics, 2016) and accounts for 70% of government revenue and 90% of its foreign exchange earnings (Export.Gov, 2017. The price of crude oil export is exogenously determined by the Organization of Petroleum Exporting Countries (OPEC) and other players in the international oil market.

The import of these is that the economic growth of the country has been on the ascendancy throughout the study period notwithstanding the value of its currency.

This is inconsistent with the predictions of the augmented Solow growth theory which predicts that the expensive nature of a country's exportable caused by an inflow of foreign currency through increased interest rate makes the value of domestic currency too high and consequently reduces the level of growth experienced in the current economic growth. Finally, although the unemployment rate is expected to contribute positively to economic growth is in line with Fuad (2011) in Jordan due to selectivity in the choice of job types by the nationals (manual jobs are shunned). The investigation by Oloni (2013) in Nigeria revealed positive but insignificant relationship between employment and growth. The postulation of Okun's law (1962) the result showed that unemployment rate had no impact with GDP in the short-run, but significantly contributed positively to economic growth in the long-run. This view holds that unemployment does not immediately impact economic growth in the short run, as people still have savings to augment their standard of living. However, as this savings is depleted, the standard of living is eroded, which thus reduces their disposable income and effective demand.

5. CONCLUSION

By itself, macroeconomic stability does not guarantee high rates of economic growth. Key institutional and structural measures are required in order to engender sustainable high rates of economic growth. These include trade liberalization, openness of governance, regulatory reform, financial sector reform, privatization, public service reform, inclusive growth programmes and institutional fight against corruption (Brian, Brown, Devarajan, & Izquierdo, 2001). The result of this investigation into the nexus of the macroeconomic factors with economic growth is mixed and supports this position. The management of the five key macroeconomic variables is an arduous task even in developed economy. This is made more difficult because the Nigerian economy is largely dependent on crude oil for its foreign earnings. This reliance renders some of its fiscal and monetary policies prostrate to the vagaries of international trade and oil politics. The country experiences stagflation, a condition of simultaneous increases in both inflation and unemployment.

Given the preponderance of exogenous influence on the efficacy of both the fiscal and monetary policies, the government is enjoined to continue the diversification of the economic base of the country. Also, the Central Bank of Nigeria is enjoined to consider the continued adoption of the concept of inflation targeting to target the level of inflation that is consistent with the growth target of the economy which will ensure the stability of prices and consequently improved economic growth.

The study also recommends that beneficial policies with trickle down effects be deployed by the fiscal and monetary authorities. Social policy that leads to transfer of resources to the poor rural area is recommended, as this will aid their spending power which obviously impacted positively on their current income.

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