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UPSKILLING TEACHERS AND TRAINERS IN ENTREPRENEURSHIP EDUCATION AND ENTREPRENEURIAL PEDAGOGY: TRANSFORMING POLICIES AND THEORIES INTO INNOVATIVE PRACTICE

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Abstract
Entrepreneurship education faces several challenges related to pedagogical-didactic principles and methodologies adopted in delivering entrepreneurial learning. More than half of EU member states have limited or no guidelines for entrepreneurship teaching, while the training of teachers and trainers emerges as an imperative need. Hence, the present manuscript attempts to discuss the pedagogical theories and principles based on which the InnoGFEED project was developed. The authors discuss the rationale, objectives and expected impact in relation to policy conclusions and recommendations, contributing to the broader dialogue on pedagogical and methodological considerations that need to be taken into account regarding entrepreneurship education.

JEL Classification: L26, Z19
Keywords: Innovation, Training of trainers, European Policies, School Education, Audio-Visual Resources

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1. Introduction

Entrepreneurs contribute significantly to the economic development of their countries by introducing new products and services that improve people's lives and create jobs (Acs & Szerb, 2007; Ribeiro-Soriano, 2017). The Greek Government, as well as several policy makers and academics, have proposed entrepreneurship as a path leading to the economic revival of the country highlighting that entrepreneurship is also important during periods of crisis (Amorós *et al.*, 2019). Nowadays, the world is facing a new challenge related to the COVID-19 crisis, in which the role of entrepreneurs may be crucial for the remediation of the post-COVID-19 world. According to Haeffele (2020), a wave of innovation has been unleashed; along with the agility and risk-taking of entrepreneurs, this combination creates promising conditions for ending the crisis and contributing towards a quick recovery. This potentiality has, in turn, led many countries to invest in the promotion of entrepreneurship education (Valerio *et al.*, 2014). The European Commission (2016) has already acknowledged that entrepreneurship education plays a central role in developing an entrepreneurial culture that encompasses not only the creation of new businesses, but also the cultivation of entrepreneurial values (UNESCO, 2008) and characteristics, such as risk taking, independence, creativity and innovation.

The impact of entrepreneurship education may be evident across all school levels, as well as at different organizational levels; in other words, entrepreneurship education may have an impact on individuals, institutions, the economy, and the society. For instance, students who attend entrepreneurship education courses in higher education might change their career aspirations and ambitions (Boldureanu *et al.*, 2020), whereas educational institutions that deliver entrepreneurship education have observed higher motivation, engagement, and deep learning among students (Lackéus, 2015). As for the economy, businesses created by further education staff and alumni offer new job positions and may have higher turnovers; it has also been demonstrated that entrepreneurship education may have a positive impact on societies through supporting individuals at risk of social exclusion (Schaper & Volery, 2007; Sarri *et al.*, 2012; European Commission, 2016).

Higher education institutions adopted entrepreneurship education by offering compulsory and elective courses, as well as complete study courses (leading to bachelor and master's degrees) in entrepreneurship (Shane 2004; Wright *et al.*, 2007; Sarri *et al.*, 2018). However, primary and secondary education were less responsive in adopting entrepreneurship education. The majority of EU countries have not (so far) introduced entrepreneurship as a separate subject in primary schools, but, rather, as a transversal topic associated with the development of skills, such as creativity, critical thinking, self-awareness and initiative taking; it also includes content knowledge (e.g., business understanding) based on autonomous and active forms of learning including role-playing games, presentation of simple examples and visits to

local businesses (European Commission, 2016). Trainers in entrepreneurship can be academics, tutors, school teachers and guidance practitioners. However, these professionals are often inexperienced and need training to gain a common view and acquire knowledge, skills and professional competencies on how to provide entrepreneurship education, particularly, in primary and secondary education (Kakouris, 2009).

2. Entrepreneurship education and entrepreneurial pedagogy

Developing entrepreneurial thinking through education was a European Directive (Oslo Agenda, 2006) and since then, entrepreneurship has been acknowledged as one of the eight basic skills that should be cultivated based on the European Policy on Lifelong Learning (European Commission, 2019a). *"Entrepreneurship education is about learners developing the skills and mind-set to be able to turn creative ideas into entrepreneurial action. This is a key competence for all learners, supporting personal development, active citizenship, social inclusion, and employability. It is relevant across the lifelong learning process, in all disciplines of learning and to all forms of education and training (formal, non-formal and informal), which contribute to an entrepreneurial spirit or behaviour, with or without a commercial objective"* (European Commission, 2016: 21). Following this definition, the purpose of entrepreneurship education should be the development of an entrepreneurial culture, early in people's lives. In this respect, it should be noted that the concept of entrepreneurial culture is not only related to establishing a new business (Davis, 2002), but also involves embracing entrepreneurial values and characteristics including risk- and initiative-taking, creativity, innovation, and opportunity recognition (Deekins & Freel, 2007; Bateman *et al.*, 2018). It also entails cultivating skills that allow learners to manage their careers, as well as identify their strong and less powerful personal characteristics (Cedefop, 2011; OECD, 2016).

Cultivating such traits from a young age can support individuals in the future, not only in terms of creating their own business (Volkmann *et al.*, 2009; Martínez *et al.*, 2010), but also in terms of being creative and innovative in the context of an already established business (Hisrich, 1990), in the private or public sector, as well as in other aspects of their daily lives (Petridou & Sarri, 2011). Therefore, entrepreneurship education does not automatically imply the creation of new businesses. According to a Eurobarometer survey in 2012, only 28% of the participants attending entrepreneurship education and training programmes were interested in starting a new business, while 40% stated that they acquired useful skills for the future, such as decision-making, risk-taking and risk assessment (European Commission, 2012; 2013). Besides creating an entrepreneurial culture, which is an additional recommendation regarding the development of a new entrepreneurial ecosystem, refers to the interconnection and cooperation of those involved in en-

trepreneurship within the framework of the quadruple helix innovation model (Carayannis & Campbell, 2009). In other words, there should be interconnection of universities and other educational institutions with companies, the state, and civil society. Interaction of all these bodies and emphasis on collaborative processes and networking among various stakeholders and interest groups may create the necessary conditions for innovation in a country (Council of the European Union, 2004; European Commission, 2019b).

As far as higher education is concerned, entrepreneurship education was offered in the United States in the 1940s at Business Schools and expanded to become international and interdisciplinary (Katz, 2003; Kuratko, 2005; Solomon, 2007); since then, the spread of entrepreneurship courses in tertiary education has been spectacular. However, despite the immediate response of higher education institutions, provision of entrepreneurship education remains rather limited to primary and secondary education, as well as in vocational education and training, despite European guidelines pointing in this direction and bringing out the need of encouraging and supporting teachers accordingly (European Commission, 2016). In particular, the European report that discusses the evolution of entrepreneurship education in the EU (European Commission, 2015a) showcases a discrepancy across countries, since there are no available data for Greece (Kakouris *et al.*, 2016), while in many countries, such as Finland and Lithuania, entrepreneurship education permeates all levels of education. In addition, much of entrepreneurship education 'leaks out' of academic contexts and emerges in non-formal learning settings, in which, sometimes, uncertain teaching models and goals exist. However, even in academic entrepreneurship courses, fragmentation of content and difficulties in evaluation are both evident (Mwasalwiba, 2010; Fayolle, 2013); therefore, the attempt to link entrepreneurship education with clear policy objectives for education (e.g., curricula) is hindered.

Lackéus (2015) suggests that there are three distinct forms of entrepreneurship education. The first one refers to teaching "about" entrepreneurship and it is most compatible with the traditional teaching of Economics and Business Administration in higher education. The second form, teaching "for" entrepreneurship, aims to provide a practical approach to interested prospective entrepreneurs regarding entrepreneurial knowledge and skills, while the third form, teaching "through" entrepreneurship, adopts an experiential approach ensuring participants experience an actual entrepreneurial learning process (Canziani *et al.*, 2015), Kakouris, 2018, Kakouris & Liardogvas, 2019. However, entrepreneurship education refers to both content and pedagogical and didactic methods (Lackéus, 2013). In terms of content, it leads to specific subject knowledge (e.g., evaluation of ideas, marketing strategies, creation of business models), while, in terms of teaching methods, it develops and enhances students' entrepreneurial behaviour with a more practical orientation,

encouraging them to act based on initiative and to feel and do things based on the knowledge and the experience they have gained (Sarri & Zikou, 2014). This dual scope reflects the broader transition from posing content questions to questions related to learning and teaching observed over the last years. As Carrier (2005) highlights "*the most relevant question regarding entrepreneurial education is rather 'what should be taught and how it should be taught?*'…". Considering specifically the "*how it should be taught*" part of Carrier's question, entrepreneurial pedagogy appears to be a rather concrete field that provides a context in which current and future research may be promoted. Namely, entrepreneurial pedagogy refers to educational strategies deployed for teaching and assessing entrepreneurship and entails underpinning educational philosophies support the achievement of the learning outcomes intended. It examines the most appropriate learning strategies, the changing role of the entrepreneurship teacher and entrepreneurship evaluation (Lomine, 2012). Hence, entrepreneurial pedagogy can be regarded as the backbone of entrepreneurship education, in which learning theories are being translated into practice; it is manifested through the approaches, techniques, tools and methods trainers and educators adopt to deliver entrepreneurial learning rather than just entrepreneurship education.

3. Teachers' training in entrepreneurship education

Some of the "pathologies" of entrepreneurship education are endogenous, due to the nature of the subject (Bygrave & Hofer, 1991; Fiet, 2001), while others are exogenous, deriving from the institutional processes of education and the heterogeneity of teachers expected to deliver relevant content. As for the latter, the need for teachers' training in entrepreneurship is clearly obvious (Hytti & O' Gorman, 2004). In more than half of EU countries there are very few or no guidelines for entrepreneurship teaching methods (European Commission, 2010). In addition, entrepreneurship education is rarely part of teachers' training university courses and is more common in the context of continuing professional development (European Commission, 2016). As a result, teachers, in collaboration with external mentors, or through field visits to companies, are expected to incorporate elements of entrepreneurship in their lessons without any prior training and without implementing methodologies specified for clear educational goals. Considering the heterogeneity of entrepreneurship education, even in higher education, along with the dominant cognitive teaching model, the European Commission underlined quite early on (Oslo Agenda, 2006) the need for innovation in entrepreneurship education and the need for specialised teachers' training. Such innovation mainly entails experiential ways of learning and learning by doing (Dewey, 1938). Indicatively, according to a report published by the European Centre for the Development of Vocational Training (Cedefop, 2011), entrepreneurship education should be typically characterised by interactive and experiential methods, which require

students to take an active role in the learning process, while teaching should be based on real and authentic situations. Furthermore, simulations and educational games, usually including teamwork, business plan development and educational visits should be utilised.

Especially in secondary education, which addresses an audience with different needs than university students, simply 'copying' practices from higher education is not optimal. Class-based knowledge delivered through traditional didactic pedagogical approaches alone is not sufficient; on the contrary, experiential teaching is viewed as a more appropriate approach (Canziani *et al.*, 2015). Research shows that teachers in secondary education often have received no specific training in entrepreneurship and, therefore, have no knowledge about teaching entrepreneurship (Ierapetritis, 2017). This recognises the need for teachers' training as an important precondition for delivering entrepreneurship education (Korhonen *et al.*, 2012; Carvalho & Franco, 2015), since comprehensive teachers' training can significantly affect the delivery and effectiveness of entrepreneurship education in secondary schools (Blimpo & Pugatch, 2019).

Furthermore, studies of cultural elements and influences (e.g., Dodd *et al.*, 2013) have shown that there are stereotypes regarding the concept of entrepreneurship/an entrepreneur in various countries, which are proven difficult to address merely through case studies or standard practice in entrepreneurial teaching. Moreover, teachers are invited to facilitate this process with no (or limited) prior experience or knowledge about these issues and without tangible educational tools. The traditional approach of cultivating entrepreneurial "spirit" through lectures is not exactly appropriate for teaching or learning about entrepreneurship (Wahid *et al.*, 2017). On the contrary, there is a need for innovation by combining different learning tools and techniques that will support students to actively participate in understanding and practically applying innovative ideas. Based on relevant literature, learning tools and techniques that can be used include case studies, group discussion, business games, and video-film screenings (Maritz & Brown, 2013).

4. The Greek context

In Greece, the need to create an entrepreneurial culture at an early age is considered significant, mainly for two reasons. The first one relates to the economic downturn the country has been facing in recent years. However, it should be noted that the overall national rate of entrepreneurship remains at high levels, while Greece notches the second highest performance among innovative countries. Nevertheless, the dire economic situation and recession of the country shrank entrepreneurial initiatives considered sustainable (Ioannidis & Giotopoulos, 2014). This new economic and social reality requires from everyone, but mainly from young people, a change in mentality and the development of their skills, such as creative thinking and quick response

to current challenges if sustainable businesses and decent jobs are to be created. Another reason for promoting the establishment of an entrepreneurial culture from a young age is the fact that the attitude of Greek society towards entrepreneurship has not been positive ever since the post-colonial period (Barsakelis *et al.*, 2010). Until recently, entrepreneurs were treated as 'fraudsters', and profit from business activity was perceived in a negative light. In addition, barriers to entrepreneurship education arise from the fact that promoting entrepreneurship in schools is often interpreted as an attempt of the entrepreneurial community to infiltrate schools and divert their purpose corrupting their values through entrepreneurial commitment to profit (Sarri & Zikou, 2014; Sarri & Laspita, 2017). Within such a context, young people who want to start a new venture are more likely to avoid doing so. However, during the last few years, such dispositions began to change, allowing entrepreneurs to envision their future without the distortions of the past (Sarri *et al.*, 2012).

Regarding entrepreneurship education in Greece, attempts are being made to educate young people at several educational levels; yet, a great deal of effort is needed to discuss about an entrepreneurial culture given the Greek educational and training policies and systems. In primary education in Greece, but also in other European countries, there are rarely widespread initiatives and programmes managed and operated by national educational authorities (Sarri & Laspita, 2017). In Greek secondary education, entrepreneurial topics are introduced in the course "Basic Principles of Business Management and Administration" that explicitly deals with managerial and administrative operations within companies (Tilavaridou & Konstantelou, 2016). However, actions completed to date have been highly erratic, with no specific strategic planning. This is also reflected in teachers' training and in assessing actions' effectiveness, aspects that were ignored when designing and implementing school programmes that mainly target students in vocational education and training (VET) (Sarri & Laspita, 2017). At this point it should be noted that entrepreneurship education is a particularly attractive topic for VET providers, in almost all EU member states, since self-employment (and, therefore, the establishment of a business) is a realistic plan for most VET students (Cedefop, 2011).

Nevertheless, the most recent policy development related to entrepreneurship education entails the "Skills Workshops" introduced in pre-primary, primary and secondary education as of 2021 by virtue of Law 2539/B/24-06-2020 (Ministry of Education and Religious Affairs, 2020). It is a new initiative that targets students' 21st century skills including the 4Cs (creativity, collaboration, communication, critical thinking), as well as life skills, citizenship, digital skills, STEAM and entrepreneurship. Entrepreneurship constitutes one of the areas to be covered mainly focusing on entrepreneurship competence areas as defined in the European Entrepreneurship Competence Framework (Bacigalupo *et al.*, 2016). Additionally, workshops

are founded on active, experiential, and student-centred pedagogical approaches, such as inquiry-based learning, project-based learning, problem-based learning, flipped classroom teaching, design thinking and collaborative learning. Moreover, a dedicated platform with educational resources, practical examples and toolkits has been developed, while the Ministry has also created and offered a basic 36-hour professional development programme for all teachers in service.

5. Method

The present manuscript aims to discuss emerging pedagogical principles in entrepreneurship education, as reflected in the case study deployed, namely, the InnoGFEED (Innovation, Games, Films, Entrepreneurship Education) project. A case study is a specific example usually designed to reflect a more general situation (Nisbet and Watt, 1984), a process that helps readers to understand concepts more clearly, rather than present abstract theoretical principles (Cohen, Manion and Morisson, 2007). Based on Yin's (1984) distinction, the present case study is explanatory, as it attempts to pilot test and lead to a research hypothesis that may guide future research.

InnoGFEED is a project designed by the University of Macedonia (Greece) aiming at providing teachers with continuous innovative professional development experience, which considers the pedagogical methodologies related to students' learning. The reasons for selecting InnoGFEED as the case study of the present manuscript are as follows: Firstly, the project is an output of a joint interdisciplinary collaboration of researchers and academics from the fields of Entrepreneurship Education, Adult Education, Pedagogy and Audio-visual Education. Furthermore, the project introduces an experiential approach to entrepreneurship education, which attempts to actively engage participants in their learning process, while, at the same time, highlights the need for training teachers in innovative methodologies. Apart from the audio-visual resources described below (videogames, films, documentaries), the project will utilise and encourage further use of Information Communication Technologies (ICT) to promote entrepreneurial learning, such as digital storytelling, creation of presentations, timelines and conceptual maps, digital reflection diaries and collaborative tools. Hence, this is the first holistic project, designed and expected to be delivered at national level, and proposing a specific educational and methodological framework for teachers' teaching practice and respective preparation and training.

Concurrently, the present project is expected to contribute towards developing a self-assessment tool to be used by students to enable them to reflect on their entrepreneurial learning experiences. This feature attempts to contribute towards bridging the considerable gap in assessing entrepreneurship education (Pittaway & Edwards, 2012), considering the impact that entrepreneurship education has on learners, institutions and the wider economy and society (European Commission,

2015). According to Komarkova, Gagliardi, Conrads and Collado (2015), a variety of assessment methods may be used in entrepreneurship education, including formative and summative methods, as well as self-assessment. In order to further secure the validity and reliability of the self-assessment tool, the Guidelines issued by the National Foundation for Educational Research concerning the assessment of enterprise capability (Spielhofer & Lynch, 2008), as well as the European Entrepreneurship Competence Framework (Bacigalupo *et al.*, 2016) will also be taken into account. However, teachers will also be assessed before and after their participation in the training course, by completing an adaptation of the Sense of Initiative and Entrepreneurship (SIE) questionnaire (Morselli, 2018; Morselli 2019) in order to reflect on whether the training they have received had an impact on their own learning and way(s) of educating students.

6. The InnoGFEED intervention project

6.1 Goals and objectives

The goals of the InnoGFEED project comprise the development of innovative experiential methods regarding entrepreneurship education, the cultivation of students' entrepreneurial culture through attending comprehensive secondary schools and VET, as well as in-service training of secondary teachers in an innovative and experiential methodology. Concurrently, the project seeks to contribute to the broader dialogue concerning the integration of entrepreneurship in school education and the creation of a comprehensive national strategy to help, in the long run, prevent unemployment and social exclusion of young people (Council of the European Union, 2014) in Greece. Specifically, the goals of the project may be translated into the following concrete objectives:

- creating a thematic library related to various topics of entrepreneurship (women, youth, green, social, etc.) that will include national and international films and documentaries, using as leverage two regional festivals, namely, "Thessaloniki International Film Festival" and "Thessaloniki Documentary Festival"
- creating a thematic library with videogames related to the development of entrepreneurial skills; such videogames expect students to manage crises and make decisions based on data and resources available, simulating real life
- developing two toolkits to assist teachers in practically implementing in their teaching practice the methodology proposed:
    - the first toolkit is to comprise proposed teaching plans based on specific films, documentaries and videogames and include specific learning objectives and activities
    - the second toolkit is to focus on describing the methodology teachers will be able to use with any film or video game to achieve the learning goals set

- training teachers in the methodology and toolkits to be developed, as well as forming a community of practice in order to share and exchange best practices, as well as to enhance knowledge transfer
- pilot-testing teaching plans in general secondary education and VET
- creating the virtual InnoGFEED innovation hub, where all outputs described above are to be uploaded using a single point of entry.

Therefore, InnoGFEED seeks to highlight the importance of engaging secondary students in topics related to entrepreneurship and innovation and to "communicate" relevant content in the light of education. Additionally, the project attempts to construct an innovative methodological framework for teachers' training, based on the use of audio-visual material (films, documentaries, and videogames), that will be contextualised in teaching plans involving learning objectives, as well as experiential, reflective and assessment activities directly applicable in teachers' daily practices.

6.2 Methodological and pedagogical principles

The overall methodology of the project includes four parts. The first one refers to the development of educational material and the second to the methodology to be followed during teachers' training. The third part refers to the methodology of the learning process that will involve the ultimate beneficiaries, students attending general secondary education and/or VET; finally, the fourth part concerns students' learning assessment.

The selection of learning resources (films, documentaries, and videogames) will form two thematic libraries based on the "Re-C-Re" approach (Sarri, Mouratoglou & Laspita, 2020). The authors formulated the "Re-C-Re" approach including three main criteria for selecting these resources:

- *Relevance*: how/to what extent does the content of the resources relate to: a) entrepreneurship and/or innovation; b) learners' needs, and c) wider societal needs and challenges?
- *Contextualisation*: how/to what extent are the resources associated with a) existing school curricula and b) other non-formal (extracurricular) learning trends?
- *Reflection*: how/to what extent do the resources permit and promote a) individual and b) collective reflection?

Furthermore, based on Instructional Design key features, the educational and methodological toolkits will be student-centred, goal-oriented, focused on meaningful actions, capable of assessing results in a reliable and valid manner, empirical, repetitive, and constituting a team effort (Branch & Merrill, 2012).

Regarding teachers' training, the basic principles of adult education (Andragogy) will be deployed. The learning process will be directly related to participants' daily

lives and needs, taking into account their educational experience(s) (Knowles, 1973; Knowles *et al.*, 2005). In this way, learning will become a process of co-formation, promoting communication, learning motivations and active involvement in the team, in a friendly and collaborative climate. However, the project's research working group also considers the relevant critique of this theory and, in particular, the lack of a critical view that does not take into consideration the broader historical and sociocultural context in which the Subject acts (Brookfield, 1986). For this reason, the educational manual to include the teaching plans, will also attempt to develop and strengthen the dialectical relationship of the project with the broader historical, social, political, and economic conditions of the country, in order to address the need Donellon, Ollila and Williams-Middleton (2014) highlighted, namely, that the context is an important contributor to entrepreneurial identity, providing social cues that influence an individual's sense of belonging and/or differing from their social group. Concurrently, the project is to be linked to school subjects and modules included in educational curricula (both in general education and VET), so that not only will an interdisciplinary approach be highlighted, but also students will be immersed in a unified learning process aligned with their school content, which will be further enriched.

Regarding the community of practice to be developed, the theory of situated learning (Lave, 1988) will provide the guiding principles. The theory of situated learning comprises a socio-cultural theory that perceives learning as an activity taking place in a specific social and cultural context, interacting with the social and natural context (Lave, 1991). A prerequisite condition for characterising a community as a "community of practice" is the existence of a non-formal group of individuals, in this case teachers, who show interest in communicating and collaborating with each other on a specific topic, in a specific field (Wenger, McDermott & Snyder, 2002). Therefore, communities of practice are groups of individuals who share a common concern or passion and interact with each other in order to further improve their achievements (Wenger, 1998).

The learning process to engage school students and VET learners will be based on Kolb's (1984) learning cycle, in which learning begins based on some experience and may lead to a more abstract generalisation level in the form of reflective learning. In terms of this experience, the present project will be based on learners' "indirect experience" using films and documentaries. Jarvis (2006), expanding Kolb's theory, distinguished experiences as direct, that is, those the individual perceives through his or her senses, and indirect, that is, those communicated to individuals in some other way. As far as reflective learning is concerned, it should be noted that such learning does not entail a linear approach. On the contrary, the learning process develops in the context of reviewing and analysing experience(s) that can contribute to:

- *reflection,* reflecting on an experience and leading to a conclusion

- *reflective practice,* a process of having thorough knowledge of a skill and, therefore, a more concrete way of applying it in practice
- *experiential learning*, a process in which theory is applied and tested at the level of social reality (Jarvis, 1987).

Finally, the teachers who will participate in the training are to apply in their teaching practice with their students some of the proposed teaching plans. In order to be able to assess the impact of the proposed intervention with their students, a self-assessment tool will be developed, which is to include quantitative and qualitative items based on the 15 entrepreneurial skills and learning outcomes defined by the European Entrepreneurship Framework (EntreComp Framework) organised in three thematic areas (ideas & opportunities, resources & into action (Bacigalupo *et al.*, 2016).

6.3 Expected impact

The research-working group, taking into account contemporary national and international research evidence and recommendations, aimed to further consolidate and promote project effectiveness. Hence, the expected impact of the InnoGFEED project entails an aggregate of responses to several challenges addressed and has been organised at three levels, namely, the expected impact on teachers, students, and society in general. Specifically:

- for teachers, the project aims to contribute to:
  - their professional empowerment in teaching entrepreneurship, through the methodology to be developed and the corresponding training they will receive (European Commission, 2019b)
  - the renewal and enrichment of their teaching methods (European Commission, 2010), through using audio-visual resources in their teaching practices

    the connection of schools and VET teachers with higher education institutions (Council of the European Union, 2004)
- for students, the project aims to contribute to:
  - the cultivation and development of entrepreneurial skills from an early age (Volkmann *et al.*, 2009; Martínez *et al.*, 2010)
  - the promotion of entrepreneurial values and behaviour patterns, such as risk and initiative taking, creativity, innovation and opportunity recognition (Cedefop, 2011)
  - the cultivation of career management skills (European Lifelong Guidance Policy Network, 2015)
  - their active engagement and reflection in changing stereotypical perceptions and the promotion of equal access to entrepreneurship (Cedefop, 2011)
  - the establishment of an entrepreneurial culture that contributes to the formation of an active and responsible state (European Commission, 2015b)

- for society, the project aims to contribute to:
  - the connection of secondary schools (including VET) with local bodies, enterprises and authorities the aim being to promote cooperation with institutions and to diffuse their experience related to entrepreneurship (Council of the European Union, 2004; European Commission, 2019b)
  - the prevention of youth unemployment and social exclusion in Greece (Council of the European Union, 2014)
  - the cultivation of the ability to start new businesses and create new jobs (International Labour Organisation, 2004)
  - the innovation, in both private and public sectors, through shaping an entrepreneurial culture among students from an early age (Petridou & Sarri, 2011; European Commission, 2019b)

Finally, a crucial aspect of the expected impact, which involves teachers, students and society in general, refers to the conceptual and operational restoration of the content of entrepreneurship within secondary education (Varsakelis *et al.*, 2010; Sarri, Laspita & Patzelt, 2012). In other words, entrepreneurship is usually associated with concepts, such as money, profit, human exploitation, corruption, the dark face of globalisation, and so on, rather than with values, such as creativity, innovation, self-realisation, and social wealth creation.

7. Discussion

While there is extensive research on entrepreneurship education offered by universities, there is scarce research related to entrepreneurship education offered at earlier stages of learning (Rosique-Blasco *et al.*, 2016), such as during secondary education. The need for further research into innovative teaching methods and the training of the trainers becomes more imperative as we move towards a more digitalised era. In this respect, the authors highlight the need for adopting an interdisciplinary approach as early as the designing phase of entrepreneurship education programmes/courses. This collaborative interdisciplinary approach provides several insights concerning which pedagogical theories and methodologies may better fit the purpose and learning objectives set in the learning content, in a pragmatic way. In addition, the approach contributes to generating ideas that combine different elements and were not considered at an individual or a single-discipline level. Therefore, addressing interdisciplinarity at the stage of delivering the content is not enough.

Through the innovative approach proposed, the focus is on experiential learning concerning entrepreneurship using students' "indirect experience" (Jarvis, 2006) and, specifically, films, documentaries, and interactive video games. In general, the use of (various forms) art in education is multifaceted, aiming simply at acquiring knowledge, or at cultivation of skills or even at critical thinking (e.g., Kokkos,

2010). Considering that the added value of experiential learning lies in cultivating teamwork skills, promoting self-regulation and managing emotions, as well as assisting individuals maintain their focus on performance (Finch, Peacock, Lazdowski and Hwang, 2015), the project proposed provides some considerations for enriching current pedagogical implications. However, it should be highlighted that the learning theories and pedagogical principles underpinning such interventions should be in line with learners' needs, objectives, tools, and techniques utilised, as well as the assessment methods. This pedagogical continuum may better support the learning process denoting a holistic meaningful experience both for teachers/trainers/educators and students. Consequently, challenges pertaining to teachers' resistance or assessment may be proactively tackled (Lackéus, 2015).

Similar implications in entrepreneurship education are rare (e.g., Fleck and Rousu, 2014; Kakouris, 2014). Remarkable fiction (films) can be used, in addition to realistic recording (documentary), for students and teachers to discuss more complex issues related to entrepreneurship in a pleasant and more understandable way. Furthermore, the use of video games, a rather popular medium among students, is recognised as a tool for developing entrepreneurial skills in relevant research (Achtenhagen & Johannisson, 2013; Bellotti *et al.*, 2012; Romero, 2013). According to Csikszentmihalyi's "flow theory", real-world learning games seem to be gaining ground in entrepreneurship education (Jones, 2007; Neck & Greene, 2011). Therefore, the present project aims to provide pilot training for teachers and educators using a specific thematic collection of films and video games related to entrepreneurship, as well as a pedagogical methodology, the ultimate goal being to design better and more relevant education programmes/courses for early learning stages.

The present case study provides a practical reflection "approach" for selecting such learning resources in entrepreneurship education, based on (and extending) the principles of learning through entrepreneurship. The "Re-C-Re" approach (Sarri, Mouratoglou & Laspita, 2020) reflects the need of taking a "break" and considering three fundamental factors before deciding which learning resources will be used in a learning process. The first factor refers to resources' *relevance* concerning the learning content (in this case entrepreneurship education), learners' needs, as well as wider societal needs and challenges. The second factor is *contextualisation*, i.e., acknowledging the need that resources need to promote connectivity and interdisciplinarity both with curricular subjects (formal learning) and extracurricular (non-formal) learning trends; finally, the third factor refers to whether learning resources permit and promote individual and collective *reflection*.

Finally, the aim of the InnoGFEED is to provide learning through entrepreneurship and not learning about and for entrepreneurship. Even though the project is yet to be implemented, the authors consider that the impact anticipated is rather promising as it adopts an interdisciplinary approach from its design stage, it gathers and

synthesises research evidence and addresses key policy priorities. At the methodological level, the underpinning foundations of learner's centrality, the experiential learning method and the assessment of entrepreneurial learning denote that the project proposed can be considered a meaningful holistic experience both for the teachers/trainers/educators and the students. At the same time, the endeavour illustrates the complexity of designing an educational project and indicates directions for further research in the areas of instructional design, teachers' professional development and pedagogy in entrepreneurship education.

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WOMEN'S LIVELIHOOD CHOICE, AND BARGAINING POWER: A CASE OF FARM HOUSEHOLDS IN OGUN STATE, SOUTHWEST, NIGERIA

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Abstract

This study examines how women's participation in multiple income-generating activities influence their decision-making power; it is based on in-depth interviews of 366 rural women in Ogun State, Nigeria. Women's bargaining power was estimated using Principal Component Analysis, and the Herfindahl index was used to estimate their income diversification. Results found that women were better off than men in two decision-making domains, food purchases, and harvest use. Farm income explained 54.4% of women's income in total household income. 70.3% of women have low bargaining power. Their participation in multiple income portfolios results in higher level of bargaining power.

JEL Classification: B54, C78, Q12

Keywords: Decision Making, Diversification, Farm, Gender, Women

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1. Introduction

Globally, women shuffle work with family responsibilities, and the situation in Nigeria is no exception. Entering marriage at a young age and developing a family play an important role for job access among women and it is a more critical issue for those from rural households (World Bank, 2015). Enfield (2019) stated that, at the age of 20, 4% of men are married, compared to about 50% of women. Women miss out on labour market opportunities since early marriage is followed by early pregnancies and household responsibilities (Egwurube, 2016).

Compared to men, women are being hindered from accessing labour market opportunities of all kinds, and they are more likely to be engaged in the lower level of income-earning livelihood opportunities, such as farming and informal jobs/employment (World Bank, 2015). The proportion of women involved in farming-related activities holds them back in low-paid jobs (World Bank SCD, 2018). Ekerebi and Adeola (2017) highlighted the wide gap in the agricultural harvest value between women and men farmers in Nigeria and stated that the backbone of the agricultural sector is women, since they are more involved in a wide range of farming activities, accounting for 60-80% of all farm labour. However, despite these important roles, women are still limited in terms of access to productive resources and decision-making power over their farm plots (FAO, 2011). As regards farming activities, women are, in general, at a disadvantage (Yigremew, 2005) as they are confronted with limited access to labour markets and are paid lower wage rates than men.

Agriculture has failed to guarantee sustainable livelihood despite being the main source of income for farm households in Sub-Sahara African countries (Babatunde, 2013). Sub-Saharan African agricultural activities are characterised by small farm sizes, low output levels, and a high level of subsistence farming (Jirstrom *et al.*, 2011). This has means that farming cannot provide sustainable means of livelihood, making farm households adopt non-farming and off-farming livelihood coping strategies. Ajani and Igbokwe, (2013) further explained that for household food security and income to be sustainable, there is a need for diversified income portfolios among farm households. According to Ellis (2000), one of the survival strategies for these farmers has been to diversify their household income sources.

World Bank (2019) posited that Nigeria had a working-age population of 110 million and 85 million are active in the labour force of which 45.5% percent were female in 2017. There is a positive development in the participation of women in both formal and informal labour markets and this has been an increasing trend from 1990 to 2009 (Olowa and Adeoti 2014). Oluwagbemiga *et al*., in 2016, found that the categories of women who are more likely to be empowered are those who are involved in work away from home, especially in a non-familial organization, having formal wage paid jobs, and full-time and permanent paid employment.

Despite the opportunities that paid employment provides, the participation of married women in paid jobs is controlled by men. However, studies conducted in India and Bangladesh found that a positive relationship exists between women's economic involvement and women's resistance against male control and efforts to renegotiate gender power relations (Kabeer 2000; Blomquist 2004). Generally, work outside the home leads to a change in the domestic power balance. The decision moves from norm-based decision-making to negotiated decision-making. Working women report jointness in decision-making rather than men being the sole decision-maker in household matters. Studies conducted in Bangladesh show that regardless of who controls the wages, women's involvement in outside work led to higher levels of savings, mobility, and surprisingly lower levels of domestic violence (Kabeer 2008). The type of work women engage in plays a key role in their overall welfare. Kabeer's (2008) study on Bangladeshi found that women who worked in the formal sector and/or were involved in the productive sector, had more control over household expenditure, were most likely to buy assets, save money, and experience a higher level of mobility and, hence, were more empowered. Egwurube, (2016) defines "women empowerment in the context of Nigeria as the relative ease with which women have access to decision-making roles and can use available legal, social, economic, and political capital to make decisions that affect their own and other people's lives around them".

The 5th Sustainable Development Goals (SDGs) highlighted the mechanism for addressing the gender needs of women and any gender imbalances through women empowerment. Visvanathan *et al*., (2011) stated that connected to this women empowerment position are intra-household power relations between women and men. Women's rights have also been improved recently through gender equality-oriented programmes and patriarchal structures have to some extent been altered. Studies have been focused particularly on how an increase in women's economic resources leads to greater involvement in household decision-making (Doss, 2013; Buvinic and Furst-Nichols, 2016; Duflo, 2003).

Doss and Senauer (1994), emphasised that increased women's income opportunities improve their bargaining power within households. Women's involvement in paid employment provides an avenue for exiting poverty and for general welfare improvement (Gibb, 2006; Hinton *et al*., 2003; Yakovleva, 2007). Buvinic and Furst-Nichols, (2016) stated that income is the principal factor leading to increased women's bargaining power, particularly through paid employment and livelihood opportunities that generate income, which eventually empowers women socio-economically.

There are developmental policy and social interventions that provide access to women to capital and training and, thus, change gender disparity in decision-making within the household (Buvinic and Furst-Nichols, 2016; Attanasio and Lechene,

2002). The reason has been that higher economic power often results in greater women's bargaining power, hence, allowing women to improve the allocation of resources in their favour (Antman, 2014). Consequently, the decision of women to be involved in multiple income portfolios provides them with more opportunities to make decisions they previously could not make and to contribute to resource allocation within the household. Current literature has found that, besides income, there are other drivers behind women's bargaining power with their husbands, such as education and pre-marital women's assets (Doss, 2013; De la Briere *et al*., 2003; Sen, 1990).

Studies in sub-Saharan Africa on income-earning activities of women and their effects have been examined within the agricultural sector, given that most women were employed in the sector in many developing countries (Doss, 2018; Bernard *et al*., 2020). Therefore, gender inclusion in agricultural policy interventions has been viewed as a means of increasing agricultural productivity and, therefore, the bargaining power of women within households.

World Bank, (2006) opined that "the promotion of empowerment of women and gender equality is 'smart economics'". Therefore, it is important to evaluate rural economy changes from the perspective of gender equality. To understand the role played by women in developing economies, it is important to assess their livelihood outcomes, their control over resources, and their level of engagement in decision-making. Based on theoretical considerations, the objective of this study is to examine the effects of increased women's livelihood diversification on their decision-making power in Ogun State, Nigeria.

Following this introduction, this study briefly reflects on relevant literature. Based on the review, this study develops a theoretical framework on the effects of women's multiple income portfolios on their bargaining power levels. Then, this study describes the database and methods of data analysis applied, followed by the results and discussion.

2. Theoretical Framework of Bargaining Models of Household Decision-Making

Bargaining models of decision-making in households explain the mechanisms by which household resources are allocated between men and women and the results of such decision-making processes (Quisumbing, 2003; Thomas, 1990; Haddad *et al*., 1997; Doss, 2013). Studies on intra-household resource allocations typically treat the family as if it operates as a single decision-maker whose members' preferences can be easily aggregated (Becker, 1981; Lundberg and Pollak, 1994). This theoretical perspective is referred to as the unitary model, according to which, one person or the couple makes all household decisions jointly and acts as both a consuming and producing unit whereupon incomes or resources are pooled by individuals (Bernard *et al*., 2020; Safilios-Rothschild, 1988; Haddad *et al*., 1997).

Unitary model assumptions have been challenged by some social scientists who rely on bargaining models to discuss how individual spousal preferences and their relative economic resources within households are as important in decision-making (Lundberg and Pollak, 1996; Haddad *et al*., 1997; Bloemen, 2010; Manser and Brown, 1980; Chiappori, 1992). Following the rejection of the household unitary model, subsequent household models have been developed concerning decision-making and bargaining power comprising cooperative, non-cooperative and collective models.

Doss (2013) stated that the cooperative bargaining model employs "a game-theoretical household model in which bargaining power is a function of the outside options of the two bargaining individuals". However, cooperative bargaining models are assumed to achieve Pareto efficiency (Quisumbing, 2003; Udry, 1996; McElroy and Horney, 1981; Seiz, 1995; Manser and Brown, 1980). Individuals can enter into binding contracts in cooperative games with each other (Seiz, 1995). The processes of achieving cooperative game outcomes do not generally involve stating various individual strategic choices. The model, however, specifies which of the possible outcomes based on set criteria should be considered optimal (Seiz, 1995). Therefore, cooperative bargaining models, therefore, provide relevant discussion on how couples negotiate their bargaining outcomes.

Non-cooperative, household bargaining models, do not assume Pareto efficient outcomes (Doss, 1996a, 1996b, 2013; Quisumbing, 2003; Seiz, 1995; Lundberg and Pollak, 1994, 1996; Bernard *et al*., 2020). These models assume that the players or individuals cannot 'communicate' (Seiz, 1995) or make binding and enforceable contracts or agreements (Lundberg and Pollak, 1993, 1994; Carter and Katz, 1997). There are many variations of these models, such as the one of separate spheres, that does not assume non-Pareto efficiency but, instead, tests for it (Lundberg and Pollak, 1993, 1994; Bernard *et al*., 2020). Non-cooperative models focus on self-enforcing equilibrium, which may be Pareto optimal (Basu, 2006; Ligon, 2002).

The collective bargaining model, developed by Apps and Rees (1988) and Chiappori (1988, 1992), allows different preferences and only specifies that allocations are such that the outcomes are Pareto efficient (Lundberg and Pollak, 1996; Quisumbing, 2003; Doss, 2013). Under this model, a member within the household can only be made better off by making the other member worse off (Quisumbing, 2003; Doss, 2013). Collective household bargaining models are also referred to as Pareto efficient models since they are based only on the minimal assumption that outcomes of intra-household cooperation and conflict are Pareto efficient.

With over 85% of the farming population depending on agriculture, this sector is clearly crucial for Nigerian economy, providing livelihoods for people, especially in rural areas. The sustainable livelihood approach, by Scoones (1998), assumed that households are endowed with capital or a set of assets utilized to implement

different livelihood strategies and achieve livelihood outcomes. This general context is linked to the main agricultural development pathways, as discussed by Headey *et al.* (2011), i.e., that agricultural food production and income are generated through farm and non-farm activities. Finally, the likely outcomes of women's empowerment are added to the theoretical framework (Herforth and Harris, 2014).

These models provide a framework for how women's work and options for women's work affect their decision-making power within the household. Given that power relations between men and women are complex, it is crucial to understand the nuances of how these behavioural patterns and preferences shape livelihood choices and decision making (Agarwal, 1997).

3. Materials and Methods

3.1 Study Area

This paper was a study of rural communities across Agricultural development zones in Ogun state, Nigeria. The state comprised of four agricultural development zones under the Ogun State Agricultural Development Project (OGADEP), namely Abeokuta, Ikenne, Ilaro, and Ijebu-Ode.

3.2 Study Data and Sampling Techniques

The study made use of primary data collected through a cross-sectional survey of 366 farm households from Ogun State between July and October 2019. Specifically, our respondents were married rural women participants. The selection of the respondents was made using a multi-stage sampling procedure. Randomly, this study selected one (1) block from each of the four (4) zones followed by the selection of five (5) cells making 20 cells. However, 20 households in each of the selected cells make 400 farm households. After clearing the data from potential outlier observations, 366 farm households were used for this study.

3.3 Analytical Techniques

Data were analysed using both quantitative and descriptive techniques. The methods of the data analysis are discussed below:

3.3.1 Measuring Women's Bargaining power

To allow for all household members' participation in decision-making processes, the decision-making index was stated by Sariyey *et al.*, (2020), Sariyev *et al.* (2017), and Loos *et al.*, (2018). Principal Component Analysis was applied to generate an index that aggregates different domains of decision-making within a household. The domains were the most important aspects of household livelihood processes observed

by almost all households in the study area. The ten (10) domains, namely, (i) purchase of assets, (ii) purchase of food, (iii) type of crop cultivated, (iv) use of farm (harvest) produce, (v) income use from the crops, (vi) use of input, (vii) non-food purchases, (viii) livestock rearing, (ix) land use, and (x) agricultural technology adoption, were considered for this study. After the respective decision-making values were generated, weights were assigned to transform this set of correlated decision-making variables into one index (WPDMi).

Principal Component Analysis is a method of dimensionality-reduction often used to reduce large data sets, by transforming a large variable set into a smaller one that will still have most of the information contained in the large set. It, therefore, reduces a larger set of variables into a smaller set of 'artificial' variables, called 'principal components', accounting for most of the variance in the original variables. As used by Loss *et al*., (2018) and Sariyev *et al*. (2020), the model is specified as:

$$\mathrm{WPDMi} = \frac{\sum FPDM_i}{PDM_i} \tag{1}$$

$FPDM_i$ and PDM_i represent women's decision-maker(s) in the ith decision domain, women's participant, and any gender participant in decision-making in the ith decision domain.

3.3.2 Herfindahl–Hirschman Index: Measuring Women's Livelihood Diversification

Livelihood diversification measurements draw on two approaches. The first is a one-dimensional index derived from counting the number of income-generating activities as stated by Martin and Lorenzen, (2016); Avila-Foucat *et al*., (2018); Yan *et al*., (2010). The second is a two-dimensional approach that considers both the number of income-generating activities and their associated income share, such as the Inversed Herfindahl-Hirschman Index by Liu and Lan, (2015), Shannon-Weiner Diversity Index by Liao *et al*., (2010), and Simpson Index by Johny *et al*., (2017). Other measures are the Ogive index, the Entropy index, the Modified Entropy index, and the Composite Entropy index. This study used the Herfindahl–Hirschman Index due to its commonly accepted measure of livelihood diversification, as specified by Roy and Basu, (2020); Sharma and Singh, (2019); Adekunle and Shittu, (2014); and Idowu, (2011).

To determine women's livelihood diversification, this study ensured that women provide information on various income-generating activities (IHHI) members of their household engaged in during the 2018/2019 farming season and the income associated with these. The Herfindahl Index equation is specified as follows:

$$\mathrm{D} = \left(\sum_{i=1}^{n} {S_i}^2\right)^{-1} \tag{2}$$

D = Herfindahl-Hirschman Index (IHHI) capturing the extent of women's livelihood diversification
S_i = Income-share of source 'i' to total income and 'n' is the number of income sources for a household household's total income.

The Herfindahl–Hirschman Index ranges from 1/n to 1, where n is the number of income sources in the household. According to Sharma and Singh, (2019), the value of D that lies between 0.15 and 0.25 implies moderate diversification, while an HHI score above 0.25 indicates high diversification. However, Idowu, (2011) and Adekunle and Shittu (2014), stated the following levels of livelihood diversification: D=1 no diversification, i.e., only farming activity, (1<D<2) moderately diversified and (D≥ 2) highly diversified.

3.3.3 Tobit Model for the Effects of Women's Livelihood Diversification on their Bargaining Power

Evidence from the levels of women's participation in decision-making within the household, for index figures ranging between zero and one. Zero implying non-involvement, and 1 implying sole decision-maker- indicates that many declared little or no participation in decision-making, and a few that they were the main decision-maker. In econometric regression models, this challenge was addressed by the Tobit regression model (1958).

The Tobit model is a censored regression model applied to data cut off from above or below, indicating there is the likelihood of mass at some point or two points, while the rest is continuous in the data (Wooldridge, 2010). This specification is widely used in econometrics, as it fits many cases encountered with variables that are censored in nature. There is a variable "y', in this case, WPDMi, as the outcome variable describing the participation of women in decision-making, which takes the value of zero in many cases and is continuous over positive values. This implies that a probability mass is present at zero (Wooldridge, 2010). Therefore, because women's decision-making index has data with many zeros and is continuous over positive values, the Tobit regression model is used because it predicts non-negative values and non-constant partial effects.

Tobit model is specified as:

$$WPDMi = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_{11} X_{11} + e_i \quad (3)$$

Where:

$WPDM_i$ = Women's decision-making index

X_1 = Age (years)
X_2 = Education (years of schooling)
X_3 = Main occupation (Farming =1, others =0)
X_4 =Value of assets owned before marriage
X_5 = Spousal education difference (years)
X_6 = Spousal age Difference (years)
X_7 = Household size
X_8 = Livelihood diversification (Yes =1, No =0)
X_9 = Older household members Present (Yes =1, No =0)
X_{10} = Marriage type (Polygamous =1, others=0)

4. Results and Discussion

4.1 Women's Socio-economic Characteristics of Respondents across Zones

The descriptive results of the women's socio-economic characteristics revealed a mean age of 47 years, implying that most rural women were in their productive years, still active to engage in multiple income portfolios. About 40% of them had formal education. On average, the household size was 5 persons, with mean household farm labour of 2, suggesting that 50% of household members were involved in farm activities.

Besides, 21.4% have access to credit and 20.3% own land, 20.1% reported they pool their income with their spouse, and 44% were Muslim. However, the main crop cultivated in the study area was cassava, followed by maize. This shows that cassava-based farm households dominated the study area.

Evidence regarding women's decision-making involvement within rural households revealed that they were worse off. However, they were better off in two (2) decision-making domains, namely, food purchases and harvest use. Meanwhile, on average, males' participation was seen more in decision domains such as the type of crops grown, purchases and sales of livestock, use of income from animals, use of land, income use from crop production, and purchases of an asset. It is, therefore, evident that, on average, women participate more in decisions regarding food purchases, while men are stronger/involved more in other household decisions.

4.2 Women's Livelihood Sources and their Associated Income

Empirical evidence from the study area suggested that rural women are indeed involved in multiple livelihood activities and, hence, they have diversified income portfolios. The various livelihood activities reported in the study area were categorized into the following two: (i) farm-based livelihood means, such as crop, and livestock production, and (ii) Non/off-farm livelihood, disaggregated into five (5) income earning activities, such as self-employed enterprises, e.g., processing, arti-

sanship, petty trading, and aggregating agricultural commodities, and engagement in paid waged labour. Table 2 shows the distribution of women's livelihood activities and the associated income. Farming contributed 56.9% of the income generated by women while non-farm income accounted for 43.1%. This implies that despite women's involvement in other income activities, women's income from farming contributed more to the household income. Therefore, farming is the dominant occupation of rural women in the study area.

Table 1. Socio-Economic Characteristics of Women Respondents across Zones in Ogun State

	Zones				
Characteristics	**Abeokuta**	**Ilaro**	**Ikenne**	**Ijebu-Ode**	**Mean**
Women's Mean Age	50.16	47.82	46.12	45.11	46.65
% of formally educated	41.14	38.62	40.51	43.16	40.08
Mean Household Size	6	5	6	4	5
Mean Family Labour	3	2	2	3	2
% of women with Access to credit	32.21	20.21	27.94	22.7	21.44
% Land ownership	29.03	24.11	16.92	20.2	20.31
% Income Pool with spouse	26.22	19.93	24.01	18.3	20.11
Major Crop planted					
Cassava	63.41	66.72	72.81	68.26	66.52
Maize	33.16	31.11	34.61	36.11	32.37
Yam	21.86	23.17	22.64	24.22	22.63
Fruits/Vegetables	8.35	7.90	6.01	6.6	6.16
Others	4.04	3.21	3.72	3.1	3.13
Women's Decision-making Participation					
Household asset purchases	0.46	0.41	0.46	0.43	0.44
Agricultural asset purchases	0.43	0.38	0.46	0.42	0.41
Purchases and sales of livestock	0.45	0.45	0.42	0.43	0.44
Crop grown	0.42	0.44	0.46	0.44	0.42
Food purchases	0.55	0.53	0.50	0.51	0.52
Harvest use	0.51	0.50	0.53	0.50	0.51
Usage of Livestock income	0.48	0.40	0.44	0.42	0.44
Usage of crop income	0.44	0.42	0.40	0.41	0.42
Input usage	0.49	0.48	0.50	0.45	0.48
Land usage	0.50	0.45	0.42	0.41	0.47

Source: Field Survey, 2019

Table 2. Distribution of Women's Income Sources

Income Sources	**Frequency**	**Percentage**	**Annual Income (Mean ₦)**	**% Share of Income**
Farming	199	54.4	155,780.0	56.9
Artisan	103	28.1	53,080.4	19.4
Trading/Marketing	178	48.6	49,055.1	17.9
Other Sources	155	42.3	15,845.4	5.8
All Sources	366	100.00	273,760.9	100

Field Survey, 2019. 1$ = N365 at the survey time

4.3 Level of Women's Livelihood Diversification

Table 3 shows the level of women's livelihood diversification. The table below shows that 31.7% of the women's income-generating activities were not diversified. This implies that, despite the seasonal nature of farming, they did not see any need for themselves to engage in multiple income-generating activities to cope during the off-season period. However, 48.1% were moderately diversified and 20.2% highly diversified. Therefore, 68.3% of rural women have multiple income portfolios and a larger share of household income.

Table 3. Level of Women's Livelihood Diversification

Level	Frequency	Percent
Non-diversified	116	31.7
Moderately diversified	176	48.1
Highly diversified	74	20.2

Source: Field Survey, 2019

4.4 Level of Women's Bargaining Power

Table 4 shows the distributions of women's bargaining power. Women's decision-making power index ranges from 0 to 1. From Table 4, it was clear that most (70.3%) of the index falls below 0.5, indicating a low level of bargaining power of women in the household. A mean score of 0.39 was estimated for women's bargaining power. Besides, 70.3% of women have a low bargaining power, while the remaining 29.7% have high bargaining power. These results suggest that women have a low household-decision power regarding welfare and productive decisions. Therefore, this study observes that women do lag behind in participation decision-making as far as household livelihood is concerned. It is important to mention that men were the main decision-makers in the household. Scholars' consensus on decision-making in the family is that there is an unequal power relationship between spouses within the family (Bammeke, 1999) and that men, being the household heads, act as main decision-makers, while men in compliance roles are friendly with their wife (Oyekanmi, 1999; Isiugo-Abanihe, 1996).

Table 4. Level of Women's Bargaining Power

Level	Frequency	Percentage
Low Bargaining Power	257	70.3
High Bargaining Power	109	29.7
Total	366	100.00

Source: Field Survey, 2019

4.5 Effects of Women's Livelihood Outcomes on Bargaining Power

Tobit regression results of the effects of livelihood diversification on women's bargaining power revealed that seven (7) out of the ten (10) variables examined had a significant effect on women's bargaining power. However, women's marriage type and their main occupation have no effect on their decision-making within the household.

Woman's age ($p<0.05$) at marriage positively influences their bargaining power. In other words, as a woman gets older, she gains more control over households decision-making. The older they are at the time of marriage, the more empowered they are in participating in household decision-making.

Women's education has a positive effect on their bargaining power. Noureen and Khalid (2012) stated that one of the important factors influencing women's empowerment is education. In the same vein, Samari and Pebley (2015), Fatima (2013), and Zafar *et al.* (2005) concluded that education is one of the strongest drivers of women's empowerment.

However, spousal education difference is significant at a one percent negative coefficient. The spousal education difference exerted a negative influence on women's bargaining in their intra-household decision-making. This suggested that the higher the men's education, the lower the likelihood for their wives to get involved in the household's decision-making. Meier zu Selhausen (2016) found a similar result, i.e., that the wider the gap in education between spouses, the lower the women's ability to make decisions. Spousal age difference also exerts a negative influence on bargaining power.

Furthermore, women's livelihood diversification has a positive effects on their bargaining power. This study suggests that women's involvement in multiple income-earning activities does increase their bargaining power. This, therefore, demonstrates that women's ability to earn additional income provides an avenue for them to participate in household decision-making. The result is compatible with the statement that women's involvement in livelihood economics by earning income is an indicator of their bargaining power. However, their income from multiple income sources empowers them to influence their decision-making within the household. Doss (2013) positioned that the income earned by women is explicitly linked to their decision-making power.

The presence of elderly members of the household has a negative impact on the bargaining power of women. Perhaps the presence of older members, particularly mother-in-law, weakens the female spouse's decision-making role. On the contrary, the study by Bayudan-Dacuycuy (2013) suggests that a wife's bargaining power may be strengthened if there is the presence of a spouse's parents or older family members.

Table 5. Results of the Effects of Women's Livelihood Choices on Women's Bargaining Power

Variables	Coefficients	*t-ratio*
Age	0.412**	2.241
Education	0.304**	2.311
Main Occupation	-0.152	-1.037
Value of assets owned before marriage	0.618***	2.822
Spousal Education Difference	-0.276***	-3.162
Spousal Age Difference	-0.136**	-2.225
Household size	0.211	1.434
Livelihood diversification	0.562**	2.711
Presence of older household members	-0.116*	1.955
Marriage type	0.037	1.136
Constant	0.4141	1.93
Number of Observation	366	
Log-likelihood	-1141.02	
Pseudo R-squared	0.0712	

Field Survey, 2019

5. Conclusion

Through in-depth interviews with 366 rural women in Ogun State, Nigeria, this study examined the participation of women in multiple income portfolios and its effects on their decision-making within the households. Results showed that women do not combine their income with that of their husbands, since they are better off than men in two decision-making domains, namely, food purchases and harvest use out of the specified ten domains studied. Despite women's main involvement in farming activities, this did not provide them with an opportunity to be fully involved in decision-making within the households. However, despite men's dominance in farming activities, women keep working to generate an additional income to support themselves, and their immediate and extended families. Women's participation in multiple income-generating activities offers them an avenue to be economically empowered and, in turn, improves their decision-making in relation to that of their husbands. Hence, women's involvement in multiple income portfolios is not a mere trivial option but, rather, a coping strategy to reduce their vulnerability when faced with different livelihood shocks. Therefore, policy issues aimed at improving the bargaining power of women within households should focus on getting the women to engage in multiple income sources.

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GLOBAL TRADE: TESTING PERSISTENCE IN GLOBAL SHIPPING BASED ON THE LINER SHIPPING CONNECTIVITY INDEX (LSCI)

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Abstract
This study investigates persistence in the liner shipping connectivity index for 16 countries, namely, the G7, BRICS, and MINT countries from 2006Q1 to 2021Q1. Both the autoregressive and fractional integration methods are used for the analysis of break-adjusted and non-break-adjusted series. Findings from the study show that the liner shipping connectivity index (LSCI) for more countries in the G7 economic group has lower persistence than for countries in the other economic groups – MINT and BRICS – whether the series is adjusted for a structural break or not, thus pointing to a possible quick recovery from a shock than elsewhere. This shows that any disruption to global trade, as proxied by LSCI, will be suffered more by developing countries than developed ones.

JEL Classification: N7, F14
Keywords: Liner Shipping Connectivity, Fractional Integration, G7, MINT, BRICS

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1. Introduction

The global economy depends on shipping to keep its wheels turning. This reality was demonstrated in the days following the blockage of the Suez Canal in Egypt by the Ever Given vessel in March 2021, creating fears of a possible threat to global supply and demand, given that the Canal is a major route for ships moving the highest number of containers in the world (Rusinov *et al*., 2021). The connection that countries have to the global shipping network is an indication of the extent to which global trade takes place (Li *et al*., 2015), contributes to economic growth (Michail *et al*., 2021), and indicates the level of economic integration such countries have with the rest of the world. Thus, events related to global shipping have the potential to shape world economy (Simcock and Kamara, 2016), given that 80% of trade across the world is carried by ships (UNCTAD, 2021).

Shipping connectivity is an important determinant of bilateral trade (Hoffmann *et al*., 2020; Saeed *et al*., 2021). The extent of shipping connectivity reduces trade costs, thus enhancing trade flows. Shipper change demand based on changes to shipping connectivity (Hoffmann *et al*., 2020) and this puts pressure on supply chains and has the potential to make economies more autarkic, reducing trade and global connectivity. Furthermore, shipping connectivity is important because it enhances intra-regional trade, which occurs as a result of removing trade barriers by countries in a particular region, and extra-trade, which is the result of rising regional integration enhanced by shipping connectivity (Lun & Hoffmann, 2016).

One of the ways to gauge global shipping is through liner shipping, which is "generally characterized by vessels that operate along pre-specified, fixed routes according to a regular, fixed schedule, where the majority of these vessels are now container ships" (van Dellen, 2011, p. 20). Liner shipping is important for determining the geography of trade and the transportation of most finished and semi-finished goods (Bertho *et al.*, 2014; Fugazza and Hoffmann, 2017). The liner shipping connectivity index (LSCI) by the United Nations Conference on Trade and Development (UNCTAD, 2021) is an index that "allows the assessment of maritime connectivity for container shipping, enabling comparisons between countries and over time" (UNCTAD, 2019). It is a window into the extent to which countries are connected to the rest of the world through trade. Thus, it is important to understand the level of persistence in the LSCI as a way of understanding the effect of shocks on global trade. To put it differently, the statistical feature of persistence in the LSCI allows us to make conclusions about the enduring nature of a trade shock; this, in turn, reflects the stability, or otherwise, in global trade. The choice of LSCI, as described in section 3 of this study, is made because it represents a more comprehensive measure of the movement of container ships across the world. The Baltic Exchange Dry Index is another index that tracks ship movement across the world. Although the COVID-19 pandemic is responsible for a decline of about 0.03% and 0.046% in both the

Baltic Dry Index and Baltic Dirty Tanker, respectively (Michail and Melas, 2020), thus reflecting the adjustments container liners made to their capacity to respond to falling demand (Notteboom *et al.*, 2021), the Baltic index represents only the cost of shipping raw materials, such as coal, iron ore and fertilizers (UNCTAD, 2021), rather than finished goods as the LSCI does. Persistence in LSCI will help explain how global trade will behave following shocks to shipping connectivity. If the LSCI of a country or country-group shows persistence (inadvertently, persistence in shipping), positive/negative shocks will have long lasting effect on trade (see Heiland *et al.*, (2021)); otherwise such shocks will easily fizzle out.

Given how important shipping connectivity is to determine export (Şeker, 2020), it is important to establish the statistical features of the LSCI to ascertain how well the index responds to shocks, which further indicates the extent to which international trade will be affected, especially regarding the degree the merchandise trade of countries is proportionate to their connection, as shown through LSCI (Lin *et al.*, 2020). There are few studies into the persistence of LSCI apart from the study by Sun *et al.*, (2021), which found that ship flow from Shanghai and Singapore ports has long-range dependence, thus taking time to recover from a shock, studies in this area are sparse.

Here is how this study contributes to relevant literature: to our knowledge, this is the first paper to investigate the persistence of the LSCI. Studying the persistent properties of the LSCI using the fractional integration approach is superior to standard methods, such as the ARIMA models, because it is more general and considers integer orders of the integration (Gil-Alana and Monge, 2020). The study also adds the autoregressive method of estimating persistence to enhance robustness.

Findings from the analysis show that the more advanced economies (the G7) have lower persistence in LSCI than the less developed economies of MINT and BRICS. Thus, the G7 economies will most likely recover from an external shock to bilateral trade more easily than countries in the MINT and BRICS groups.

The rest of the paper is structured as follows: In section 2, we lay out the methodology adopted in the study. Section 3 describes data and source; section 4 discusses empirical results, while section 5 concludes the study.

2. Methodology

In this section, the methodology underpinning this study is laid out. As stated earlier, this adopts the non-integer-valued order of analysing persistence. The traditional method does not allow for fractional differencing, that is, integrated series are restricted to 0, 1, and 2. Economic series have been shown not to necessarily follow integer integration, that is, $I(1)$ process but can be fractionally integrated (Gil-Alana and Carcel, 2020)Baillie and Bollerslev (1994. Fractionally integrated series are such that the impact of shocks is not assumed to be permanent but transient, even if the

transitory nature of such shocks takes time to fizzle out (Oloko *et al*., 2021; Salisu *et al*., 2020). As far as we know, this approach has not been applied for understanding the time series properties of the LSCI. Hence, we extend the fractional integration approach to understanding the LSCI by estimating the following equation:

$$(1-L)^d\, lsci_t = \alpha + \gamma Trend + \varepsilon_t \tag{1}$$

Where $lsci_t$ is the log of the Liner Shipping Connectivity Index; d is any real value; L is the lag operator so that $Llsci_t = lsci_{t-1}$; $(1 - L)^d$ is a polynomial function of order d; a is the model intercept; γ is the trend coefficient that allows the model to be expressed in a more generalized form for the determination of the fractional order; $\varepsilon_t \sim N(0, \sigma_\varepsilon^2)$. The polynomial function in equation (1) can be reformulated using the binomial expansion so that, for all real d,

$$(1-L)^d = \sum_{j=0}^{\infty} \psi_j L^j = \sum_{j=0}^{\infty} \binom{d}{j} (-1)^j L^j = 1 - dL + \frac{d(d-1)}{2} L^2 - \ldots, \tag{2}$$

$$(1-L)^d lsci_t = lsci_t - d\, lsci_{t-1} + \frac{d(d-1)}{2} lsci_{t-2} - \ldots, \tag{3}$$

Thus, equation (1) becomes:

$$lsci_t = \alpha + \gamma Trend + d\, lsci_{t-1} - \frac{d(d-1)}{2} lsci_{t-2} - \ldots + \varepsilon_t \tag{4}$$

In equation (4), d is the degree of dependence of *lsci* so that, the higher the value of d, the higher the level of association of the series between observations (Gil-Alana and Carcel, 2020). The value of the fractional integration parameter d can be one of these three cases: first, if $d = 0$, then current $lsci_t$ is not dependent on its past values, in which case the series is described as covariance stationary; second, if d lies between 0 and 0.5, $lsci_t$, it is said to possess "long memory" but it is mean, reverting and stationary; third, if $d \geq 0.5$, $lsci_t$, it is said to be non-stationary but mean reverting.

If possesses "long memory", it can be mean reverting or non-mean reverting. If $lsci_t$ possesses "long memory", it can be mean reverting or non-mean reverting. It is mean reverting if $0.5<d<1$, while it is non-mean reverting if $d \geq 1$, in which case, shocks to $lsci_t$ will tend to remain permanent.

Asides from the fractional integration estimation, the autoregressive approach will be employed to estimate the fractional integration parameter for robustness.

We account for unknown structural breaks in each series using the Perron (1997) method. The Perron (1997) method looks for a single unknown break point. Once the break point is found, it is common for researchers to account for it in the model by including a dummy of the break period as a regressor in the linear model.

However, given that this study is a univariate analysis, we adopt the innovative three-step method of Salisu and Obiora (2021) in accounting for the break period which is found using the Perron (1997) method. In the first step, we use the ADF method to determine the break dates in the LSCI for each country. Next, we construct a dummy variable for each of the break periods and regress each of the variables against the dummy. We illustrate step two in equation (5)

$$y_t = \vartheta + \sum_{j=1}^{N} \iota_j D_{jt} + \mu_t \quad (5)$$

In equation (5), y is the break-adjusted series; D_j is 1 for each j, and zero otherwise. Finally, the break-adjusted series is determined by estimating $y_t^d = y_t - \sum_{j=1}^{N} \hat{\iota}_j D_{jt}$. Persistence is thus tested on the break-adjusted series.

3. Data and source

The Liner Shipping Connectivity Index (LSCI) for 16 countries from 2006Q1 to 2021Q1 is sourced from the United Nations Conference on Trade and Development (UNCTAD)[1]. These countries are divided into various economic groups, which are: the Group of seven (G7) countries comprising Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States; the MINT economies comprising Mexico, Indonesia, Nigeria, and Turkey; the BRICS economies comprising Brazil, Russia, India, China, and South Africa. According to UNCTAD (2019)[2], LSCI is based on five container shipping components – (i) the number of shipping lines servicing a country, (ii) the size of the largest vessel servicing the country, (iii) the number of services to which a country is interconnected, (iv) the number of container ships deployed in a country, and (v) the carrying capacity of these containers. Thus, this is a comprehensive measure of container ship movement across the world. The higher a country's index, the more its maritime activities are connected to the rest of the world.

In Figure 1, it is observed that in all the countries under review, the LSCI follows an upward linear pattern. In the G7 countries, Figure 1 shows that Canada is the lowest, while there is intense competition at the topmost, with the United States, the United Kingdom, and France. In the BRICS economies, it is observed that China is far ahead of the other countries in the index. In the MINT group, intense competition among Mexico, Indonesia, and Turkey ended around 2009, with Turkey in a clear lead. The lowest ranking country in the trend is Nigeria.

1. Data accessed via https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=92
2. Accessed via https://unctad.org/news/unctad-maritime-connectivity-indicators-review-critique-and-proposal

Table 1 confirms what is observed in Figure 1. Among the G7 countries, it is seen that within the period under review, Canada had the lowest index at 32.12, while the United States the highest at 105.56. Among the MINT countries, Nigeria had the lowest index at 15.71, with Turkey having the highest index at 61.53. Finally, among the BRICS economies, Russia had the lowest index at 18.50, while China the highest at 163.81. On average, of the 16 countries sampled for the study, Nigeria had the lowest index at 20.91 while China the highest at 133.91. It can be concluded that China was the most connected maritime country, while Nigeria the least connected, of the countries sampled within the study period.

Table 1. Descriptive statistics

	Mean	Max.	Min.	S. Dev.	Skew.	Kurt	J-B	Obs.
G7								
Canada	39.44	47.53	32.12	4.90	0.22	1.58	5.63**	61
France	66.55	79.29	56.83	6.93	0.08	1.60	5.08**	61
Germany	81.84	85.53	76.07	2.39	-0.43	2.05	4.19***	61
Italy	63.36	77.14	54.19	5.22	0.62	3.45	4.42***	61
Japan	73.94	88.70	65.37	5.27	1.06	4.19	15.08	61
United Kingdom	82.24	91.21	74.11	4.80	0.17	1.71	4.53***	61
United States	84.32	105.56	74.23	7.64	0.93	3.61	9.73	61
MINT								
Mexico	39.46	49.07	30.75	5.86	0.06	1.70	4.31***	61
Indonesia	36.88	51.13	32.68	4.28	1.57	4.29	29.34	61
Nigeria	20.91	29.16	15.71	2.25	0.07	5.39	14.59	61
Turkey	47.34	61.53	29.79	9.77	-0.39	1.66	6.11	61
BRICS								
Brazil	34.37	37.55	30.18	1.70	-0.53	2.50	3.53***	61
Russia	35.79	53.09	18.50	10.15	-0.24	1.66	5.13**	61
India	48.68	58.48	38.41	5.54	0.25	1.82	4.13***	61
China	133.91	163.81	100.00	16.27	-0.12	2.28	1.48***	61
South Africa	35.73	41.92	26.78	4.11	-0.54	2.23	4.42***	61

Source: Computed by author

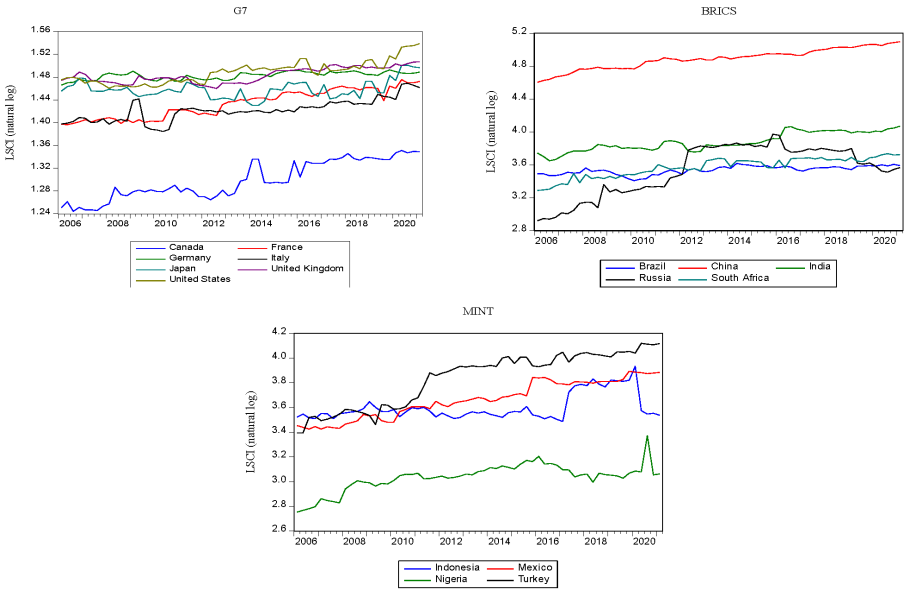

Figure 1. Trends in the Liner Shipping Index in the G7, BRICS and MINT

4. Empirical results

In this section, the result of the analysis is presented and discussed. It is worth remembering that, if the estimated d = 0 for *lsci*, the series has short memory and is covariant stationary; for d≥0.5, the series has long memory and is mean reverting and stationary, while for , the series has long memory, it is non-stationary, but mean reverting. For a series that exhibits long memory and is non-stationary, if 0.5<*d*<1, the impact of shocks will not be permanent, but if d≥1, the impact of shocks will be permanent. The empirical result of the study is subdivided into two groups: the first one presents the persistence of the LSCI without structural breaks, and the second one presents and discusses the result with structural breaks.

4.1 Persistence in the liner shipping connectivity index without structural breaks

In Table 2, the result of the persistence test on liner shipping connectivity index is presented without structural breaks. The result for all country-groups shows that both the autoregressive and fractional integration methods of estimating *d* present evidence of fractional differencing in the series, even if *d* is at different levels of significance. When examining *d*, it is observed that in the G7 countries, Germany, Italy, Japan, and the United Kingdom, the LSCI possesses short memory, and is covariance stationary given that falls within the interval *d*(0,0.5). Hence, for these countries, shocks to the LSCI will have only a temporary effect and recovery will be quick. For Canada, France, and the United Kingdom, it is futile modelling the LSCI with fractional differencing without controlling for structural breaks.

In MINT economies, it is observed that parameter *d* in all countries is not statistically significant; therefore, it may not be appropriate to explain the behaviour of the LSCI in the MINT economic group using the fractional differencing approach in the absence of structural breaks.

BRICS economies are found to behave similarly to MINT economies. In other words, parameter *d* for all countries is not statistically significant, except for Russia, for which it is significant at the 10% level. Again, similar to the MINT countries case, adopting the fractional differencing approach for understanding the behaviour of the LSCI in the absence of structural breaks is not an optimal approach.

Table 2. Persistence in the Liner Shipping Connectivity Index using the autoregressive and fractional integration approaches without structural break

	Autoregressive approach		Fractional Integration approach		
LSCI	$\sum_{i=1}^{p}\gamma_i(p)$	$\sum_{i=1}^{p}\gamma_i=1$	*d* [se]	$d=0.5$	$d=1$
G7 Countries					
Canada	0.5415***(2)	-0.4585***	-0.0255[0.1927]	-2.7266***	-5.3210***
France	0.5466***(1)	-0.4534***	0.1274[0.3038]	-1.2263	-2.8719**
Germany	0.6115***(2)	-0.3885***	0.5000***[2.11E-06]	-2.6806***	-2.369069***
Italy	0.4893***(2)	-0.5107***	-0.3963**[0.1900]	-4.7184***	-7.3504***
Japan	0.7255***(1)	-0.2745***	-0.2756[0.2233]	-3.4740**	-5.7135***
United Kingdom	0.8692***(1)	-0.1308*	-0.1319[0.1858	-3.4009***	-6.0921***
United States	0.7124***(1)	-0.2876***	0.4857[0.3855]	-0.0372	-1.3341
MINT					
Mexico	0.6062***(1)	-0.3938***	0.0671[0.2222]	-1.9494	-4.2012***
Indonesia	0.7683***(1)	-0.2317**	-0.2726[0.2009]	-3.8454***	-6.3339***
Nigeria	0.7280***(3)	-0.2720**	0.1854[0.5355]	-0.5874	-1.5211
Turkey	0.8908***(3)	-0.1092	0.4329[0.9900]	-0.0678	-0.5729
BRICS					
Brazil	0.7623***(1)	-0.2377***	-0.2308[0.1960]	-3.7287***	-6.2799***
Russia	0.9587***(1)	-0.0413	0.4812*[0.2724]	-0.0689	-1.9047*
India	0.7087***(3)	-0.2913***	-0.0998[0.2148]	-2.7930***	-5.1213***
China	0.6240***(5)	-0.3760***	0.1596[0.1365]	-2.4934**	-6.1559***
South Africa	0.6618***(2)	-0.3382***	0.3741[0.3137]	-0.4014	-1.9955**

Note: ***, ** and * represent level of significance at 1%, 5% and 10%, respectively. Figures in "[ ]" are standard errors (se), while figures in "( )" are the optimal lag length for the autoregressive model. The lag length for the autoregressive model is selected using the Akaike Information Criterion (AIC); according to the result, the maximum lag length is 5. The traditional autoregressive model is defined as $lsci_t = \propto + \beta t + \sum_{i=1}^{p}\gamma_i\, lsci_{t-1} + \varepsilon_t$, where $lsci_t$ is the liner shipping connectivity index, *t* is the trend term, *p* is the optimal lag length, $\sum_{i=1}^{p}\gamma_i$ is the sum of the autoregressive coefficients measuring the degree of persistence. The maximum likelihood method is used to estimate the *d* fractional parameter using the parametric method in line with Sowell (1992). The restriction test for shocks to the liner shipping connectivity index lasting forever are $\sum_{i=1}^{p}\gamma_i=1$ and $d=1$. The test that $d=0.5$ tests that the liner shipping connectivity index is fractionally integrated. The Wald test is conducted for the restriction test, while the t statistics is reported with respect to testing restrictions for *d*.

Source: Computed by author.

Table 3. Persistence in the Liner Shipping Connectivity Index using the autoregressive and fractional integration approaches with structural break

	Autoregressive approach		Fractional Integration approach				Break Dates
LSCI	$\sum_{i=1}^{p}\gamma_i(p)$	$\sum_{i=1}^{p}\gamma_i=1$	d [se]	$d=0.5$	$d=1$		
G7 Countries							
Canada	0.5322***(3)	-0.4678***	-0.4228***[0.1033]	-8.9327***	-13.7730***		2014Q1
France	0.9045***(1)	-0.0955	-0.079[0.1709]	-3.3887***	-6.3148***		2019Q2
Germany	0.4770***(2)	-0.5230***	-0.6388***[0.1739]	-6.5472***	-9.4219***		2013Q3
Italy	0.6664***(2)	-0.3336***	0.4991***[0.0111]	-0.0765	-45.3192***		2009Q3
Japan	0.3421**(1)	-0.6579***	0.3476***[0.1201]	-1.2691	-5.4323***		2019Q4
United Kingdom	0.8935***(1)	-0.1065*	-0.1181[0.2123]	-2.9115***	-5.2670***		2009Q2
United States	0.4486***(1)	-0.5514***	0.4669**[0.1765]	-0.1878	-3.0215***		2020Q2
MINT							
Mexico	0.8392***(2)	-0.1608*	-0.0481[0.3911]	-1.4015	-2.6799***		2015Q4
Indonesia	0.5350***(1)	-0.4650***	-0.4674**[0.1990]	-4.8612***	-7.3738***		2017Q2
Nigeria	0.6899***(3)	-0.3101**	0.1148[0.5140]	-0.7494	-1.7221*		2020Q3
Turkey	0.5552***(1)	-0.4448***	0.4881***[0.1156]	-0.1028	-4.4274***		2011Q3
BRICS							
Brazil	0.7731***(1)	-0.2269***	-0.2204[0.2205]	-3.2679***	-5.5359***		2008Q1
Russia	0.8281***(2)	-0.1719*	0.3739[0.3920]	-0.3217	-1.5973		2012Q2
India	0.8223***(2)	-1.1777**	0.4987***[0.0143]	-0.0940	-35.0721***		2012Q2
China	0.8691***(1)	-0.1309*	0.4882***[0.1157]	-0.1016	-4.4220***		2010Q3
South Africa	0.7666***(1)	-0.1992***	-0.0285[0.2073]	-2.5494**	-4.9613***		2014Q1

Note on structural beaks: Structural break dates are determined based on Perron (1997) and then filtered from the liner shipping connectivity index series of each country.

Source: Computed by author.

4.2 Persistence in the liner shipping connectivity index with structural break

In Table 3, the result of the persistence test on the liner shipping connectivity index (LSCI) with structural breaks is presented. Again, adopting the autoregressive method and fractional method, results for all country-groups show evidence of fractional differencing in the series. From the analysis, it is observed that the LSCI in the G7 economies performed better after controlling for structural breaks. From the result, given that parameter *d* for France is not significant, we can conclude that modelling persistence in the LSCI for France using fractional differencing is not optimal. Apart from France, parameter *d* for the rest of the countries is statistically

significant. For Canada, Italy, Japan, the United Kingdom, and the United States, the LSCI possesses short memory, and it is covariance stationary, given that d falls within the interval $d(0,0.5)$. This implies that shocks to the LSCI of these countries will fizzle out within a short period. For Germany, it is observed that parameter d falls within the interval $(0.5<d<1)$. This implies that for Germany, the LSCI possesses long memory, and it is highly persistent, but mean reverting. The implication is that shocks to the LSCI for Germany will take a longer time to die out.

In MINT economies, it is observed that there is a marked improvement in the persistence of the LSCI for the economies. Going by the value of parameter d, we find that the LSCI for Indonesia and Turkey lies within the interval $d(0,0.5)$. The implication of this is that shocks to the LSCI in these two countries, after controlling for structural breaks, possesses short memory and is covariance stationary, making it possible for these two countries to easily recover from a shock to the LSCI. For Mexico and Nigeria, it is still not appropriate to model the LSCI using fractional differencing, given that their d parameters are not statistically significant.

Persistence in the LSCI for BRICS economies, after controlling for structural breaks, follows that of MINT economies. For India and China, the value of parameter d lies within the interval $d(0,0.5)$ and it is statistically significant. This shows that the LSCI for these two countries has short memory and is covariance stationary, implying that the index will easily recover from unexpected shocks.

5. Implication and Conclusion

In this study, the persistence of the liner shipping connectivity index is examined using both the autoregressive and fractional integration methods. The analysis is done for the G7, BRICS and MINT economies from 2006Q1 to 2021Q1. The analysis is carried out for break-adjusted and non-break-adjusted series.

Empirical results show that for most of the countries considered, adopting the fractional integration approach for understanding the series is appropriate, as shown by the results from the autoregressive method. In the non-break adjusted series, d parameter for most countries is not significant. In addition, fewer countries exhibit short memory. After controlling for a structural break, it is found that the LSCI for most countries in the G7 group exhibit short memory and low persistence (except for France), while two countries each, in the MINT and BRICS economies, show short memory and low persistence in the LSCI. These countries are Indonesia and Turkey for the MINT group and India and China, for the BRICS group.

The implication of the findings of this study is that, faced with shocks to the LSCI, bilateral trade in the G7 economies will most likely recover more quickly than in the economies of the other country-groups. Findings from the study show that more than 85 percent of countries in the G7 country-group exhibit low persistence. This is unsurprising given that the G7 countries represent the most advanced

countries in the world, possessing the resources to both ward off potential threats to the movement of container ships originating from or going to their ports and to have the capacity to speedily implement measures to enhance the movement of container ships originating from their countries. However, in the MINT economic group, 50 percent of the economies present low persistence, compared to about 40 percent in BRICS economies. In general, BRICS and MINT economies have shown high persistence in liner shipping, given that they are not as advanced as the G7 countries. Hence, long-term policies aimed at reducing congestion, and the design and construction of ships, will make transportation of goods over long distances economical and help build the capacity of these country-groups to recover more quickly from shocks to trade as measured through the LSCI. Furthermore, given that larger economies will recover more quickly, following a shock to shipping connectivity than smaller economies, where potentially severe consequences are more likely, efforts must be made to reduce tensions, such as trade wars, that make the movement of goods across the world difficult.

According to Hoffmann *et al.*, (2020), and Fugazza and Hoffmann (2017), given that shipping connectivity is an important determinant of bilateral trade, we can make the following conclusion based on the findings concerning the persistence of the LSCI, which is the focus of this study:

- Bilateral trade in an overwhelming number of G7 countries will recover quickly in the event of a shock, given the result of the persistence test on the LSCI.
- In MINT countries, bilateral trade of half of them will recover more easily following a shock to the LSCI. For the other half, testing persistence through fractional differencing is not appropriate.
- In BRICS economies, international trade of fewer than half of the countries will revert quickly to its previous mean level.
- Being in the group with the most developed economies, countries in the G7, considering their size, available resources, and maritime sophistication and connections, can more easily recover from a shock to bilateral trade occasioned by a shock to the LSCI.

Finally, given that this study has demonstrated bilateral trade rebounds quickly in most of the developed economies considered than in less developed economies, care must be taken to ensure that global trade through liner shipping does not suffer undue shocks that may potentially cause delays and disrupt supply chains.

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EFFECTIVENESS OF FOREIGN AID FOR HEALTH IN REDUCING HIV PREVALENCE IN SUB-SAHARAN AFRICA

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Abstract
The study examined the effect of health aid on HIV prevalence in sub-Saharan Africa (SSA) using data on 46 countries from 2000-2019 analysed with system-GMM due to its appropriateness. Results confirmed persistence in HIV prevalence and showed that health aid significantly reduced HIV prevalence in SSA. Furthermore, domestic health expenditure, education and government effectiveness significantly reduced the scourge in SSA. All post-estimation diagnoses indicated that the estimated model was valid and robust. Increased domestic health expenditure to complement health aid, determination to encourage school enrolment and efforts to improve government service delivery, especially in the health sector, are recommended.

JEL Classification: C23, H53
Keywords: HIV Prevalence, Health Aid, Sub-Saharan Africa

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1. Introduction

HIV/AIDS was clinically observed for the first time worldwide in the United States in 1981. Because the early incidence of the virus was noticed among men who were gay and injection drug users, it was first referred to as GRID (Gay-Related Immune Deficiency) but with time and the realization, as more facts emerged, that it was not limited to these groups of the population, the United States Centre for Disease Control (CDC) introduced the term Acquired Immune Deficiency Syndrome (AIDS). According to Keele (2006) and Gao (1999), scientific tracing suggests that HIV came from Chimpanzees in southern Cameroon, southern Senegal, and in the west of the Ivory Coast, as early as the beginning of the 20th century. It is believed that the spread of HIV/AIDS got accelerated due to the influence of colonialism and the subsequent growth of large colonial African cities; this resulted in significant social changes entailing diverse patterns of sexual contacts, among which the most prominent ones were having more than one sexual partner at the same time, and prostitution (Worobey, 2008).

Overtime, HIV has spread to all countries of the world, due to increased mobility and globalization, at varying levels of prevalence. In 1995, HIV prevalence rate in SSA was 2.22%, 0.24% in the Latin America and the Caribbean (LAC), 0.4% in the United States; the world average was 0.3% (World Bank Data, 2021). Five years after, i.e., by 2000, average prevalence rate in SSA had increased to 4.68%, 0.47% in LAC, while the U.S. rate remained at 0.4% and the world average moved up to 0.6%. By 2019, the SSA prevalence rate was 3.72%, 0.5% in LAC, the U.S remained at 0.4%, while world average increased to 0.7%. The SSA average is usually pushed up by the high prevalence rate in Eastern and Southern African sub-regions. For instance, in 2019, the prevalence rate was 27% in Eswatini (Swaziland), 22.8% in Lesotho, 20.7% in Central Africa Republic, 19% in South Africa and 12.4% in Mozambique. Figure 1 shows that HIV prevalence in SSA has remained unacceptably high, especially when compared with other developing regions, such as LAC, and the world average. This situation has multiple implications concerning co-morbidity, livelihood, and labour productivity, among several others.

The HIV infection concentration always skews towards SSA. The region is responsible for 70% of the global HIV/AIDS load (UNAIDS, 2020). In 2019, over 38 million individuals (including 1.8 million children) were HIV positive, with a global HIV prevalence of 0.7% among adults. AIDS-related illnesses claimed the lives of approximately 690,000 persons in the same year. Compared to 2004, when the number peaked at 1.7 million, it dropped by almost 60%. Meanwhile, 59% of the 4,500 persons in the world who are infected with the virus everyday reside in SSA (UNAIDS, 2020).

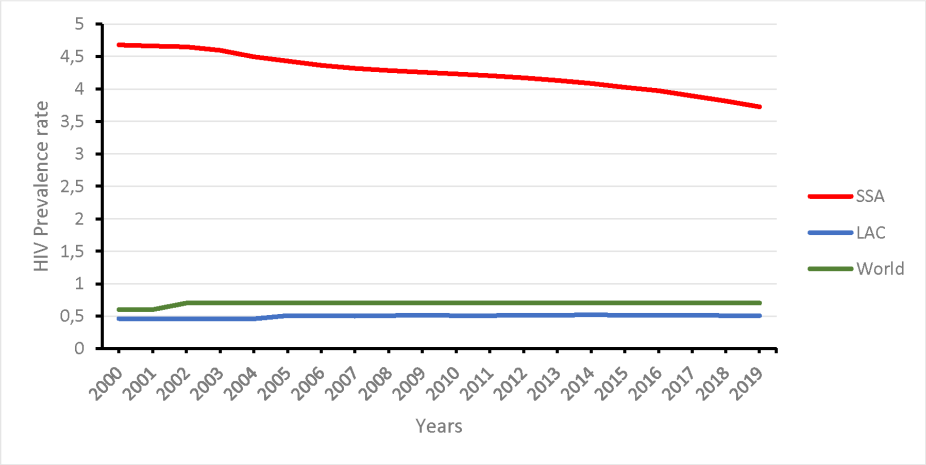

Figure 1. HIV prevalence rate in SSA, in LAC and the world average

HIV destroys the host's immune system cells, increasing the risk of infection and sickness as the immune system becomes weaker. If not treated, a person's CD4 cell count can drop to dangerously low levels, leading to AIDS, which is accompanied by a variety of opportunistic illnesses, such as malaria, TB, and so on (MHHS, 2021).

The economic consequences of HIV are many and including, but not limited to, loss of productive time for those infected, high cost of time for family members who stay away from work to care for sick relatives, high financial cost for drugs where sponsored treatments are not available, etc. All these affect the overall economic position of society.

At the turn of the millennium, developed countries discussed and agreed on the need to help developing countries achieve improvements in all spheres of human development including HIV/AIDS reduction and treatment. Before then, there have been isolated efforts aimed at reducing HIV/AIDS and the consequent societal burden, due to other diseases, in developing countries. According to Joseph *et al.* (2017), it was indeed imperative to halt and reverse the global rise of infection, because of its negative impact on productivity, particularly among sick people and their family members. Global health initiatives (GHIs), such as the US President's Emergency Plan for AIDS Relief (PEPFAR) and the Global Fund to Fight AIDS, Tuberculosis, and Malaria (GFTAM), among others, have become critical tools for ensuring that everyone in need can receive antiretroviral drugs and other healthcare issues. All these are coming to complement other forms of bilateral and multilateral foreign development assistance through the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD).

To this end, there has been an influx of foreign aid into the health sector in recent decades in developing countries, especially those in sub-Sahara Africa. For instance, OECD data series show that total aid to the health sector in the region came to approximately $742.47 million in 2001 at 2010-constant price and increased to approximately $1.873 billion in 2019. Correspondingly, HIV prevalence rate in the region was 4.67% in 2001and 3.72% in 2019. However, existing knowledge concerning the effect of health aid on HIV prevalence in SSA is limited and contradicting, and the need to carry out an objective assessment of the relationship between the two variables becomes imperative. The results of most relevant previous studies carried out in the region are outdated, not to mention few deficiencies in the methodologies used. For instance, Younde (2010) used Pearson correlation and data from 2004-2008, while Yogo and Mallaye (2012) utilised data from 2000-2010. The present study, therefore, assessed the effect of health aid on HIV prevalence in SSA using available up-to-date data analysed following the system GMM procedure, which can address some of the problems identified in certain available studies. Study findings are expected to be useful for governments and donors of foreign aid to the health sector in the region. The second part of the paper reviews relevant literature, while the third presents the methodology adopted. The fourth part presents and discusses the results, while the last (fifth) one summarises and concludes accordingly.

2. Empirical Literature Review

There have been attempts to assess the effect of foreign aid for the health sector and other related variables on HIV prevalence in developing countries, quite divergent in their findings. For instance, Peiffer and Boussalis (2010) looked at how foreign funding affects a country's reaction to an epidemic. While HIV/AIDS-focused aid enhanced treatment coverage rates, it was shown that a country's predisposition to implementing preventative measures focused on HIV/AIDS education is more likely to be influenced by its level of traditionalism.

Using Pearson correlation analysis, Youde (2010) examined the association between health aid, HIV prevalence, and government spending in 15 PEPFAR (the President's Emergency Plan for HIV/AIDS Relief)-targeted countries from 2004 to 2008. The study, which was to pave the way for future research into the link between health aid and HIV prevalence, revealed a statistically significant negative link between adult HIV prevalence and health aid. The study showed that the relationship between foreign aid and domestic government spending had a cumulative effect, implying that the government may rely on foreign resources to fund AIDS-related activities rather than its own money.

Nunnenkame and Ohler (2010) used the Difference-in-Difference estimation method to investigate whether or not there was a noticeable difference in HIV/AIDS outcomes between a group receiving treatment and another group not receiving

treatment. The paper used the number of people who were HIV positive and AIDS-related deaths as regressands. It was found that foreign aid had a significantly negative impact on AIDS-related deaths but no statistically significant influence on the number of people living with the virus. Bendavid and Bhattacharya (2009) also employed the foregoing procedure to evaluate the impact of PEPFAR on Sub-Saharan Africa. It was revealed that a statistically significant difference existed between the treatment group, which received PEPFAR programme assistance, and the control, namely people who did not benefit from such assistance.

Yogo and Mallaye (2012) looked at the influence of health aid on health outcomes in 28 Sub-Saharan African countries between 2000 and 2010. Results show that, for each additional unit of health aid, the prevalence of HIV dropped by 0.05% after accounting for endogeneity; the technique used was the instrumental variable one. Using data from 120 low- and middle- income countries, Hsiao and Emdin (2015) investigated whether health aid, directed explicitly at malaria, HIV, and tuberculosis (TB), was connected with changes in mortality associated with these diseases. Country and time-period fixed effects and control variables were used in the regression analysis carried out in the study. Health aid was linked to lower HIV mortality rates, according to the findings. Various sensitivity assessments, including GMM estimation, yielded consistent results. Findings revealed that targeted health aid had a strong link with reduction in HIV mortality at the national level.

Atun *et al*. (2016) carried out an extensive review of how Innovative Financing (IF) has been used to co–finance HIV/AIDS responses in some SSA countries. The review identified IF instruments that could be adopted in HIV responses based on analysis of non–health sectors. The instruments identified included tax/levy, such as the AID Trust Fund used in Zimbabwe, a debt conversion instrument, such as the one used in Botswana, and the debt Buy–Down, as adopted in the Debt2Health Debt Swap Agreement in Ivory Coast. Hence, the study concluded that a small number of innovative finance tools allocated just a small portion of funds to domestic HIV/AIDS initiatives.

Developed countries, who are donors of foreign development assistance to fight HIV/AIDS in developing countries, have come to recognise the need to curb corruption and develop strong management and audit systems. This became imperative because utilisation of foreign aid is more important throughout the process. All of these are part of the effort to enhance the effectiveness of foreign aid. Therefore, Tun (2017) utilised data from 2005-2014, covering 17 countries selected across Africa, Asia, Latin America, and Europe, and adopted the panel-fixed effect procedure. The study reported that receipt of foreign aid for battling anti-corruption reduced HIV prevalence by 8.6%, while AIDS-related death rate was not affected. In addition, it was revealed that foreign aid for battling anti-corruption worsened the level of corruption instead of improving it, but the coefficient was not significant. It was, therefore,

recommended that attention should be focused on AIDS treatment programmes that are susceptible to corruption because of the high cost of treatment pharmaceuticals, the goal to lower AIDS-related mortality by increasing the effectiveness of foreign aid flows into treatment programmes.

The impact of foreign aid on the fight against HIV/AIDS in Nigeria was investigated by Joseph *et al.* (2017). Their findings show that foreign aid from a variety of sources was responsible for significant improvements in HIV/AIDS care as well as lower mortality and morbidity rates. Official development assistance was stated to have aided in the reversal of HIV prevalence and incidence rates. The study also revealed that donor-funded initiatives have overstretched the workforce and health systems, resulting in a shift in healthcare priorities toward disease intervention programmes. It was stated that the HIV/AIDS programme is still reliant on donors and it is sometimes misunderstood as "donor-agency things."

Olakunde *et al.* (2019) examined the structure and correlated domestic HIV expenditure in 30 countries in SSA between 2012 and 2017. The study looked at the relationship between domestic proportion of the overall HIV expenditure, HIV prevalence, antiretroviral coverage, gross national income (GNI) per capita, total domestic government health expenditure (GGHED), and GGHED per capita. It was concluded that some SSA countries are still reliant on outside assistance to combat HIV. However, boosting domestic HIV spending in the countries sampled may necessitate economic growth; governments might improve their countries' fiscal status by seeking creative and long-term funding options within the country.

It is evidently clear from some of the previous studies reviewed so far that some of the findings are outdated, while some others neglected the factor of endogeneity, which may arise in a model such as the present one involving HIV prevalence and health aid. There is, therefore, a need for new investigation using current, up-to-date data and appropriate methodology, which is what the present study attempted to do.

3. Methodology

Model Specification

The study adapted the model of Tun (2017) and stated the modified empirical model implicitly as:

$$HIV = f(HDN, SSER, HEXP, POP, TOP, CORR, GOV, GDPC, PHY) \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Equation 1 can be explicitly stated thus:

$$HIV_{it} = \alpha_0 + \alpha_1 HIV_{it-1} + \alpha_2 HDN_{it} + \alpha_3 SSER_{it} + \alpha_4 HEXP_{it} + \alpha_5 POP_{it} + \alpha_6 TOP_{it} + \alpha_7 CORR_{it} + \alpha_8 GOV_{it} + \alpha_9 GDPC_{it} + \alpha_{10} PHY_{it} + \eta_i + \mu_t + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where: HIV= HIV prevalence Rate; HDN= Health aid share of GDP; SSER = Secondary School Enrolment Rate (education proxy); HEXP = Health expenditure as a percentage of GDP; POP = Population; TOP = Trade Openness; CORR = Corruption Index; GOV = Government Effectiveness Index, GDPC = GDP per capita; PHY = Physicians per 1000 (physician density); η = Country specific effect; μ = Time specific effect; ε = Error term; α = slope co-efficient; i = Cross-section of countries; t = time period

A priori Expectations

Health Aid (HDN) is expected to have negative effects on HIV prevalence. Health aid is supposed to improve access to and quality of health care including the special care needed for HIV patients as it provides the necessary resources to bridge existing shortages. This expectation is in line with empirical work, such as that by Azuine *et al.* (2014) in a study that covered countries in Africa and Asia, and that of Hsiao and Emdin (2015) in a study that utilised data across 120 developing countries from 1990-2010. Health Expenditure share of GDP (HEXP) is expected to reduce HIV prevalence (negative effect). Health expenditure is expected to improve health infrastructure and availability of quality manpower in the health sector, thereby, improving the quality of healthcare, which trickles down to positive health outcomes, such as reduction in HIV prevalence. The expectation aligns with the report by Osemwengie and Shaibu (2020), which assessed the impact of public health spending on HIV prevalence rate in Nigeria.

Population (POP) is expected to worsen HIV prevalence rate (positive effect) due to increased pressure on available health facilities, manpower and budgets. The expected sign is in line with some health studies outcome, such as those by Hsiao and Emdin (2015), David (2017), etc. Corruption (CORR) is expected to worsen HIV prevalence rate (positive effect). Corruption is most likely to reduce the efforts aimed at reducing HIV prevalence rate due to outright embezzlement and misappropriation. This is in line with the model estimated by Doucouliagos *et al.* (2019). The effectiveness of government institutions (GOV) is expected to decrease (negative effect) HIV prevalence rates. Improvement in government effectiveness enhances service delivery and efficient use of resources. This expectation aligns with reports by Hwa-Young *et al.* (2016) in a study of developing countries from 2000-2010.

Secondary School Enrolment Rate (SSER) was used as a proxy for education, and it is expected to reduce (negative effect) HIV prevalence rate. Education is likely to improve health awareness and the expected negative sign aligns with the study of Vandemoortele and Delamonica (2000), which reported that HIV spreads twice as fast among uneducated girls in Zambia. GDP per capita (GDPC) stands as a proxy for income and the expected negative sign is in line with reality, as high-income countries tend to have a lower HIV prevalence rate. The expectation is in line with findings by

Asiedu *et al.* (2015) and Toseef *et al.* (2019). Trade Openness (TOP) is expected to reduce HIV prevalence rate if the country concerned engages in beneficial trade, such as making available hitherto unavailable pharmaceutical products through several other routes. This thought aligns with that of Manavgat (2020). Fertility Rate (FET) is expected to increase or have a positive effect on HIV prevalence rate, as giving birth frequently may expose women to the risk of direct and indirect contraction of HIV. This was included in the health outcome model in the study of Jain (2011). Availability of well-trained medical doctors relative to the population (physician density – PHY) is expected to reduce HIV prevalence due to availability of personnel needed for the care of HIV patients and raising the awareness of other ailments among patients. The expectation aligns with that of Welander (2012).

Summary of *a priori* Expectations: $a_1>0$, $a_2<0$, $a_3<0$, $a_4<0$, $a_5>0$, $a_6<$ or >0, $a_7>0$, $a_8<0$, $a_9<0$, $a_{10}<0$.

Definition and Measurement of variables

*HIV Prevalence (HIV)***:** This is the estimated number of adults aged 15 to 49 who have HIV infection, regardless of having AIDS symptoms, expressed as a percentage of the total population of the same age range (WHO, 2018).

Health Aid: This is foreign aid to be channelled into the health sector measured in Dollars (2010=100).

Population: At mid-year estimates, this is the total number of individuals living in a country, regardless of their legal status or citizenship.

*Control of Corruption index***:** This is a measure of how much public power is used for private benefit, including both petty and grand forms of corruption, as well as "state capture" by elites and private interests (WGI, 2017). It was calculated using an annual corruption control index that scores countries on a scale of –2.5 (high corruption) to 2.5 (low corruption). The indicator was rescaled, for ease of interpretation, by deducting nations' scores from 2.5, as implemented by Ackay (2006). In this approach, higher values correspond to higher levels of corruption.

Government Effectiveness: The quality of public and civil service and its degree of independence from political influences, the quality of policy formulation and implementation, and the genuineness of the government's commitment to such policies are all factors that constitute government effectiveness. Estimate is the country's overall score on the aggregate indicator, expressed in standard normal distribution units range from -2.5 to 2.5 (WGI, 2017).

Trade Openness: This metric captures the degree of trade openness by combining import and export rates as a percentage of GDP.

Secondary School Enrolment Rate: The gross enrolment ratio is the proportion of total enrolment, regardless of age, in the population age group that officially corresponds to the level of education shown. Secondary education completes the basic education provided at the elementary level, the goal being to lay the foundations for lifetime learning and human development by providing more subjects or skill-oriented teaching taught by more specialised teachers.

Domestic Health expenditure: This is measured in constant 2010 US Dollars but enters the estimation as a share of the GDP.

GDP per Capita: This is a metric that breaks down a country's economic output per person and it is determined by dividing GDP (2010=100) by the entire population.

Physician Density: This is measured as the number of medical doctors per 1000 people.

Sources of Data

There are different descriptions of the number of countries that make up the SSA region. The present study, however, covered the entire 48 sub-Saharan African countries, as listed by the World Bank, using data from 2000 to 2019. Meanwhile, two countries (Somalia and South Sudan) were dropped because of the large number of missing data points. Therefore, 46 countries were finally used for the study. Data on HIV/AIDS prevalence, population, trade openness, secondary school enrolment rate, domestic health expenditure, GDP per capita and physician density were obtained from the World Bank's World Development Indicator (WDI) website. Health aid data were obtained from the OECD Creditors' Reporting System (CRS), while data on control of corruption and government effectiveness were obtained from the World Governance Indicator (WGI).

4. Estimation Techniques

Pre-Estimation

Descriptive Statistics: These provide a detailed description of the data used in the econometric analyses. Some of the descriptive statistics reported in the study concern mean, median, mode, standard deviation, skewness, kurtosis, and the Jaque-Berra test for normality of distributions.

Correlation Analysis: This was used to assess the joint movement of variables. The test was imperative as a pre-estimation analysis because it gives an insight into the possibility of relationships among variables. Correlation estimation helps guard against the problem of multicollinearity, which may arise when two or more highly correlated variables exist as regressors in an econometric model. Such occurrence may lead to a situation where estimates of the model become indeterminate and standard errors become infinitely large leading to wrong conclusions about parameter estimates.

Estimation

The most appropriate analytical procedure for the study is the system Generalized Method of Moment (System GMM) regression technique. It has been established in literature that a simultaneous relationship usually exists between foreign aid and human development, which includes health outcomes, such as HIV/AIDS prevalence; this may lead to the problem of endogeneity in the said models. The GMM estimation procedure has the desirable properties capable of taking care of such endogeneity issues. It combines the relevant regressors in a system expressed as first differences and levels. The Differenced GMM and System GMM procedures are contained in the GMM procedure. The System GMM is mostly suited for the present study because it corrects unobserved country heterogeneity, omitted variable bias, measurement error and potential endogeneity (Arellano and Bover, 1995; Blundell and Bond, 1998). The use of the GMM estimation approach is further justified as the procedure is not only dynamic in nature but also allows control for persistence in HIV/AIDS prevalence, which has behavioural effects that persist. The association between HIV/AIDS prevalence and its accompanying first lag can be used to assess persistence. In addition, the number of time series in each section is lower than the number of cross sections, i.e., N (46) > T (20). In regressions, cross-country variations are also taken into account. Finally, Blundell and Bond (1998) theorised that the system GMM estimator corrects for differenced estimator biases.

The study used the orthogonal deviation to transform equation 2. Arellano and Bover (1995) presented orthogonal deviations as an alternative to differencing, which was the original transformation employed in the typical GMM approach. This procedure subtracts the average of all future accessible observations of a variable from the variable's existing data. It can be calculated for all observations except the last one for each individual, regardless of the number of gaps, hence, minimising data loss (Roodman, 2009a). Time dummies, which capture time-specific effects, were also incorporated in all estimations. The assumption of no autocorrelation between countries is reflected in time dummies, which helps lower the degree of autocorrelation among countries and the error idiosyncratic term, thus resulting in a robust estimation (Roodman, 2009a).

Roodman (2009b) posited that the number of instruments should not exceed the number of groups to avoid proliferation and over-identification of instruments, which may lead to over-fitting of endogenous variables, bias in the GMM estimator and weakening of the Sargan-Hansen test (cross-section). With Windmeijer correction for finite samples, the two-step system GMM estimate is robust to panel-specific autocorrelation and heteroskedasticity, reducing standard error biases. Instruments were collapsed and set to a lag limit of 2 and longer lags for the transformed equation and a limit of 2 for the level equation to make results more robust. In addition, some instruments were removed until the set retained was found to be exogenous, as shown through the Sargan- Hansen test.

5. Results and Discussion

Preliminary Analyses

Descriptive Statistics

Table 1 presents the results of the descriptive statistics of the study variables. Those reported in the present study are mean, median, minimum, maximum, standard deviation, skewness, kurtosis, and the Jaque-Berra test for normality of distribution. Results showed that the average HIV prevalence rate was 4.25% during the period of the study. This is higher than 0.5% in LAC and the world average of 0.69% for the same period. SSA has long been labelled as the epicentre of the HIV scourge in the world and, indeed, a lot of efforts have been geared towards slowing down the prevalence of the virus in the region. The value of physicians per 1,000 population members of 0.24 was far below the WHO recommended ratio of 1: 1,000 and this may adversely affect the fight against HIV/AIDS in the region, as medical doctors are needed to attend to the health needs of HIV/AIDS patients. The average health expenditure share of the GDP was 5.14. This was a bit lower than 6.35 for East Asia and the Pacific (EAP), 7.22 for LAC and the world average value of 9.47 in the period covered by the study. Low investment in health may adversely affect health outcomes including the prevalence of HIV/AIDS since such funds are needed to raise awareness about its existence, prevention, and treatment. All the study variables except corruption skewed to the right (implying that majority of observations in each of the series fall below their various averages and the long tails lie to the right of the distribution), while kurtosis, corruption, and secondary school enrolment rate were mesokurtic in distribution. Jaque-Berra statistics combines the properties of measures of skewness and kurtosis to access the normality of the distribution of series and the statistics confirmed that none of the series was normally distributed.

Table 1. Results of Descriptive Analyses

	HIV	HDN	GDPC	HEXP	CORR	GOV	PHY	POP	SSER	TOP
Mean	4.25	0.3484	2290.37	5.14	3.11	-0.71	0.24	17820385	42.06	72.05
Median	1.16	0.18	989.57	1.58	3.21	-0.74	0.10	10409229	38.56	62.04
Maximum	21.24	5.39	20532.95	7.12	4.33	1.05	2.53	1.91E+08	99.90	311.35
Minimum	0.010	2.33E-07	194.87	0.04	1.28	-1.88	0.008	81131.00	6.11	16.67
Std. Dev.	3.61	0.5163	3193.26	1.17	0.62	0.61	0.38	27421484	21.20	37.44
Skewness	2.38	3.59	2.57	1.37	-0.69	0.53	3.25	3.56	0.66	1.80
Kurtosis	8.80	23.48	10.12	5.12	2.91	2.79	15.21	18.19	2.80	8.60
Jarque-Bera	2065.65	17998.22	2952.65	455.72	70.22	42.76	2919.14	10783.17	49.58	1617.51
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	880	917	919	910	874	874	366	920	678	877

Source: Author's Computation, 2021

Correlation Analyses

Table 2 presents the results of product moment correlation analyses conducted on all study variables. Results showed that there was no such high correlation between any pair of proposed explanatory variables to portend the possibility of multicollinearity in the model estimated.

Table 2. Results of Correlation Analyses

	HIV	AID	GDPC	FERT	HEXP	CORR	GOV	PHY	POP	SSER	TOP
HIV	1										
AID	-0.03	1									
GDPC	0.41	-0.42	1								
FERT	-0.36	0.30	-0.80	1							
HEXP	0.57	-0.14	0.58	-0.53	1						
CORR	-0.34	0.08	-0.61	0.64	-0.54	1					
GOV	0.19	-0.28	0.24	0.17	0.18	-0.35	1				
AIW	0.17	-0.29	0.70	-0.73	0.46	-0.57	0.41				
PHY	0.06	-0.32	0.86	-0.72	0.29	-0.44	0.14	1			
POP	-0.16	-0.10	-0.14	0.22	-0.33	0.32	0.31	-0.06	1		
SSER	0.13	-0.27	0.63	-0.73	0.36	-0.54	0.39	0.62	-0.14	1	
TOP	0.38	-0.15	0.47	-0.50	0.27	-0.40	0.26	0.37	-0.37	0.49	1

*Source:*Author's Computation, 2021

Effect of health aid on HIV prevalence

The health outcome of the people is a product of many complex interacting factors. The issue of morbidity (disease occurrences and illnesses) is as important as the issue of mortality that terminates people's lives and stops their contributions to economic growth and development, more so, as the former leads to the latter. The occurrence of illnesses from diseases such as HIV/AIDS can be truly devastating, as sick people may not be able to work during the period of illness, while substantial time of family members who stay at home or at the health facilities to provide additional care is wasted and entails huge incidental costs. The multiple implications of illnesses suggests that morbidity is as important as mortality.

Meanwhile, UNAIDS (2021) reported that 67% of people living with HIV/AIDS worldwide are living in SSA. In order to rein the tide of HIV/AIDS in SSA, there has been an influx of foreign aid for health specifically to fight HIV/AIDS in the region. In order to achieve the objective of analysing the effect of health aid on HIV/AIDS in the region and to answer the question regarding how effective health aid is in reducing HIV prevalence, a system GMM model was analysed as stated in equation 2 and reported in Table 3. Results showed that lagged HIV prevalence rate, health aid, secondary school enrolment, health expenditure and government effectiveness significantly affected the HIV prevalence rate in SSA. The lag of HIV prevalence rate came up with a significantly ($P<0.01$) positive coefficient value of 0.9325 implying

that a 1% increase in HIV prevalence in the last period leads to an increase in current HIV prevalence by 0.93%. Health aid returned a significantly (P<0.05) negative coefficient. A 1% increase in health aid share of GDP decreased HIV prevalence rate by 0.0878%. This result aligned with the finding of Azuine *et al.* (2014), which assessed the global health donor presence in relation to variations in HIV/AIDS prevalence in selected developing countries in Africa and Asia and reported that increased donor presence yields quantifiable reduction in HIV prevalence burden. The negative effect of health aid on HIV prevalence also agreed with the report of Hsiao and Emdin (2015), which also reported HIV prevalence reducing effect of health aid in a study that covered 120 developing countries from 1990-2010. It also agreed with that of Yogo and Mallaye. (2012), which reported a significantly negative effect of health aid on HIV prevalence rate in a study that used data from 28 SSA countries from 2000-2010. Nunnenkamp and Öhler (2010), on the other hand, in a study that examined the impact of foreign aid on HIV/AIDS-related deaths and the number of people living with HIV in developing countries from 1990 to 2007, found no evidence that foreign aid prevented new infections to the extent that it would reduce the number of people living with HIV. However, the study found that foreign aid made a significant contribution to the medical care of affected patients. Meanwhile, it was reported that only the biggest bilateral supplier of foreign aid, namely, the United States, has clear proof of significant treatment effects on AIDS-related fatalities. Targeted US assistance programmes, in particular, appeared to be more effective than multilateral organisation operations. The difference in the finding might be due to the fact that the total amount of foreign aid was used as the explanatory variable in the reference study rather than aid targeted at the health sector as operationalised in the present study. Besides, the period covered by the reference study marked the beginning of an aggressive fight against HIV/AID in SSA; therefore, the impact might not have been evident. Furthermore, Akinbode *et al.* (2019) also reported insignificant effect of health aid on HIV prevalence in Nigeria. Furthermore, the study used per capita health aid while the present study used the health aid share of GDP, in addition to the fact that the present study used data from 46 SSA countries rather than a single country.

Health expenditure was negative and significant at 10% risk level. A 1% increase in domestic health expenditure share of GDP significantly reduced HIV prevalence rate by 0.06% in SSA in line with *a priori* expectations. This is in line with result of Osemwengie and Shaibu (2020), who assessed the impact of public health spending on HIV prevalence rate in Nigeria from 1982-2016 using the Vector Autoregressive (VAR) procedure and reported a significantly negative relationship between public health expenditure and the HIV prevalence rate in the country.

Secondary School enrolment served as a proxy for the educational level of people in the estimated model. It is expected that well educated people will understand

the problem posed to society by the HIV/AIDS pandemic and will be aware of it, and perhaps, take precautionary measures. The coefficient of school enrolment was negative and significant at the 10% risk level. A 1% increase in secondary school enrolment reduced HIV prevalence by about 0.15%. This implies that, if secondary school enrolment doubles, HIV prevalence will reduce by about 15%. Moreover, education is important as HIV/AIDS is known to be more prevalent among people aged 15-49 years, which is a range that consists of active individuals. A study carried out in Zambia found that the virus spreads twice as fast among uneducated girls (Vandemoortele and Delamonica, 2000). A study in Kenya also found that there is a fourfold higher likelihood that girls who are in school will be virgins and present low HIV prevalence than girls who drop out of school (World Bank, 2002).

Government effectiveness as an explanatory variable in the HIV model came up with a significantly ($P<0.1$) negative coefficient. A unit increase in the index score decreased HIV prevalence rate by 0.336%. Government effectiveness is part of the family of governance indicators, which includes accountability, regulatory quality, and rule of law/legal rules, among others. The significance implied that, as government improves service delivery, HIV prevalence decreases. This is plausible as ineffective service delivery may impede health services aimed at reducing HIV prevalence. This result aligned with that of Hwa-Young *et al.* (2016) in a study of developing countries from 2000-2010. The result is a call to action for governments in SSA to improve service delivery and increase their commitments in the conduct of government business in the region in order to reduce HIV/AIDS prevalence.

Post Estimation Assessments

Autocorrelation Tests

In an attempt to establish the validity of the system GMM model estimated, the autocorrelation test of the first order i.e., AR (1), and that of the second order, i.e., AR (2), were carried out on differenced idiosyncratic error terms. The AR (1) test result, which came up with a p-value of 0.048 implied the presence of first order serial correlation and this is expected in line with the theory. The AR (2) test, with a p-value of 0.154, implied the acceptance of the null hypothesis of "no second order serial correlation", thereby, confirming the validity of the estimated system GMM model (Table 3).

Validity of the instrumental variables

The Sargan-Hansen tests are over-identifying restriction tests that are used to determine the validity of instrumental variables. "All instruments as a group were exogenous or valid," was the null hypothesis. The Sargan and Hansen test had probability values of 0.117 and 0.239, respectively (Table 3). As a result, the GMM's instrumental variables were assumed to be valid. The consistency of parameter estimates generated from the system-GMM model depends on the validity of instrumental variables. In applied econometrics and policy making, estimates that are inconsistent are less valuable.

Check for Robustness

The analysed GMM model must be assessed for robustness. The criterion is that the estimated coefficient of the lagged dependent variable in the GMM model falls between its value in the fixed effect model and the pooled OLS model, as stated by Roodman (2009a). Table 3 displays the results of the Pooled OLS and fixed effect models. Results showed that parameter estimates of the lagged HIV prevalence rate obtained in the GMM model (0.9470) was between its values in the fixed effect (0.9315) and pooled OLS (0.9667) estimates. As a result, the robustness of the estimated GMM model was confirmed.

Table 3. Results of the HIV prevalence model

	Main Results			**Robustness Check Results**					
	Two-Step System GMM			**Pooled OLS model**			**Fixed Effect Model**		
	Coeff.	S.E.	t-value	Coeff.	S. E.	t-value	Coeff.	S. Error	t-value
Const.	-0.0978	1.3589	-0.07	0.2458	0.3052	0.81	2.9554***	1.0415	2.8407
L1.HIV	0.9470	0.0950	9.97	0.9667***	0.1736	5.57	0.9315***	0.2268	4.11
HDN	-0.0878**	0.0416	-2.11	-0.0588**	0.0297	-1.98	0.0211	0.0409	0.52
SSER	-0.1453*	0.0756	-1.92	-0.0014**	0.0007	-1.99	-0.0628**	0.0248	-2.53
HEXP	-0.0643*	0.0337	-1.91	-0.0353***	0.0128	-2.76	-0.0411*	0.0241	-1.70
InPOP	-0.0040	0.0161	-0.25	-0.0031	0.0115	-0.27	0.1663	0.1944	0.86
TOP	0.6710	0.7170	0.92	0.0013***	0.0005	2.51	0.05105	0.0912	0.56
CORR	-0.0120	0.0653	-0.18	-0.0284	0.0350	-0.81	-0.1190	0.0947	-1.26
GOVEFF	-0.3363**	0.1450	-2.31	-0.0231	0.0391	-0.59	-0.1750**	0.0774	-2.26
InGDPC	0.0530	0.1745	0.30	-0.0110	0.0278	-0.40	0.1346	0.1450	0.93
InPHY	-0.0048	0.0790	-0.06	0.2090	0.0181	1.15	0.0053	0.0334	0.16
AR (1) p-value	0.048	-	-	-	-	-	-	-	-
AR (2) p-value	0.154	-	-	-	-	-	-	-	-
Hansen test p-value	0.239	-	-	-	-	-	-	-	-
Sargan test p-value	0117	-	-	-	-	-	-	-	-
R-Squared	-	-	-	0.9983	-	-	-	-	-
Adj. R^2	-	-	-	0.9725	-	-	-	-	-
F-Stat (Prob)	1533.47 (0.0000)	-	-	13,297.57 (0.0000)	-	-	1149.33 (0.0000)	-	-
No. of instruments	18	-	-	-	-	-	-	-	-

No. of countries = 46; No. of years =20
S.E = Standard Error; *, ** and *** implies significant at 10%, 5% and 1% respectively
Source: Author's Computation, 2021

5. Summary and Conclusion

HIV prevalence rate model results revealed that lagged HIV prevalence rate significantly increased the present period rate, while health aid, education, domestic health expenditure and government effectiveness had significantly negative effects on HIV prevalence rate in SSA. The AR(1) and AR(2) tests, which examined the presence, or otherwise, of first and second order autocorrelation in the error terms of the two-step system GMM model, showed that the estimated model was valid given the rejection of the null hypothesis of "no autocorrelation" of AR (1) and the acceptance of the null hypothesis of "no autocorrelation" of AR (2) tests. The Sargan-Hansen tests results showed that the instrumental variables used for the estimation of the system GMM models were all exogenous, and, by extension, valid. The results of the Pooled OLS and fixed effect models verified the robustness of the system GMM model, with the coefficient of the lagged dependent variable in the GMM model falling between its value in the fixed effect and the pooled OLS model. It was concluded that health aid plays a crucial role in SSA's attempts to reduce HIV/AIDS prevalence. The study recommended that governments in SSA should increase their domestic health expenditure in order to complement the contribution of health sector aid. Efforts should be made to improve government service delivery, especially in the health sector, while improvement in formal and informal education is important for the fight against HIV/AIDS in the region.

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