Economic Analysis of Insurance, Uncertainty and Economic Growth

Godwin Oluseye Olasehinde-Williams

Submitted to the
Institute of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
in
Economics

Eastern Mediterranean University
November, 2018
Gazimağusa, North Cyprus

Approval of the Institute of Graduate Studies and Research

Assoc. Prof. Dr. Ali Hakan Ulusoy
Acting Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Doctor of Philosophy in Economics.

Prof. Dr. Mehmet Balcılar
Chair, Department of Economics

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Doctor of Philosophy in Economics.

Prof. Dr. Mehmet Balcılar
Supervisor

Examining Committee

1. Prof. Dr. Mehmet Balcılar
2. Prof. Dr. Mehmet Akif Bakır
3. Prof. Dr. Mustafa Ismihan
4. Prof. Dr. Salih Katırcıoğlu
5. Prof. Dr. Zeynel Abidin Özdemir

ABSTRACT

The first essay examines whether there is a relationship between Africa's economic growth and insurance-market activity (life, non-life, and total). Applying panel-estimation techniques that are robust to heterogeneity and cross-sectional dependence to a model of panel data for 11 African countries between 1995 and 2016, we find significant evidence in support of such a relationship. Total-insurance penetration has a long-term impact on economic growth, and when disaggregated into its components (life- and non-life-insurance penetration), we find evidence in support of short-term and long-term impacts on economic growth in both cases. Our study also confirms the feedback hypothesis, as we find a positive, bi-directional causality between insurance-market activity and economic growth. We also find that the contribution from non-life-insurance market activity toward economic growth far outweighs that of life-insurance market activity.

The second essay examines whether the roles of the insurance and banking sectors are complimentary or substitutive in terms of growth effect. Using a dynamic panel-GMM estimation technique, we evaluate the synergistic effect of both sectors on economic growth in a panel of 10 African countries. The insurance-banking-growth nexus was also examined through bootstrap panel causality tests. The results show that life insurance market and the banking sector are complimentary and that the non-life insurance market and the banking sector are also complimentary. We find that overall, the relationship between the insurance and banking sectors in Africa is a complimentary one and that their synergistic impact on economic growth is positive.

The feedback hypothesis was also confirmed in the relationship between the insurance sector and economic growth and between the banking sector and economic growth.

The third essay tests for asymmetric causal relationships between financial systems (insurance markets, banking systems and stock markets) and economic performance in nine African countries over a 24-year period. This section of the study posits that it is important that asymmetric causal effects are taken into account when empirically examining the finance-growth nexus since it is possible that the economy (financial system) would react differently to changes in financial system (economy), depending on whether it is a positive or negative change. It proposes testing for asymmetric causality by using cumulative sums of positive and negative shocks via a bootstrap simulation approach. The results show that the pattern of causality varies across the selected countries and the following hypotheses were confirmed: negative and positive demand-following hypotheses, negative and positive supply-following hypotheses, and negative and positive feedback hypotheses.

The final essay investigates the impact of economic policy uncertainty on insurance premiums, controlling for the effect of real income, in a panel of 15 countries over the period 1998-2016. Findings from the error correction based panel estimations show that the insurance sector is not immune to the effects of economic policy uncertainty and real income. Economic policy uncertainty initially raises insurance premiums in the short run but eventually lessens it in the long run whereas real income increases insurance premiums both in the short and long run, although its long run impact is greater than the short run impact. Also, economic policy

uncertainty exerts a bigger influence on non-life insurance premium than on life insurance premium.

Keywords: Insurance market; Financial systems; Economic growth; Africa; Panel ARDL; Dynamic GMM; symmetric & asymmetric Causality; Synergistic effect; Economic policy uncertainty.

ÖZ

Tezin ilk kısmında, Afrika'nın ekonomik büyümesi ile sigorta-pazar faaliyeti (hayat, hayat dışı ve toplam) arasında bir ilişki olup olmadığı incelenmektedir. 1995 ve 2016 arasında 11 Afrika ülkesi için panel verisi modeline heterojenlik ve kesitler arası bağımlılığa dayanan panel-tahmin teknikleri uygulayarak, böyle bir ilişkinin desteklenmesinde önemli kanıtlar bulunmuştur. Toplam sigorta penetrasyonunun ekonomik büyüme üzerinde uzun dönemli bir etkisi vardır ve sigorta penetrasyonu bileşenlerine ayrıldığında (hayat ve hayat dışı sigorta penetrasyonu), her iki durumda da ekonomik büyüme üzerindeki kısa ve uzun dönemli etkilerin desteklenmesinde kanıt bulunmuştur. Çalışmamızda ayrıca, sigorta piyasası faaliyeti ve ekonomik büyüme arasında pozitif, çift yönlü nedensellik ilişkisi bulunduğundan, geri besleme hipotezinin geçerliliği de doğrulanmaktadır. Hayat dışı sigorta piyasası faaliyetlerinden ekonomik büyümeye olan katkının, hayat sigortası piyasası faaliyetlerine oranla çok daha fazla olduğu bulunmuştur.

Tezin ikinci kısmında, sigorta ve bankacılık sektörlerinin rollerinin büyüme üzerine olan etkisinin tamamlayıcı mı yoksa ikame mi olduğunu incelenmiştir. Dinamik panel-GMM tahmin tekniği kullanarak, her iki sektörün ekonomik büyüme üzerine sinerjik etkisi 10 Afrika ülkesi için panel veri analizi çerçevesinde değerlendirilmiştir. Sigorta-bankacık-büyüme ilişkisi bootstrap panel nedensellik testleri ile incelenmiştir. Sonuçlar, hayat sigortası piyasası ve bankacılık sektörünün tamamlayıcı olduğunu ve hayat dışı sigorta pazarının ve bankacılık sektörünün de tamamlayıcı olduğunu göstermektedir. Genel olarak, Afrika'daki sigorta ve

bankacılık sektörleri arasındaki ilişkinin tamamlayıcı olduğunu ve ekonomik büyüme üzerindeki sinerjik etkisinin olumlu olduğu bulunmuştur. Sigorta sektörü ve ekonomik büyüme ile bankacılık sektörü ve ekonomik büyüme arasındaki ilişkide de geri besleme hipotezi doğrulanmıştır.

Tezin üçüncü kısmında, finansal sistemler (sigorta piyasaları, bankacılık sistemleri ve hisse senedi piyasaları) ile ekonomik performans arasındaki asimetrik nedensellik ilişkileri dokuz Afrika ülkesi için 24 yıllık veri kullanılarak test edilmiştir. Çalışmanın bu bölümünde, ekonominin (finansal sistemin) finansal sistemdeki (ekonomi) değişimlere, pozitif veya negatif bir değişim olup olmamasına bağlı olarak farklı şekilde tepki vermesi mümkün olduğundan, finans-büyüme ilişkisini ampirik olarak incelerken asimetrik nedensellik etkilerin dikkate alınmasının önemli olduğu vurgulanmıştır. Asimetrik nedenselliğin test edilmesinde, bootstrap simülasyon yaklaşımı aracılığıyla kümülatif pozitif ve negatif şok toplamlarının kullanılması önerilir. Analiz sonuçları, nedensellik örüntüsünün seçilen ülkeler arasında değiştiğini ve aşağıdaki hipotezlerin doğrulandığını göstermektedir: negatif ve pozitif talep-hipotezleri, negatif ve pozitif arz-hipotezleri ve negatif ve olumlu geri besleme hipotezleri.

Tezin son kısmında, 1998-2016 dönemleri için 15 ülkeden oluşan bir panel veri analizinde, iktisadi politika belirsizliğinin sigorta primleri üzerindeki etkisini, reel gelirin faktörünü kontrol ederek incelemiştir. Hata düzeltme temelli panel tahminlerinden elde edilen bulgular, sigorta sektörünün ekonomik politika belirsizliği ve reel gelir üzerindeki etkilere karşı duyarsız olmadığını göstermektedir. Ekonomik politika belirsizliği, başlangıçta kısa dönemde sigorta primlerini yükseltmekte, ancak

uzun dönemde etkisini azaltmaktadır. Reel gelir hem kısa hem de uzun dönemde sigorta primlerini artırır, ancak uzun dönemdeki etkisi kısa dönemdeki etkisinden daha büyüktür. Ayrıca ampirik bulgulara göre, ekonomik politika belirsizliği, hayat dışı sigorta priminde hayat sigortası priminden daha büyük bir etki yarattığı bulunmuştur.

Anahtar Kelimeler: Sigorta piyasası; Finansal sistemler; Ekonomik büyüme; Afrika; Panel ARDL; Dinamik GMM; simetrik & asimetrik Nedensellik; Sinerjistik etki; Ekonomik politika belirsizliği.

DEDICATION

In memory of my father

To my mother and my wife

With love and eternal appreciation

ACKNOWLEDGMENT

I give glory to God Almighty, the Source of all knowledge.

I am indebted to Prof. Mehmet Balcilar, my supervisor, for his exceptional guidance, insightful comments and support during the course of this study. Without him, this thesis would have been impossible.

Special gratitude is extended to Prof. Rangan Gupta of the University of Pretoria, South Africa, and Prof. Chien-Chiang Lee of National Sun Yat-Sen University, Taiwan, both of whom co-authored three of the essays included in this thesis and contributed immensely to its completion.

My profound appreciation is extended to the entire staff and post-graduate students of the Department of Economics, Eastern Mediterranean University, for their relentless support during the course of my study.

The scholarship awarded to me by the Department of Economics, Eastern Mediterranean University, is also acknowledged and greatly appreciated.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ARDL	Autoregressive Distributive Lag
ASEAN	Association of South East Asian Nations
BC	Banking Sector Credit
BSA	Banking Sector Activity
CADF	Cross-sectional Augmented Dickey Fuller
CD	Cross-sectional Dependence
CI	Composite Index
CIPS	Cross-sectionally Aaugmented Im, Pesaran and Shin
COR	Corruption
DFE	Dynamic Fixed Effect
EPU	Economic Policy Uncertainty
GDP	Gross Domestic Product
GDPPC	Gross Domestic Product Per-capita
GEXP	Government Expenditures
GMM	Generalized Method of Moments
INF	Inflation
INV	Investment-to-GDP Ratio
IP	Insurance Penetration
IRMAA	Income-related Monthly Adjustment Amount
LA-VAR	Lag Augmented Vector Autoregressive
LID	Life Insurance Density
LIP	Life Insurance Penetration

LM	Lagrange Multiplier
MG	Mean Group
NLID	Non-life Insurance Density
NLIP	Non-life Insurance Penetration
OECD	Organization for Economic Cooperation and Development
OPEN	Trade Openness
PCA	Principal Component Analysis
PCGR	Per-capita Growth
PGR	Population Growth
PMG	Pooled Mean Group
PPP	Purchasing Power Parity
SUR	Seemingly Unrelated Regression
TID	Total Insurance Density
TIP	Total Insurance Premium
TOR	Turnover Ratio
USD	United States Dollars
VAR	Vector Autoregressive

Chapter 1

INTRODUCTION

Discovering the reasons for different growth rates across countries is the fundamental aim of growth economics. Factors such as macroeconmic stability, trade openness, capital accumulation, quality of institutions, resource endowments have been put forward as part causes of these differences. More recently, a new wave of research has succeeded in adding financial sector development to this list of factors. Consequently, the interlinkage between financial and real sectors of economies has become an issue of significant interest in growth economics. As a result, numerous studies examining the finance-growth nexus currently exist. However, some shortcomings are still noticeable in existing literature.

First, the insurance sector has been widely ignored in the finance-growth literature. The focus has been on banking systems and stock markets. Yet, the insurance sector serves as the main risk management service provider in the financial sector, provides financial intermediation services similar to those oferred by banks and provides long term income streams. These functions suggest that insurance play a crucial role in the achievement of sustainable economic growth.

Second, most existing studies on finance-growth nexus are focused on developed and industrializing economies. Few studies exist that examine how Africa's financial sector impacts its economic growth. This is perhaps due to the small size of the sector on the continent.

Third, on the methodological front, existing research on the finance-growth nexus has mainly been done through cross-sectional and time-series analyses. A surge in the application of panel data analysis to this issue has however been witnessed in recent times. Key advantages of panel data analysis include more accurate inference of model parameters and greater capacity for capturing complex human behaviour. Still, most of the available panel studies on the finance-growth nexus largely ignored the twin challenges of cross-sectional dependency and country-specific heterogeneity that are associated with panel studies.

For these three reasons, the primary part of this thesis investigates the potential impact of Africa's insurance sector on its economic growth, using up to date panel estimation techniques that account for cross-sectional dependency and country-specific heterogeneity. Specifically, the second chapter of this thesis examines the relationship between insurance penetration and economic growth in a panel of eleven African countries.

Fourth, extant literature on finance-growth nexus is concentrated on testing one-way and bi-directional relationships. Little attention has been paid to possible synergistic effects in the financial system. Chapter three of the thesis fills this gap by examining the synergistic effect of insurance and banking sector activities on economic growth in a panel of ten African countries.

Fifth, the validity of the linearity assumption often imposed when testing the finance-growth nexus has been questioned. İt has been suggested that finance-growth relationship is characterized by asymmetries. Not properly modeling asymmetric dynamics in the finance-growth relationship could result in misleading inferences. Therefore, chapter four of this thesis examines asymmetric causal relations between financial systems (insurance market, banking sector and stock market) and economic growth in a panel of nine African countries.

A well-functioning financial system is established as critical to economic growth in chapters two to four through its role in mobilizing savings, promoting efficient allocation of resources, providing indemnification against losses, risk pooling and facilitating trade in goods and services A clear understanding of the factors that drive financial system development is therefore important since financial system development facilitates economic growth. One of such factors not yet studied in depth is policy-related uncertainty. A number of uncertainty studies have thus considered its impact on different aspects of the financial system. Such studies are however mainly focused on its impact on banking systems and their lending decisions and on stock markets. Studies examining the influence of policy-related uncertainty on the insurance sector are almost non-existent.

The fifth chapter of this thesis is focused on the impact of economic policy uncertainty on the insurance sector in a panel of selected countries. Though not focused on Africa due to data inavailability, lessons learnt from this chapter are still valuable to the African insurance market. Finally, chapter six provides a summary of the conclusions reached in the previous chapters in a manner that conveys the overrall idea of the thesis.

Chapter 2

INSURANCE PENETRATION-GROWTH NEXUS IN AFRICA

2.1 Introduction

A prominent feature of Africa is its relatively less developed economy compared with other continents. Gross domestic product (GDP) data based on purchasing power parity (PPP) for 2016 shows that all of the 10 poorest countries in the world are located in Africa. Thus, it is not surprising that much effort is currently being directed towards achieving sustained economic growth and development on the continent.

While trying to address this challenge of tackling underdevelopment, significant research efforts have been directed toward the role of the financial sector in general and the insurance market in particular (Omoke, 2012; Olayungbo, 2015).

Particular attention is being paid to concepts that link financial development in general and insurance-market activity in particular to economic growth. Examples include the demand-following hypothesis which suggests that economic growth stimulates financial development, the supply-leading hypothesis which suggests that financial development stimulates economic growth, and the feedback hypothesis which asserts that there is a bi-directional relationship between financial development and economic growth. According to the demand-following hypothesis, financial sectors develop in response to the financial needs of firms and also because richer countries can afford expensive financial systems (Robinson, 1952). The supply-leading hypothesi instead posits that the level of development in a country's financial system in terms of its ability to identify and finance investments plays a crucial role in determining its level of economic growth (Bagehot, 1873; Schumpeter, 1911; Hicks, 1969). The feedback hypothesis suggests that both the demand-following and supply-leading hypotheses are simultaneously valid.

This current interest is tied to the following reasons:

1) Over the past few decades, the global insurance sector has grown rapidly, at an average rate of 10% annually since 1950. In particular, rapid growth in the insurance sector has been observed in developing economies through increased financial integration and liberalization (e.g. Outreville, 2011; Chang *et al.*, 2014). This huge growth in the sector has drawn increased global attention.

2) It has been suggested that the insurance industry may contribute directly and indirectly to economic growth in several ways. Examples include indemnification against losses, risk pooling, provision of financial intermediation services like those offered by banks, and provision of investment opportunities for shareholders (Skipper, 1997; Ward and Zurbruegg, 2000; Rule, 2001; Kugler and Ofoghi, 2005; Lee, 2013).

3) There is a very low insurance-penetration rate (market size/GDP) in Africa. Developed nations dominate the global insurance industry. According to KPMG's 2014 report on the insurance industry in Africa, roughly 65% of the global insurance

market belongs to the G7 countries, even though they account for approximately 10% of the world's population. This low insurance-penetration rate in Africa indicates huge potential for growth in the continent's insurance sector.

The argument is that if the insurance sector can drive economic growth, then it is possible for the continent to take advantage of its insurance industry's potential to advance economic growth. Unfortunately, extant literature provides little research on the insurance sector's contributions to African nations' economies.

Like banks and capital markets, the insurance sector provides financial intermediation between households and businesses. The insurance sector plays a vital role in economic stability by making stakeholders in business transactions accept aggravated risks. The main responsibility of the insurance companies to thier policyholders is risk transfer. Policyholders pay a premium in exchange for security against certain risks. By taking up risks, insurance companies reduce unertainty in the economy, limit volatility in business cycles and minimize the effect of crisis situations on the economy. Also, by providing insurance against property loss, the insurance sector encourages risk-averse individuals to participated in trade, capital lending and purchase of assets.

The insurance companies are key players in the capital market, they accept claims, pool premiums and create reserve funds which are often placed on the capital market. Through this way they have the potential to contribute to economic growth. The presence of the insurance sector, most especially life-insurance, in the financial system also leads to the saving-substition effect which may result in shift of assets between financial intermediaries.

This study's contribution to extant literature is three-fold. First, we examine the relationship between insurance-market activity and economic growth across different countries by applying panel-estimation techniques that are robust to heterogeneity and cross-sectional dependence. Thus, we avoid the pitfalls of estimation techniques used mostly by prior studies that simply assume that countries are homogenous and have no cross-sectional dependence among them. Such studies are susceptible to forecasting errors.

Second, our study confirms the feedback hypothesis. The positive, bi-directional causality found between insurance-market activity and economic growth suggests the existence of a mutually beneficial cycle in which insurance-market activity stimulates economic growth and economic growth in turn fuels insurance-market activity.

Third, our empirical findings indicate that total insurance market activity makes a long-term impact on economic growth, and when disaggregated into its component parts—life and non-life insurance—we find evidence of both short-term and long-term effects on economic growth. We also discover that non-life-insurance market activity makes a bigger impact on economic growth in Africa than life-insurance market activity.

The rest of this study is organized as follows; section (2.2) presents an overview of the insurance sector in Africa, section (2.3) reviews relevant literature, section (2.4) describes the methodology and empirical results, and in section (2.5), key conclusions are presented.

2.2 An Overview of the Insurance Sector in Africa

Africa's insurance sector is still mostly underdeveloped. Access to insurance products is still limited, it only begins to rise quickly in the upper middle income group (KPMG, 2017). According to Swiss Re, Africa's total insurance premium for 2016 was US$ 60.7 bn. This shows that Africa is responsible for just about 1.3% of total world premium.

The low level of the continent's share in the world insurance market becomes even more pronounced when South Africa is excluded. South Africa was responsible for 70% (US$ 41.962 bn) of total premiums written on the continent in 2016. Without South Africa, Africa's share of total world premium falls to 0.4% (US$ 18.747 bn). Moreover, Africa's insurance market is extremely diverse and fragmented with just 11 countries (South Africa, Morocco, Egypt, Nigeria, Kenya, Algeria, Angola, Namibia, Tunisia, Botswana and Mauritius) responsible for 92% of total premiums on the continent. Some of the reasons for the low insurance penetration on the continent include low income, lack of trust in financial service providers, lack of human capital and expertise, and availability of informal forms of insurance (KPMG, 2017). Gradual improvements are however noticeable as Africa's insurance market growth has been one of the highest in the world, with an average well above the global average (KPMG, 2015).

Tables 1 and 2 present the insurance market depth across regions of the world and within Africa. As shown in table 1, Africa has the second lowest volume of premiums, only higher than the Middle East & Central Asia. The penetration rate is a measure of the insurance market deepening and is calculated as the value of insurance market size to GDP ratio. Africa's penetration rate is also the second lowest, again only higher than the Middle East & Central Asia. The premiums per capita for Africa is not just the lowest of all the regions, it is also way below the global average by a very wide margin. The global average for 2016 was US$ 621.

Table 2 shows that the 11 listed countries jointly account for 92% of the insurance market activity within the continent. The size and impact of the insurance sectors of the remaining countries of the continent is quite negligible. South Africa has the biggest insurance industry in Africa, with a total premium of US$ 41.962 bn (70% of the regional total), a premiums per capita value of US$ 762 and a penetration rate of 14.3% (more than double of the global average). The penetration rate of South Africa is higher than the regional averages of all the regions considered and is one of the highest in the world. Other than South Africa, Namibia and Mauritius also have relatively well developed insurance sectors, with penetration rates of 6.9% and 6.4% respectively.

Table 1: Insurance market depth by region, 2016.

Region	Total Premium (USDm)	Penetration Rate (%)	Premium Per Capita(USD)
North America	1,466,908	7.3	4,072
Europe	1,470,021	6.7	1,620
Middle East & Central Asia	53,889	2.0	150
Asia	1,493,527	5.6	343
Africa	60,709	2.8	50
Latin America	148,500	3.2	257
Oceania	92,524	6.3	2,343

Source: Swiss-Re Sigma data

Table 2: Insurance market depth by country, 2016.

Country	Total Premium (USDm)	Penetration Rate (%)	Premium Per Capita(USD)
Algeria	1209	0.8	30
Angola	788	0.8	30
Botswana	444	3.2	196
Egypt	2130	0.6	23
Kenya	1915	2.8	41
Mauritius	776	6.4	608
Morocco	3561	3.5	102
Namibia	783	6.9	311
Nigeria	1159	0.3	10
South Africa	41,962	14.3	762
Tunisia	824	2.0	72
Others	5158	-	-
Africa	60,709	2.8	50

Source: Swiss-Re Sigma data

2.3 Literature Review

Despite the recent increased interest in the study of the relationship between insurance-market activity and economic growth, there is no general consensus on the relationship structure. There are two major hypotheses concerning the relationship between insurance-market activity and economic growth. The first is the supply-leading hypothesis, which asserts that financial development precedes economic growth. The second is the demand-following hypothesis, which contends that economic growth elicits the need for financial services.

Examples of empirical findings in support of the supply-leading hypothesis are discussed below:

The study by Ward and Zurbruegg (2000) is the first to empirically provide evidence in support of the supply-leading approach. Their work investigated the effect of insurance-sector activity on economic growth in Organization for Economic Cooperation and Development (OECD) countries between 1961 and 1996. Their study produced weak evidence in support of the supply-leading view.

Webb *et al.* (2002) studied the effect of both banking-sector and insurance-sector activities on economic growth in 55 countries between 1980 and 1996 using simultaneous equation-estimation techniques. Their results indicate that while both banking and life-insurance penetration drive growth, no relationship exists between non-life insurance and growth, however.

Pradhan *et al.* (2017) applied a panel vector autoregressive model to test Granger causality between insurance and economic growth, amongst other variables in 18 middle-income countries between 1980 and 2012. They reported unidirectional causality from insurance market activities to economic growth. Other popular studies in support of the supply-leading theory include Han *et al.* (2010), Lee (2011), and Pan and Su (2012).

Some studies have also confirmed the supply-leading theory in Africa. Akinlo and Apanisile (2014) found in a panel regression framework for 30 Sub-Saharan African countries in the period 1986-2011 that insurance has a positive impact on economic growth in the region.

Olayungbo and Akinlo (2016), from a panel data for 8 African countries in a Time Varying Parameter Vector Autogressive Model with stochastic volatility, found evidence in support of the supply-leading theory in Egypt, Kenya, Mauritius and South Africa.

Alhassan and Biekpe (2016), after examining the causal relationship between insurance penetration and economic growth in 8 selected African countries over the period 1990-2010, found unidirectional causality from insurance market development to economic growth.

Examples of empirical findings in support of the demand-following hypothesis are discussed below:

Probably the first empirical study to provide evidence that supports the demand-following approach is that of Beenstock *et al.* (1988). Within the framework of a cross-sectional analysis of 45 countries in 1981 and a time-series study of 12 industrialized countries between 1970 and 1981, they reported that life-insurance activity depends on GDP per capita.

Outreville (1990), using a cross-sectional sample of 55 developing countries to which multiple regression analyses were applied, discovered a positive relationship between property-liability insurance growth and GDP per capita, i.e., an increase in GDP per capita caused a more-than-proportionate increase in demand for insurance.

Beck and Webb (2003), with the aid of panel-regression estimations, examined the interaction between life insurance and GDP among several other variables within 68 countries between 1961 and 2000. They concluded, on the basis of their estimation results, that income per capita is one of the most robust predictors of life-insurance market activity.

Pradhan *et al.* (2015) examined the causal relationships among economic growth, insurance market development and financial development in 34 OECD countries over the period 1988-2012. With the aid of Granger causality tests based on panel vector autoregression model, they found that insurance market development is a long-run causative factor of economic growth.

In Africa, the demand-following hypothesis has also been confirmed. Sibindi (2014) investigated the causal relationship between life insurance and economic growth in South Africa, applying the Johansen procedure and Granger causality tests based on vector error correction model to annual time-series data for the period between 1990 and 2012. The findings showed that causality runs from the economy to the life insurance sector, confirming the demand-following hypothesis.

Sibindi and Godi (2014) applied the Johansen procedure and Granger causality tests based of vector error correction model on 1990-2012 data for South Africa to test the relationship between insurance sector and economic growth. The findings also showed that the direction of causality is from the economy to the insurance sector.

While most studies on the insurance-growth nexus support either the supply-leading or demand-following approaches, others have found bidirectional relationships that support the feedback hypothesis. A few such works are reviewed below.

Kugler and Ofoghi (2005) examined the long-term connection between insurance and growth. The paper focused on the United Kingdom and covered the period between 1966 and 2003. By applying co-integration and Granger causality tests, they concluded from the results that the relationship is mainly bidirectional.

A panel study by Lee *et al.* (2013) of 41 countries, covering the period between 1979 and 2007, similarly concluded that rather than being strictly supply-leading or demand-following, the relationship between insurance and growth was bidirectional.

Also, Pradhan *et al.* (2016), applying a panel-data study to the Association of South East Asian Nations (ASEAN) between 1988 and 2012, produced results in support of a bidirectional causal relationship between insurance and growth.

In Africa, Ukpong and Acha (2017) investigated both cointegration and causal relationship between insurance and economic development using Nigerian time-series data from 1990 to 2013. The findings from the study showed that a bidirectional relationship exists between GDP and non-life insurance premiums.

A few other studies have discovered differences in the insurance-growth nexus for developed and developing countries. For example, Arena (2008) found that life insurance had a greater effect on growth at low levels of development. This suggests that insurance contributes more to growth in developing countries than in developed countries.

Haiss and Sümegi (2008) investigated the role of the insurance sector in economic growth performance in 29 European countries. The authors observed that while life insurance is more important in high-income European Union countries, non-life insurance is more important in developing European Union nations.

Han *et al.* (2010), by applying GMM dynamic panel estimations to 77 nations, also concluded that non-life insurance is of bigger importance to the growth of developing nations.

Some researchers also have suggested that there is no relationship between insurance-market activity and economic growth (Kok *et al.*, 2011; Pan and Su, 2012; Pradhan *et al.,* 2015).

It is quite evident from reviewed empirical studies that in the past, insurance-growth nexus research was carried out mainly through cross-sectional and time-series analyses. More recently, the focus has shifted toward panel-data analysis as a means of evaluating related issues. Still, most of the available related panel studies do not consider cross-sectional dependency and country-specific heterogeneity.

2.4 Methodology and Empirical Results

2.4.1 Data and Model Specification

Our study sample consists of 11 African countries (Algeria, Angola, Botswana, Egypt, Kenya, Mauritius, Morocco, Namibia, Nigeria, South Africa, and Tunisia) that jointly account for 92% of the insurance-market activity on the continent, according to Swiss-Re statistics. Annual data for the selected countries during the 1995-2016 period was obtained on eight variables: per-capita GDP (GDPPC), insurance penetration (IP), investment-to-GDP ratio (INV), inflation (INF), trade openness (OPEN), government expenditures (GEXP), corruption (COR), and population growth (PGR).

Since our intention is to examine the impact of insurance activity on economic growth, following Shen and Lee (2006), we specify a typical growth equation that takes the functional form:

GDPPC=*f* (IP, INV, INF, OPEN, GEXP, COR, PGR) (1)

Equation (1) is re-specified in an econometric form as:

$$GDPPC_{it} = \beta_0 + \beta_1 IP_{it} + \beta_2 INV_{it} + \beta_3 INF_{it} + \beta_4 OPEN_{it} + \beta_5 GEXP_{it} + \beta_6 COR + \beta_7 PGR + \varepsilon_{it} \quad (2)$$

In which all variables are included in logarithmic form, $\beta_0 =$ constant term, β_k(k = 1, 2, 3, 4, 5, 6, 7) = coefficients on independent variables, ε_{it} = error term.

Per-capita GDP, a measure of the average income per resident of a country, serves as the dependent variable. Insurance penetration is the independent variable of particular interest. Since it is a measure of the level of development of the insurance sector, we adopt it as the measure of insurance market activities. It is computed as the ratio of direct domestic insurance premiums-to-GDP. We also introduce other variables that are generally accepted as determinants of economic growth to serve as control variables (Barro, 1996; Gyimah-Brempong, 2002; Shen and Lee, 2006; Ndoricimpa, 2017). These variables include; investment which accounts for changes in capital stock, inflation rate which accounts for monetary discipline, financial stability and macroeconomic stability, trade openness which is a measure of the degree of economic openness to trade, government expenditures, population growth, and corruption which accounts for institutional quality. We expect insurance penetration, investment, government expenditures, and trade openness to have positive effects on per-capita GDP, and we expect inflation and corruption to negatively impact per-capita GDP. The impact of population growth is indeterminate from extant literature.

Data on per-capita GDP, inflation, trade openness, and population growth rate were sourced from the World Development Indicators (https://data.worldbank.org/indicator). Data on investment-to-GDP ratio and government expenditures were sourced from the World Economic Outlook database (https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx). Data on corruption was obtained from the Transparency International website (https://www.transparency.org/news/feature/corruption_perceptions_index_2016), and insurance-penetration data were acquired from Swiss Re's Sigma database (www.sigma-explorer.com/).

Table 3: List of variables used

Variable	Measure (in USD)	Notation	Expected Impact
Dependent Variable			
Real per-capita GDP	Real GDP as % of population	GDPPC	
Independent Variables			
Total-insurance penetration	Domestic premium as % of GDP	TIP	+
Life-insurance penetration	Domestic premium as % of GDP	LIP	+
Non-life-insurance penetration	Domestic premium as % of GDP	NLIP	+
Investment-to-GDP ratio	Total investment as % of GDP	INV	+
Inflation	Percentage change in CPI	INF	-
Trade openness	Exports + imports as % of GDP	OPEN	+
Government expenditures	Total expenses and the net acquisition of nonfinancial assets as % of GDP	GEXP	+
Corruption	Ranked index on a scale from 0 (very clean) to 100 (highly corrupt)	COR	-
Population growth rate	Exponential growth rate of midyear population expressed as a percentage	PGR	- +

2.4.2 Summary Statistics

A summary of descriptive statistics of variables is reported in table 4. For the period 1995-2016, the minimum average values for insurance penetration, total investment (% of GDP) and government expenditure (% of GDP) are found in Nigeria. South Africa has the most insurance penetration on the average, Algeria has the highest mean total investment (% of GDP) and Angola has the highest mean value for government expenditure (% of GDP). Angola also has the maximum average values for inflation rate, corruption, population growth rate and trade volume (% of GDP) while Morocco has the minimum average inflation rate, Botswana has the lowest mean corruption value, Mauritius has the lowest average population growth rate and Egypt has the lowest trade volume (% of GDP). The maximum real per-capita GDP is in Mauritius and the minimum is in Kenya.

Table 4: Summary statistics

Country	Mean	Std. Dev	Minimum	Maximum
Panel A: Total premiums (% of GDP)				
Algeria	0.627	0.093	0.473	0.800
Angola	0.985	0.307	0.578	1.836
Botswana	2.500	0.826	0.900	3.744
Egypt	0.709	0.094	0.586	0.858
Kenya	2.341	0.319	1.893	2.942
Mauritius	4.920	0.890	3.819	6.400
Morocco	2.750	0.314	2.336	3.500
Namibia	6.651	1.777	2.846	8.225
Nigeria	0.373	0.062	0.300	0.530
South Africa	14.565	1.266	12.564	17.087
Tunisia	1.681	0.165	1.444	2.000
Panel	3.461	4.042	0.300	17.087
Panel B: Total investment (% of GDP)				
Algeria	35.233	8.649	22.440	51.299
Angola	16.886	7.869	8.350	35.198
Botswana	30.540	5.030	21.319	38.725
Egypt	19.053	3.924	13.643	28.487
Kenya	18.547	2.566	13.519	22.494
Mauritius	25.074	2.917	20.731	30.510
Morocco	29.165	5.144	21.797	39.089
Namibia	23.901	4.418	17.098	34.186
Nigeria	15.775	2.230	11.601	20.072
South Africa	19.036	1.900	15.745	23.150
Tunisia	23.792	1.350	21.447	26.179
Panel	23.364	7.566	8.350	51.299
Panel C: Inflation, consumer prices (annual %)				
Algeria	5.848	6.461	0.339	29.779
Angola	376.991	1011.135	7.279	4145.108
Botswana	7.777	2.331	3.060	12.702
Egypt	8.275	4.457	2.269	18.316
Kenya	8.918	5.135	1.554	26.239
Mauritius	5.232	2.371	1.023	9.732
Morocco	1.876	1.317	0.435	6.123
Namibia	5.805	1.990	2.281	9.451

Nigeria	14.890	13.963	5.382	72.835
South Africa	6.163	2.144	1.385	11.536
Tunisia	3.828	1.151	1.983	6.244
Panel	40.553	317.003	0.339	4145.108
Panel D: Trade (% of GDP)				
Algeria	62.461	8.011	45.094	76.684
Angola	121.686	28.364	59.460	178.993
Botswana	97.384	9.822	85.834	122.949
Egypt	47.222	10.925	30.033	71.680
Kenya	54.521	6.775	37.929	71.745
Mauritius	118.622	9.275	98.383	132.199
Morocco	67.657	12.741	47.095	85.672
Namibia	98.723	11.504	80.762	125.477
Nigeria	54.872	17.194	21.124	81.812
South Africa	56.103	7.358	43.610	72.865
Tunisia	92.761	10.116	77.905	114.354
Panel	79.274	29.135	21.124	178.993
Panel E: Government expenditure (% of GDP)				
Algeria	34.649	5.645	27.108	46.145
Angola	41.277	7.809	23.723	63.323
Botswana	38.434	4.732	32.174	50.341
Egypt	33.787	1.656	30.253	36.177
Kenya	22.501	2.651	18.659	27.542
Mauritius	23.758	1.562	21.486	26.690
Morocco	27.681	4.835	19.035	35.216
Namibia	32.387	4.699	24.996	42.766
Nigeria	17.112	5.402	9.258	30.857
South Africa	28.114	3.103	24.830	33.175
Tunisia	26.285	2.442	23.726	32.419
Panel	29.793	7.954	9.258	63.323
Panel F: Corruption				
Algeria	71.000	4.807	64.000	79.000
Angola	79.210	5.083	66.000	85.000
Botswana	40.000	3.018	35.000	46.000
Egypt	67.863	2.740	63.000	72.000
Kenya	77.610	2.606	73.000	81.000
Mauritius	50.278	4.720	43.000	59.000
Morocco	63.926	3.616	53.000	68.000
Namibia	51.773	4.857	43.000	59.000
Nigeria	78.973	5.633	72.000	90.000
South Africa	53.694	3.129	48.000	59.200
Tunisia	54.915	4.885	47.000	62.400
Panel	62.658	13.427	35.000	90.000
Panel G: Population growth (annual %)				
Algeria	1.631	0.267	1.267	2.036

Angola	3.332	0.309	2.715	3.575
Botswana	1.745	0.259	1.361	2.352
Egypt	1.936	0.148	1.747	2.245
Kenya	2.735	0.084	2.560	2.961
Mauritius	0.577	0.376	0.068	1.271
Morocco	1.271	0.134	1.117	1.519
Namibia	1.972	0.668	1.135	3.042
Nigeria	2.583	0.074	2.488	2.677
South Africa	1.394	0.266	1.046	2.086
Tunisia	1.097	0.238	0.760	1.741
Panel	1.843	0.815	0.068	3.575
Panel H: Real per-capita GDP				
Algeria	4077.370	535.681	3223.558	4827.724
Angola	2770.708	783.128	1775.899	3747.568
Botswana	5821.071	1071.853	4237.567	7574.282
Egypt	2221.041	354.532	1661.332	2724.397
Kenya	924.874	98.582	823.091	1143.065
Mauritius	6847.890	1681.219	4439.863	9822.008
Morocco	2472.417	488.680	1722.193	3209.715
Namibia	4630.936	884.870	3617.290	6114.056
Nigeria	1861.919	518.277	1242.738	2563.092
South Africa	6636.990	784.482	5528.169	7571.876
Tunisia	3519.566	625.545	2432.313	4265.372
Panel	3798.616	2062.119	823.091	9822.008

2.4.3 Preliminary Analysis

Two important concerns arise in panel-data estimations. The first is the existence of cross-sectional dependence. A key consideration in panel-data studies is the possibility that individual units are interdependent (Sarafidis and Wansbeek, 2012). Wrongly assuming that there is no cross-correlation between error terms (relaxation of the cross-sectional dependence assumption) means the variance-covariance matrix will likely increase with the number of cross-sections, and the test distributions will be rendered invalid (Cerrato and Sarantis, 2002). The second issue is the existence of heterogeneity in slope parameters, erroneously assuming that slope coefficients are homogeneous across cross-sections when they are, in fact, heterogeneous results in inconsistent parameter estimates.

Therefore, we begin by testing for cross-sectional dependence and slope homogeneity in our data.

Cross-sectional dependence test

The most widely used types of cross-sectional dependence tests are Breusch-Pagan (1980) LM, Pesaran (2004) scaled LM, and Pesaran (2004) CD tests. However, we apply the Pesaran (2004) CD test because it addresses the size-distortion problem present in the other tests. The Pesaran (2004) CD test is developed by averaging pairwise correlation coefficients to test the null of no cross-sectional dependence. The test statistic is given as:

$$CD_p = \sqrt{\frac{2}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} T_{ij} \hat{\rho}_{ij} \rightarrow N(0,1) \quad (3)$$

In which $\hat{\rho}_{ij}$ = Pairwise correlation coefficient.

Results displayed in Table 5 provide sufficient evidence to reject the null of no cross-sectional dependence in all variables and conclude that cross-sectional dependence exists in the data.

Table 5: Cross-sectional dependence test results

	GDPPC	TIP	INV	INF	OPEN	GEXP	COR	PGR
Statistic	6.98***	5.56***	6.29***	2.55**	4.16***	3.89***	1.82*	5.70***
p-value	0.00	0.00	0.00	0.01	0.00	0.00	0.07	0.00

*Note: ***, **, and * indicate rejection of the null of no cross-sectional dependence at the 1%, 5%, and 10% levels, respectively.*

Homogeneity test

To test whether heterogeneity exists in the slope parameters, we apply the Swamy (1970) test of slope homogeneity. The Swamy (1970) test is deemed suitable since the time dimension is large, relative to cross-sections in our data. The test is based on the dispersion of individual slopes from a suitable pooled estimator (Pesaran and Yamagata, 2008) for a null of slope homogeneity. The test statistic is given as:

$$\hat{S} = \sum_{i=1}^{N} (\hat{\beta}_i - \hat{\beta}_{WFE})' \frac{X_i' M_T X_i}{\hat{\sigma}_i^2} (\hat{\beta}_i - \hat{\beta}_{WFE}) \quad (4)$$

In which $\hat{\beta}_{WFE}$= weighted fixed-effect pooled estimator of slope coefficients.

The test results presented in table 6 also provide enough evidence to reject the null of slope homogeneity in favor of heterogeneous slopes.

Table 6: Swamy (1970) homogeneity test result

Test	**Statistic**
95.17***	0.0026

*Note: *** indicate rejection of the null of slope homogeneity at the 1%, level.*

2.4.4 Tests for Unit Roots

Cross-sectional dependence and heterogeneity robust cross-sectional augmented Dickey Fuller (CADF) and cross-sectionally augmented IPS (Im *et al.*, 2003) panel unit root tests were applied to test for the presence of panel stationarity. Both tests can deliver reliable and consistent results when both cross-sectional dependence and heterogeneity are present.

Cross-sectional augmented Dickey Fuller (CADF) unit root test

Pesaran (2007), by building on the Dickey Fuller/Augmented Dickey Fuller unit root tests, produced the CADF test for a null of unit root, with the CADF statistic given as:

$$CADF_i = t_i(N,T) = \frac{\left(y_{i,-1}^T \bar{M} y_{i,-1}\right)^{-1}\left(y_{i,-1}^T \bar{M} \Delta y_i\right)}{\sqrt{\sigma_i^2}\left(y_{i,-1}^T \bar{M} y_{i,-1}\right)^{-1}} \tag{5}$$

Cross-sectionally augmented IPS (CIPS) unit root test

Pesaran (2007) generated the CIPS test for a null of unit root against a heterogeneous alternative by averaging CADF test statistics for the entire panel. The CIPS test statistic is given as:

$$CIPS(N,T) = N^{-1} \sum_{i=1}^{N} t_i\,(N,T) = \frac{\sum_{i=1}^{N} CADF_i}{N} \tag{6}$$

In which $t_i(N,T)$ = the cross-sectionally augmented Dickey-Fuller test statistic for the ith cross section unit from the t-ratio of the coefficient of $y_{i,t-1}$ in the CADF regression.

Results from both tests are presented in table 7. CADF results show that all variables contain unit roots except inflation and population. CIPS results similarly indicate that all variables excluding inflation and population growth contain unit roots.

Table 7: Results from unit root tests

	CIPS		CADF	
	LEVEL	**Δ**	**LEVEL**	**Δ**
GDPPC	-2.486	-3.990***	-0.781	-4.122***
LIP	-2.608	-4.113***	-0.509	-2.297**
NLIP	-2.614	-4.835***	-0.741	-3.471***
TIP	-2.681	-4.272***	-0.532	-3.002***
INV	-2.317	-3.098 ***	-2.218	-3.205***
INF	-2.573***	-3.839***	-2.913***	-3.247***
OPEN	-1.218	-3.938***	0.879	-2.699***
GEXP	-2.025	-4.096***	2.610	-4.775***
PGR	-2.438**	-4.180***	-2.438***	-2.604***
COR	-1.847	-4.155***	0.513	-2.609***

*Note: ***, **, and * indicate rejection of the null of unit root at the 1%, 5%, and 10% levels, respectively.*

2.4.5 Panel Cointegration Test

Long-term estimation results can only be non-spurious if non I(0) variables are cointegrated. Thus, we employ the error-correction-based test by Westerlund (2007) to check for the existence of long-term relationships among the variables.

Westerlund (2007) Cointegration Test

Westerlund (2007) developed four-panel cointegration tests for the null of no cointegration. The tests are constructed to determine whether the error-correction term in a conditional error correction model equals zero. A rejection of the null of no error correction causes a rejection of the null of no cointegration. All four tests can deal with individual specific slope parameters and cross-sectional dependence via bootstrapping. Two out of the four tests (group mean statistics) test the null of no cointegration against an alternative in which at least one section of the panel is cointegrated. The other two tests (panel statistics) test the null of no cointegration against the alternative that the panel is cointegrated as a whole.

The group-mean statistics are computed as:

$$G_\tau = \frac{1}{N}\sum_{i=1}^{N}\frac{\hat{\alpha}_i}{SE(\hat{\alpha}_i)} \tag{7}$$

and

$$G_\alpha = \frac{1}{N}\sum_{i=1}^{N}\frac{T\hat{\alpha}_i}{\hat{\alpha}_i(1)} \tag{8}$$

In which $\hat{\alpha}_i$ = error correction estimate, and $SE(\hat{\alpha}_i)$ = standard error of $\hat{\alpha}_i$.

The panel statistics are constructed as:

$$P_\tau = \frac{\hat{\alpha}}{SE(\hat{\alpha})} \tag{9}$$

and

$$P_\alpha = T\hat{\alpha} \tag{10}$$

As shown in table 8, when the long-term relationship between per-capita GDP and the explanatory variables is tested, three out of the four cointegration tests reject the null of no cointegration, i.e., G_t, P_t, and P_a test statistics reject the null hypothesis at the 5% significant level.

Table 8: Westerlund ECM panel cointegration test results

Statistic	**Value**	**Z-Value**	**Robust P-Value**
G_τ	-1.330	-1.126**	0.050
G_α	-2.148	1.206	0.550
P_τ	-4.733	-2.605**	0.050
P_α	-1.160	-0.153**	0.020

*Note: ***, **, and * indicate rejection of the null of no cointegration at the 1%, 5%, and 10% levels, respectively.*

2.4.6 Error-Correction-Based Panel Estimates

We estimate the relationship between per-capita growth and the explanatory variables using an error-correction form of the ARDL model. In line with Pesaran *et al.* (1999), the following ARDL model is specified as:

$$GDPPC_{it} = \gamma_i + \sum_{j=i}^{p} \lambda_{ij} GDPPC_{it-j} + \sum_{j=0}^{q} \delta'_{ij} X_{it-j} + \varepsilon_{it} \quad (11)$$

in which i = number of groups (1,2,3,…,N) , t = number of periods (1,2,3,…,T), X_{it} = vector of explanatory variables (IP, INV, INF, OPEN, GEXP, COR, PGR), δ_{it} = vector of coefficients, and γ_i = group specific effect.

We further re-specify eq. (11) as an error-correction equation:

$$\Delta GDPPC_{it} = \emptyset_i (GDPPC_{it-1} - \theta'_i X_{it}) + \sum_{j=i}^{p-1} \lambda^*_{ij} \Delta GDPPC_{it-j} + \sum_{j=0}^{q-1} \delta'^*_{ij} \Delta X_{it-j} + \varepsilon_{it} \quad (12)$$

In which

$\emptyset_i = -\left(1 - \sum_{j=i}^{p} \lambda_{ij}\right)$ = speed of adjustment. If $\emptyset_i$ = 0, there is no proof of a long-term relationship.

$\Theta_i = \frac{\sum_{j=0}^{q} \delta_{ij}}{1 - \sum_k \lambda_{ik}}$, $\lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im}$ and $\delta'^*_{ij} = -\sum_{m=j+1}^{q} \delta_{im}$

In eq. (12), the term $\emptyset_i (GDPPC_{it-1} - \theta'_i X_{it})$ measures the adjustment in GDP per-capita to the deviation from its long-term relationship with the independent variables; the terms $\sum_{j=i}^{p-1} \lambda^*_{ij} \Delta GDPPC_{it-j}$ and $\sum_{j=0}^{q-1} \delta'^*_{ij} \Delta X_{it-j}$ capture the short-term dynamics of the model.

The error-correction equation is estimated via three different techniques: Pooled Mean Group (PMG) estimation (Pesaran *et al.*, 1999), Mean Group (MG) estimation (Pesaran and Smith, 1995), and Dynamic Fixed Effect (DFE) estimation. While the

MG estimator allows heterogeneity in both short- and long-term coefficients, the DFE estimator restricts the short-term, long-term, and speed-of-adjustment coefficients to be equal across cross-sections. The PMG estimator is in between both the MG and DFE. It assumes homogeneity in long-term slope coefficients, but allows heterogeneity in short-term slope coefficients.

Table 9 presents the MG, PMG, and DFE results. Results from row I of the table reveal that the estimated speed-of-adjustment coefficients are negative and significant at 10%, 5%, and 1% in the MG, PMG, and DFE estimations respectively, pointing to the existence of a long-term relationship between the variables. The result corroborates the conclusion drawn from the Westerlund (2007) cointegration test—that the variables have a long-term relationship. In absolute terms, the coefficient reported by DFE estimation is the highest (-0.079), followed by PMG (-0.050), then MG (-0.026).

2.4.7 Hausman Test

As stated earlier, both PMG and DFE exhibit some degree of slope homogeneity, and they are both consistent and more efficient compared with MG, when homogeneity restrictions hold. However, once the null hypothesis of homogeneous slopes is rejected in favor of heterogeneous slopes, both PMG and DFE estimates become inconsistent, whereas the MG estimates are always consistent irrespective of whether the model is homogeneous or heterogeneous. We apply the Hausman test as a means of determining the difference in the models by performing pairwise comparisons between PMG and MG, and also between DFE and MG.

The Hausman test results reported in table 9 indicate that the null of homogeneity restrictions is rejected in both cases[1]. Thus, we may conclude that our panel time-series data contain heterogeneous slopes. The result is a reaffirmation of the Swamy (1970) test result, leading to the conclusion that the MG estimates are superior to the others.

Based on the more suitable MG results, insurance penetration has a positive and significant impact on per-capita GDP in the long term, while the short-term effect is insignificant. Specifically, a percentage increase in total insurance premium results in a roughly 0.31 percent increase in per-capita GDP in the long term. The result is significant at 1%.

Other results show that investment has only a long-term impact on per-capita GDP, and that a 1 percent increase in INV leads to a roughly 1.264% rise in GDPPC. The result is significant at 1%. This conforms to economic theory that says increased investment stimulates economic growth. Our result however suggests that the impact of investment on economic growth is not instantaneous.

Inflation is shown to have a significantly negative effect on per-capita GDP, both in the long term and short term. For every percentage-point increase in INF, GDPPC falls by approximately 0.490 percent in the long term. In the short term, one period-lagged effect of a percentage change in INF results in a 0.018 percent change in GDPPC in the following periods. Both results are significant at 5%. This finding is

[1] It is noteworthy that the MG outcomes are only marginally superior to the PMG and DFE outcomes at 6.39% and 5.7%. The results from the 3 estimations are relatively similar.

also in line with the economic theory suggesting that a negative relationship exists between inflation and economic growth.

Trade openness significantly impacts per-capita GDP positively in the long and short terms. For every percentage-point rise in OPEN, per-capita GDP rises by approximately 1.9 percent in the long term, and in the short term, one period-lagged effect of a percentage increase in OPEN leads to a 0.016 percent increase in GDPPC in the following periods. The results are significant at 1% and 5% respectively.

Government expenditures have a positive and significant effect on per-capita GDP, both in the long and short terms. If GEXP increases by 1 percent, GDPPC is expected to increase by 1.376 percent in the long term, and one period-lagged effect of a percentage increase in GEXP results in 0.054 percent increase in GDPPC in the following periods. Results are significant at 5% and 1%, respectively. Our findings suggest that government expenditures have the most influence on per-capita GDP for the selected African countries. This outcome aligns with the findings of Barro (1990) and Barro and Sala-i-Martin (1992), which concluded that government expenditures increase GDP.

Corruption, which we use as a proxy for quality of African institutions, has a negative and significant long-term impact on economic performance. A 1% increase in the level of corruption leads to a 1.363 percent decrease in GDPPC. The result is significant at 1%.

The impact of population growth also turns out to be significantly negative in the long term, with each percentage increase in the population growth rate resulting in a 1.823 percent decrease in GDPPC. Our findings suggest that population growth has the largest negative impact on economic performance.

Table 9: PMG, MG, and DFE estimates of the growth equation

	(1)	**(2)**	**(3)**
	MG	**PMG**	**DFE**
Adjustment coefficient	-0.026(-1.68*)	-0.0504(2.61**)	-0.079(-3.57***)
Long-term coefficients			
TIP	0.31 (2.84***)	0.27 (2.76***)	0.11 (2.42***)
INV	1.264(5.74***)	1.348 (3.36***)	1.961 (1.86*)
INF	-0.490(2.46**)	-1.077(3.21***)	-1.056(-3.36***)
OPEN	1.901(3.50***)	1.585(2.56**)	2.325 (2.39***)
GEXP	1.376(1.94**)	0.3023(1.58*)	0.607 (2.31**)
COR	-1.36(4.78***)	-0.959(-2.50**)	-0.824(-3.20***)
PGR	-1.823(2.19**)	-0.508(-1.46)	-3.334(-2.60***)
Short-term coefficients			
ΔTIP_{t-1}	0.062(1.09)	0.073 (3.87***)	0.091 (4.74***)
ΔINV_{t-1}	0.053 (1.07)	0.072 (2.47**)	0.00037 (0.02)
ΔINF_{t-1}	-0.018(2.37**)	-0.005(-2.63**)	-0.006 (-1.26)
$\Delta OPEN_{t-1}$	0.016 (2.44**)	0.051 (2.14*)	0.028 (1.07)
$\Delta GEXP_{t-1}$	0.054(4.61***)	0.073 (1.96**)	0.0098(4.40***)
ΔCOR_{t-1}	0.002 (1.25)	-0.001(-1.78*)	-0.0001 (-0.12)
ΔPGR_{t-1}	2.547 (1.17)	0.885(0.94)	-0.0077(-0.29)
Number of observations	234	234	234
Number of countries	11	11	11
Hausman test	MG VS PMG		MG VS DFE
Chi2 (5)	13.36		22.91
Prob>chi2	0.0639		0.057

*Notes: (1) ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. (2) T-ratios are in parenthesis.*

2.4.8 Estimates Based on Life- and Non-Life-Insurance Penetration

As a form of robustness test, we disaggregate the total insurance-penetration data into its two component parts—life- and non-life-insurance penetration—to examine the different impacts made by each component on per-capita growth. Again, the more-suitable MG estimate is used, and the results are presented in table 10.

Table 10 results show that the error-correction term remains negative and significant. Impacts from both life- and non-life-insurance penetration were significant and positive in both the long and short terms, and the impact from non-life-insurance penetration (NLIP) was found to be larger than that of life-insurance penetration (LIP). In the long term, for every percentage-point increase in NLIP, per-capita GDP increases by 0.14 percent, and every percentage-point increase in LIP results in a 0.05 percent rise in per-capita GDP. The results are significant at 1% and 5%, respectively. In the short term, one period-lagged effect of NLIP and LIP results in 0.062 and 0.030 percent increases in GDPPC in the following periods, respectively. Both results are significant at 1%. The findings suggest that while long-term effects of insurance are robust in the long term, they are not in the short term, since regardless of whether total insurance penetration or its disaggregated components are used as regressors, the results show that there is a long-term effect. However, the same cannot be said about the short-term estimates that become significant when disaggregated variables are used. Other results are like what was previously obtained in table 9.

Table 10: Robustness check with life- and non-life-insurance penetration

	MG
Adjustment coefficient	-0.086 (-3.91***)
Long-term coefficients	
NLIP	0.14 (3.07***)
LIP	0.05 (2.25**)
INV	1.924 (1.90*)
INF	-1.004 (-1.43*)
OPEN	2.128 (2.87**)
GEXP	0.654(2.59***)
COR	-0.769 (-3.16***)
PGR	-3.467 (-2.99***)
Short-term coefficients	
$\Delta NLIP_{t-1}$	0.062(3.34***)
ΔLIP_{t-1}	0.030 (3.10***)[2]
ΔINV_{t-1}	0.002 (0.07)
ΔINF_{t-1}	-0.006 (-2.35**)
$\Delta OPEN_{t-1}$	0.031(1.47*)
$\Delta GEXP_{t-1}$	0.018 (2.27**)
ΔCOR_{t-1}	-0.00024 (-0.27)
ΔPGR_{t-1}	-0.0051 (-0.19)
Number of observations	234
Number of countries	11

*Notes: (1) ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.(2) T-ratios are in parenthesis.*

2.4.9 Panel Granger Causality Tests

Finally, we use the Dumitrescu-Hurlin (2012) Granger causality test to detect causal relationships among the variables for the selected countries. The general form of the multivariate regressions in panel Granger causality testing is specified as:

$$y_{it} = \alpha_{0i} + \alpha_{1i}y_{it-1} + \cdots + \alpha_{li}y_{it-l} + \beta_{1i}X_{it-1} + \cdots + \beta_{li}X_{it-l} + \varepsilon_{it} \tag{13}$$

$$X_{it} = \alpha_{0i} + \alpha_{1i}X_{it-1} + \cdots + \alpha_{li}X_{it-l} + \beta_{1i}y_{it-1} + \cdots + \beta_{li}y_{it-l} + \varepsilon_{it} \tag{14}$$

The Dumitrescu-Hurlin (2012) approach leaves all coefficients free to vary across cross-sections such that:

$$\alpha_{0i} \neq \alpha_{0j}, \alpha_{1i} \neq \alpha_{1j}, \ldots, \alpha_{li} \neq \alpha_{lj}, \forall i, j, \tag{15}$$

$$\beta_{1i} \neq \beta_{1j}, \dots, \beta_{li} \neq \beta_{lj}, \forall i, j \tag{16}$$

Under the Dumitrescu-Hurlin panel causality test, Granger causality regressions are performed for each of the cross-sections from which test-statistics averages are generated. The differenced data for the non-stationary variables are used in the bivariate Panel Granger causality tests, while the level data are used for the stationary variables.

Results from the Dumitrescu-Hurlin causality tests are reported in table 11. Bidirectional causality is revealed between total insurance penetration and per-capita GDP, total insurance penetration and corruption, investment and corruption, investment and population growth, inflation and per-capita GDP, trade openness and per-capita GDP, government expenditures and per-capita GDP, government expenditures and corruption, population growth and per-capita GDP, and per-capita GDP and corruption.

One-way causality was revealed running from investment to total insurance penetration, total insurance penetration to trade openness, total insurance penetration to government expenditures, population growth to total insurance penetration, investment to inflation, investment to per-capita GDP, trade openness to investment, investment to government expenditures, trade openness to corruption, trade openness to government expenditures, and government expenditures to population growth.

No causality was found between total insurance penetration and inflation, inflation and trade openness, inflation and government expenditures, inflation and corruption, inflation and population growth, trade openness and population growth, and corruption and population growt

Table 11: Results from Dumitrescu-Hurlin (2012) Granger causality tests

Hypothesis	**Statistic**	**P-value**	**Conclusion**
ΔTIP→ΔGDPPC	0.256**	0.022	Two-way causality between TIP & GDPPC
ΔGDPPC→ΔTIP	0.079***	0.005	
ΔTIP→ΔINV	0.771	0.481	One-way causality from INV to TIP
ΔINV→ΔTIP	2.404***	0.000	
ΔTIP→INF	0.344	0.100	No causality between TIP & INF
INF→ΔTIP	0.989	0.973	
ΔTIP→ΔOPEN	0.448*	0.089	One-way causality from TIP to OPEN
ΔOPEN→ΔTIP	0.569	0.184	
ΔTIP→ΔGEXP	0.368**	0.041	One-way causality from TIP to GEXP
ΔGEXP→ΔTIP	0.939	0.852	
ΔTIP→ΔCOR	0.272**	0.025	Two-way causality between TIP & COR
ΔCOR→ΔTIP	2.457***	0.000	
ΔTIP→PGR	1.393	0.226	One-way causality from PGR to TIP
PGR→ΔTIP	0.189**	0.012	
ΔINV→ΔGDPPC	0.128***	0.007	One-way causality from INV & GDPPC
ΔGDPPC→ΔINV	1.361	0.266	
ΔINV→INF	0.421*	0.075	One-way causality from INV & INF
INF→ΔINV	0.574	0.189	
ΔINV→ΔOPEN	0.677	0.498	One-way causality from OPEN to INV
ΔOPEN→ΔINV	0.445*	0.087	
ΔINV→ΔGEXP	0.414*	0.071	One-way causality from INV to GEXP
ΔGEXP→ΔINV	0.834	0.609	
ΔINV→ΔCOR	0.613***	0.000	Two-way causality between INV & COR
ΔCOR→ΔINV	0.555***	0.000	
ΔINV→PGR	0.628***	0.000	Two-way causality between INV & PGR
PGR→ΔINV	0.145***	0.002	
INF→ΔGDPPC	0.149***	0.009	Two-way causality between GDPPC & INF
ΔGDPPC→INF	2.543***	0.000	
INF→ΔOPEN	1.184	0.570	No causality between OPEN & INF
ΔOPEN→INF	1.014	0.966	
INF→ΔGEXP	0.603	0.221	No causality between INF & GEXP
ΔGEXP→INF	0.712	0.374	
INF→ΔCOR	1.301	0.354	No causality between COR & INF

ΔCOR→INF	1.019	0.954	
INF→PGR	-0.137	0.788	No causality between INF & PGR
PGR→INF	0.697	0.579	
ΔOPEN→ΔGDPPC	0.410*	0.069	Two-way causality between OPEN & GDPPC
ΔGDPPC→ΔOPEN	0.326**	0.038	
ΔOPEN→ΔGEXP	1.125***	0.000	One-way causality from OPEN to GEXP
ΔGEXP→ΔOPEN	1.803	0.150	
ΔOPEN→ΔCOR	0.312*	0.055	One-way causality from OPEN to COR
ΔCOR→ΔOPEN	0.692	0.523	
ΔOPEN→PGR	1.235	0.237	No causality between OPEN & PGR
PGR→ΔOPEN	0.453	0.107	
ΔGEXP→ΔGDPPC	0.589***	0.000	Two-way causality between GEXP & GDPPC
ΔGDPPC→ΔGEXP	1.573***	0.000	
ΔGEXP→ΔCOR	0.6657***	0.0005	Two-way causality between GEXP & COR
ΔCOR→ΔGEXP	0.811***	0.000	
ΔGEXP→PGR	2.065***	0.000	One-way causality from GEXP to PGR
PGR→ΔGEXP	0.471	0.207	
ΔCOR→ΔGDPPC	1.000***	0.003	Two-way causality between GDPPC & COR
ΔGDPPC→ΔCOR	1.411***	0.004	
ΔCOR→PGR	2.594	0.297	No causality between COR & PGR
PGR→ΔCOR	1.499	0.397	
PGR→ΔGDPPC	26.84***	0.000	Two-way causality between GDPPC & PCR
ΔGDPPC→PGR	3.664***	0.000	

*Note: ***, **, and * indicate rejection of the null of no causality at the 1%, 5%, and 10% levels, respectively.*

2.5 Conclusion

Most extant literature on the relationship between insurance-market activity and economic growth have focused mainly on either time-series analysis of single countries or on panel studies that do not consider cross-sectional dependence and slope heterogeneity. As a result, their findings have been mostly ambiguous and influenced heavily by country-specific factors. We improved on these studies by investigating the insurance penetration-growth nexus in 11 African nations within a panel framework that is robust to these two problems. The econometric techniques adopted in our study provide an improvement on past studies. Thus, our findings are more accurate and very useful for aiding insurance-market policy formulation.

This study adopted the following: Pesaran (2004) CD test, Swamy (1970) slope homogeneity test, CIPS and CADF unit root tests, Westerlund (2007) cointegration test, and the PMG, MG, and DFE estimation techniques to examine the relationship between insurance penetration and per-capita GDP in 11 African countries that jointly account for 92% of the continent's insurance-market activity. A panel time-series data set for the period 1995 to 2016 was used for our analysis.

Results from the panel cointegration test proffered evidence in support of a long-term relationship between total insurance penetration and per-capita GDP. The MG estimates indicated that increases in total insurance penetration cause per-capita GDP to rise only in the long term. However, it is possible to obtain incorrect estimates when an aggregated measure of insurance-market activity is used in regression estimates (Kugler and Ofoghi, 2005). To avoid this problem, we disaggregated total insurance penetration into life- and non-life-insurance penetration, with the results showing that per-capita GDP is, in fact, positively affected by increases in life- and non-life-insurance penetration, both in the short and long terms.

To obtain further details about the patterns of relationships concerning insurance penetration and per-capita GDP (i.e. demand-following hypothesis, supply-leading hypothesis, neutral hypothesis, and feedback hypothesis), we applied panel-causality tests. The outcomes indicated that a positive and bi-directional relationship exists between total insurance penetration and per-capita GDP.

The findings also indicate that non-life-insurance market activity has a bigger effect than life-insurance market activity on economic performance in Africa. Therefore, we reached the following conclusions:

First, our study provides evidence in support of both the supply-leading and demand-following concepts (feedback hypothesis) for Africa. This positive, bi-directional causality found between insurance penetration and per-capita GDP suggests that while insurance-market activity stimulates economic growth, economic growth also induces insurance-market activity. This supports the conclusions reached by Lee *et al.* (2013), and Pradhan *et al.* (2016).

Second, our study provides empirical justification for the adoption of policies that strengthen the insurance sector in Africa. For example, policies that address issues said to be limiting insurance penetration on the continent e.g. lack of trust in financial service providers, challenging business environments, lack of reliable information (especially in assessing creditworthiness), poor legal and judicial systems, and lack of human capital/expertise should be actively pursued.

Third, policies that drive growth in the real economy should be supported to improve the insurance sector's performance in Africa. According to KPMG's 2014 sector report on insurance in Africa, because most Africans still struggle to meet their daily needs, insurance is not a priority for them. Thus, a major way to boost the insurance sector in Africa is to improve residents' standard of living.

Fourth, the larger impact of non-life-insurance market activity, compared with life-insurance market activity, provides evidence that supports the conclusion reached by Haiss and Sümegi (2008) and Han *et al.* (2010) that the impact of non-life insurance is greater than that of life insurance in developing countries. This suggests that although both life and non-life Insurance generate significant impact on the economy by mobilizing domestic savings. Non-life Insurance plays a bigger role in economic growth by providing protection against the hazards and risks of business. Examples include provision of protection against property damage, legal liability and employee-related risks.

Chapter 3

THE SYNERGISTIC EFFECT OF INSURANCE AND BANKING SECTOR ACTIVITIES ON ECONOMC GROWTH IN AFRICA

3.1 Introduction

Explaining why economic growth rates differ among countries is one of the central focus areas in growth economics. Many factors such as education, macroeconomic stability, trade openness, capital accumulation, quality of institutions and resource endowments have been established as being partly responsible for these differences (Romer, 1986; Lucas, 1988; Barro, 1991; Rebelo, 1991; Mankiw *et al*., 1992; Grossman and Helpman, 1993; Acemoglu, 1996). More recently, the level of financial sector development has also been added to the list of factors causing these differences (King and Levine, 1993a, 1993b; Demetriades and Hussein, 1996; Levine, 1997; Demirgüç-Kunt and Maksimovic, 1998; Rajan and Zingales, 1998).

Following the ground-breaking works of authors like Schumpeter (1934), Robinson (1952), Goldsmith (1969), McKinnon (1973), and Shaw (1973), many researchers have explored the connection between financial market activities and economic growth. Empirical evidence provided by most of these researchers is heavily skewed in favor of positive impacts of financial market activities on economic growth (see Levine *et al*., 2000; Beck and Levine, 2004; Beck *et al*., 2005; Loayza and Ranciere, 2006; Cheng and Degryse, 2010). The summary of these studies is that the financial sector boosts economic growth through its roles of mobilizing savings, efficiently allocating resources, aiding the trading, hedging, pooling and diversification of risks, exertion of corporate control etc.

The most common approach used by previous studies of the relationship between financial market activities and growth is the examination of one-way independent impacts of financial markets on economic growth (Ang, 2008; Haiss and Sümegi, 2008; Körner and Schnabel, 2009; Bojanic, 2012). Other researchers have gone further to investigate the bi-directional interactions between specific financial markets and economic growth (Al-Yousif, 2002; Kugler and Ofoghi, 2005; Wolde-Rufael, 2009).

While these two approaches have succeeded in providing relatively meaningful findings in the past, their adequacy in recent times has waned. The reason for this is two-fold. First, the financial sector has become extremely complex over the past few decades such that separation between different financial markets has made unclear their individual contributions to the economy (Pradhan *et al*., 2017). The second is that various financial markets in the financial system exhibit complex inter-relations amongst themselves (Tennant and Abdulkadri, 2010; Lee, 2013; Liu *et al.*, 2016). Moreover, it has been shown that the insurance sector in particular has the potential to stimulate economic growth through its interaction with banking sector activities (Chen *et al*., 2012; Lee, 2013).

Thus, the motivations behind this study are as follows; first, rather than study only the independent relationships between specific financial markets and economic growth, we improve on previous studies by examining both the independent and synergistic effects of the insurance and banking sectors on economic growth. This approach provides an additional channel for investigating the financial sector-economic growth nexus. Our focus is on the insurance and banking sectors, being two key components of the financial system. To the best of our knowledge, this study is the first to empirically investigate the synergistic impact of the insurance and banking sectors on the economic performance of Africa.

Second, to avoid the pre-test bias associated with pretesting for stationarity and cointegration, and the estimation bias associated with the possible presence of cross-sectional dependence, we carry out the panel Granger causality tests using the approach in Emirmahmutoglu and Kose (2011) as a form of robustness check and also as a means of detecting the direction of causality in the insurance-banking-growth nexus. The direction, strength, and stability of the linkage among banking sector, insurance market and economic growth play a critical role in the implementation of economic and financial polices (Lee, 2013). To the best of our knowledge, this approach has not been considered in examining the relationships between insurance, banking and economic growth.

In summary, our findings show that life insurance market activities, non-life insurance market activities and banking sector activities individually stimulate economic growth. Moreover, life insurance market activities and banking sector activities have complementary synergistic effects on economic growth in Africa and similarly, non-life insurance market activities and banking sector activities also have complementary synergistic effects on economic growth in Africa. The insurance and banking sectors function better together than they do separately in the continent. Improvements in the insurance sector (banking sector) does not only lead to better economic performance but also to a better banking sector (insurance sector) performance. We also were able to confirm the feedback hypothesis for the relationship between the insurance sector and economic growth, and the relationship between the banking sector and economic growth along the line.

The rest of this article is structured as follows; section (3.2) gives an overview of Africa's financial system, section (3.3) presents a review of relevant literature and the identified gap, section (3.4) details the conceptual framework and the proposed hypotheses, section (3.5) describes the specified model and data used in the study, section (3.6) outlines the empirical methodology adopted in the study, section (3.7) presents obtained results and their interpretations, and in section (3.8), the important conclusions are presented.

3.2 An Overview of the Financial Sector in Africa

With a few exceptions like South Africa and Mauritius, the financial sectors across most of Africa are still mostly underdeveloped. A close look at the insurance market in Africa however shows that the continent's economic boom and the resultant growth of its insurance market which well exceeds the global average are the region's most significant strengths (KPMG, 2015). The continent's biggest opportunities for further growth in the insurance market lie in the very low insurance penetration (Africa's average insurance penetration of 2.8% is well below the global average of 6.1% in 2016), introduction of new products (in life insurance, medical care and micro-insurance) and a growing middle class (AIO, 2016).

Despite the positives, Africa's insurance markets remain diverse and fragmented, with only 10 African countries (South Africa, Morocco, Egypt, Nigeria, Kenya, Algeria, Angola, Namibia, Tunisia and Mauritius) contributing 92% of the total premiums based on 2014 figures, and South Africa alone accounting for 87% and 40% of life and non-life premiums respectively (AIO, 2016). Shortage of skilled insurance professionals, low income and lack of understanding of insurance benefits by the populace are some of the reasons for the poor performance of the insurance markets across the continent.

Figures 1 and 2 show the geographical split of total insurance premiums across Africa in 2016. The 10 aforementioned countries jointly account for 91% of total premiums in the continent and when the South African insurance market is excluded, the remaining 9 countries jointly account for 70% of total premiums in the continent.

Like the insurance sector, the banking sectors of several African countries have exhibited significant growth in recent times due mainly to the following reasons; economic growth, better regulatory oversight and rapid rise of Pan-African bank (KPMG, 2015). Growing presence of large global and Pan-African banks across the continent has not only improved the quality and availability of financial services but has also driven efficiency, innovation and financial deepening. Despite the strong growth being witnessed in the banking sector, penetration is still well below the global average and remains as low as 36% in some of the larger African economies (KPMG, 2015). As shown in figure 3, the same set of countries identified as dominant players in the African insurance market also jointly account for 61% of the top 200 African banks in terms of total assets, net earnings, credits and deposits in 2014.

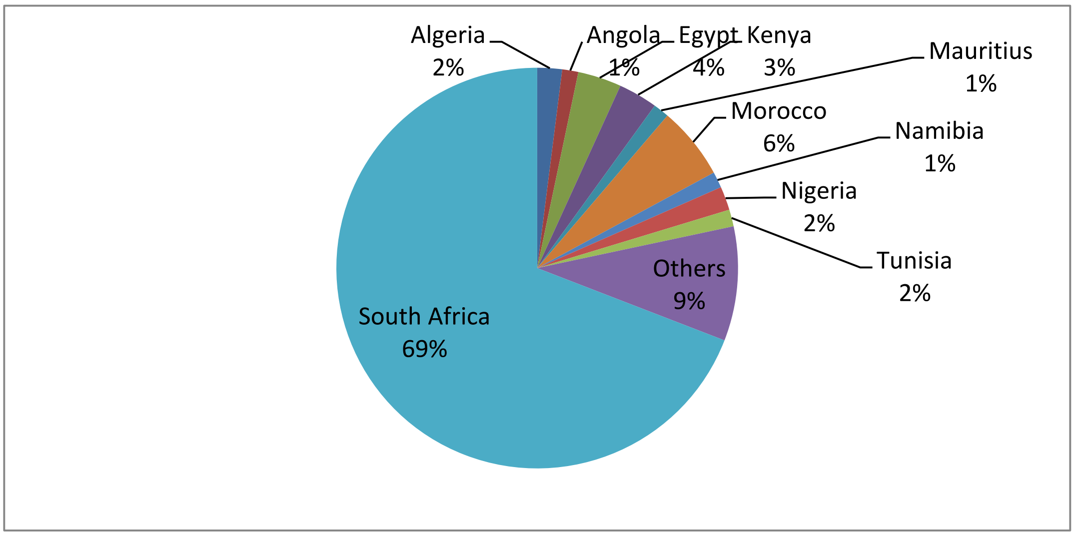

Figure 1: Geographical split of African insurance premiums. Data from Swiss Re sigma explorer (2016).

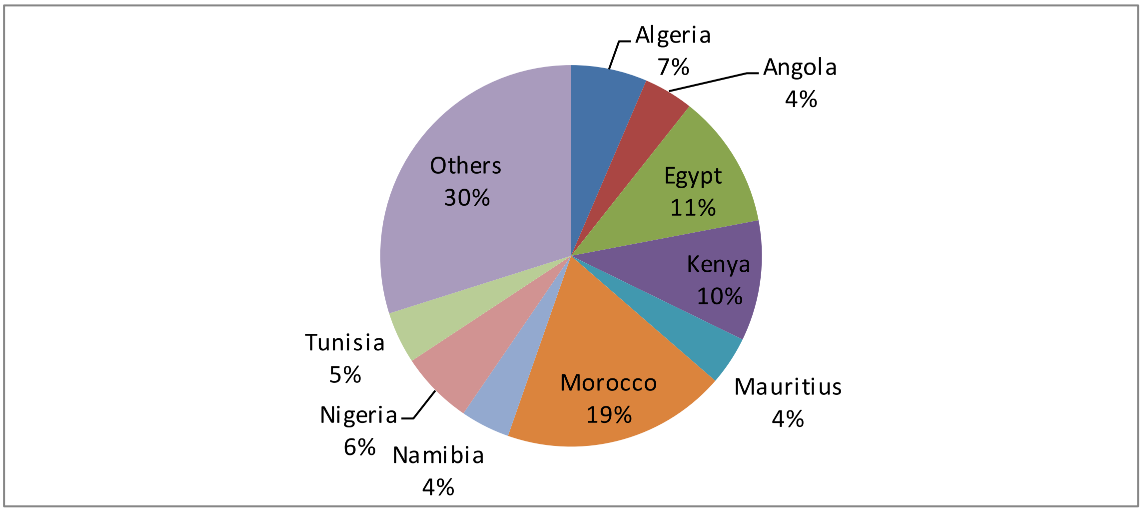

Figure 2: Geographical split of African insurance premiums (excluding South Africa). Data from Swiss Re sigma explorer (2016).

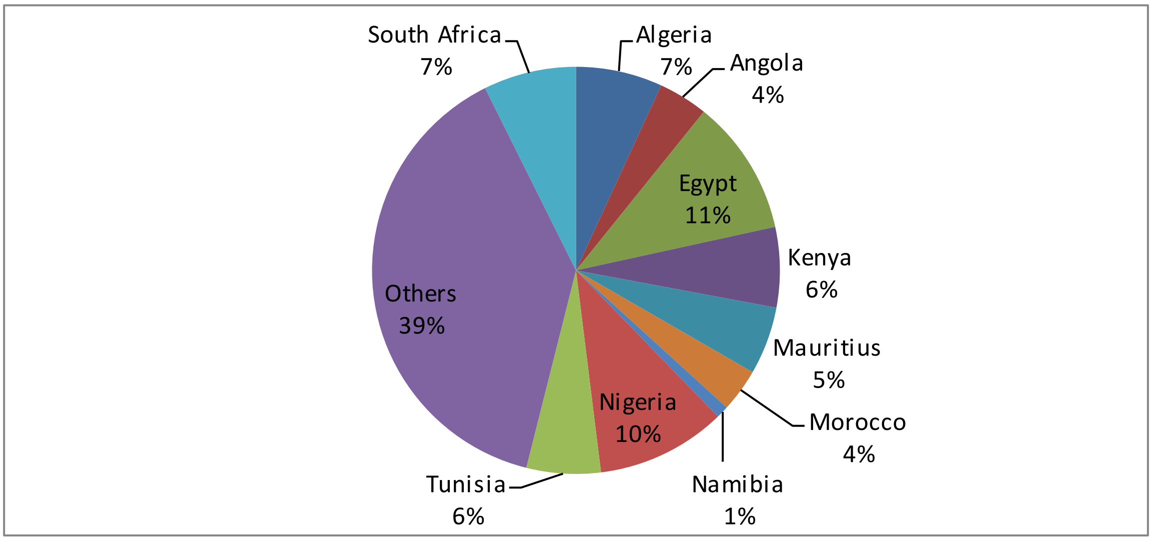

Figure 3: Geographical split of top 200 banks in Africa. Data from The Africa Report (2014).

3.3 Literature Review in Brief

The extensive body of literature on the relationship between financial markets, economic growth, and insurance market activity are broadly grouped into 4 categories (Pradhan *et al.*, 2013, 2017; Samargandi *et al.*, 2015).

The first category consists of those who provide empirical evidence in support of the supply-leading theory. This theory claims that economic growth is preceded by financial development. The rationale behind this approach is that financial development induces improvements in savings and investment efficiency which in turn drives economic growth. Examples of such studies include Ward and Zurbruegg (2000), Haiss and Sümegi (2008), Han *et al.* (2010), Chen *et al.* (2012), Pan and Su (2012), and Pradhan *et al.* (2015), who all find one-way positive effect of insurance market activity on growth performance, thus confirming the supply-leading theory in the relationship between insurance market activity and economic growth.

Similarly, studies by Calderón and Liu (2003), Ang (2008), Körner and Schnabel (2009), Bojanic (2012), and Pradhan *et al.* (2014) all find one-way effect of banking sector activity on economic growth, providing evidence in support of the supply-leading theory in the banking sector.

The second category is made up of supporters of the demand-following theory. This theory suggests that economic growth drives the demand for financial services. The underlying idea is that growth in the real sector of the economy leads to increased need for supporting financial services and this consequently induces growth in the financial sector. Studies by Beenstock *et al.* (1988), Outreville (1990), Browne and Kim (1993), Beck and Webb (2003), Ching *et al.* (2010), and Pradhan *et al.* (2014) all find evidence in support of a one-way impact of economic growth on insurance market activity, confirming the demand-following theory in the relationship between insurance market activity and economic growth. Also, studies by Liang and Jian-Zhou (2006), Ang and McKibbin (2007), and Panopoulou (2009) confirm the demand-following theory by providing evidence in support of one-way impact of economic growth on banking sector activities.

The third category of studies consists of those who affirm the neutrality hypothesis. This group of literature argues that there is no significant relationship between financial market activities and economic growth. Examples include Pan and Su (2012) and Pradhan *et al.* (2015) who find no relationship between insurance market activity and economic growth, and Al-Yousif (2002) and Mukhopadhyay *et al.* (2011) who find no relationship between banking sector activity and economic growth.

The fourth category covers the group of studies that infer bi-directional causality between financial markets and economic growth. This is referred to as the feedback hypothesis. This group of studies supports both the supply-leading and demand-following theories. Their position is that improved financial sector performance positively affects economic growth; this increased growth in turn further stimulates increased demand for financial services. Such studies include Kugler and Ofoghi (2005) and Pradhan *et al.* (2016) who find bi-directional causality between insurance market activity and economic growth, while Al-Yousif (2002), Wolde-Rufael (2009), and Pradhan *et al.* (2013) find bi-directional causality between banking sector activity and economic growth.

On the African front, the supply-leading theory was confirmed in the insurance sector by Akinlo and Apanisile (2014), Alhassan and Fiador (2014), Alhassan and Biekpe (2016), Olayungbo (2016), and Olayungbo and Akinlo (2016), and in the banking sector by Kikwebati (2004), Mensah, Abor, Aboagye and Adjasi (2012), and Nyasha and Odhiambo (2015). Evidence in support of the demand-following theory in the insurance sector was found by Sibindi (2014) and Sibindi and Godi (2014), and in the banking sector by Kagochi, Al Nasser and Kebede (2013). Akinlo (2015) finds evidence in support of the feedback hypothesis in the insurance sector while Akinboade (1998) and Odhiambo (2005) find similar evidence in the banking sector. Hakeem (2010) however confirms the neutrality hypothesis in the Sub-Saharan African banking sector.

Over and beyond the investigation of financial sector-economic growth nexus, researchers have also studied the interactions between different financial markets.

Researchers have particularly studied the interaction between insurance market activities and banking sector activities and obtained mixed results. Some have found complimentary effects in the interaction between the insurance and banking sectors (see Webb *et al.*, 2002; Zou and Adams, 2006; Bernoth and Pick, 2011; Lee and Chang, 2015). The complementary effects are said to be due to the risk mitigating and compensating activities of the insurance sector which protects lenders and encourages banks to easily offer more loans.

Some authors have found substitutive interactions between both markets (see Levine, 1997; Tennant and Abdulkadri, 2010). The substitutive impact is viewed to be due to the duplicative role of both the insurance and banking sectors in capital allocation. The insurance sector to some degree also plays the role of an intermediary in the transfer of savings which is the traditional role of the banking credit market (Liu and Zhang, 2016). Song and Thakor (2010) further discovered that the relationship between the two markets could be both complimentary and substitutive under certain conditions.

3.3.1 Identified Gap in Literature

The detailed overview of relevant literature on the relationship between the financial sector and economic growth provided in section 3.3 clearly shows that the individual impacts of the insurance and banking sectors, as well as the interaction between the insurance sector and the banking sector have been studied extensively. The synergistic effect of both sectors on economic growth is where the main gap in the financial sector-economic growth literature exists.

3.4 Hypotheses

We propose a conceptual framework for evaluating the individual and interactive relationships between insurance market activities and banking sector activities on economic growth in Africa. These relationships are tested through the null (H_0) hypotheses and alternative (H_1) hypotheses specified below and described in figure 4.

H_0^A: Insurance market activities do not influence economic growth.

H_1^A: Insurance market activities exert some level of influence economic growth.

H_0^B: Banking sector activities do not influence economic growth.

H_1^B: Banking sector activities exert some level of influence economic growth.

H_0^C: The interaction between Insurance market and banking sector activities does not influence economic growth.

H_1^C: The interaction between Insurance market and banking sector activities exerts some level of influence economic growth.

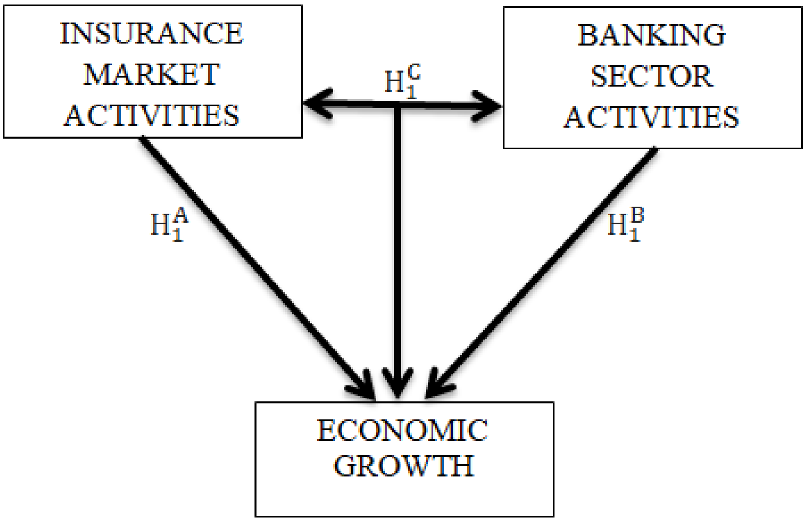

Figure 4: Conceptual framework with hypotheses

3.5 Model specification

Our study applies panel data analysis to examine the synergistic impacts of insurance market activity and banking sector market activities on economic growth in Africa. The basic regression model is:

$$y_{it} = \alpha y_{it-1} + \beta' x_{it} + v_{it}, \qquad v_{it} = \mu_i + \eta_t + \varepsilon_{it} \tag{1}$$

where y_{it} is real gross domestic product, the dependent variable, in country i at time t, β represents a vector of coefficients, and x_{it} represents the regressors for each country i at time t; it includes (i) measures of insurance market activity and banking sector market activity and their interactions, (ii) variables included to control for additional factors that could influence economic growth in the selected countries such as inflation rates, government expenditure, total investment, trade openness and initial GDP. μ_i represents the unobserved country-specific effects. η_t represents the time specific effects and ε_{it} represents the idiosyncratic error term.

We specifically determine the synergistic effects of the insurance and banking sector market activities on economic growth in Africa with the aid of interaction terms between life insurance market activity and banking sector activity, non-life insurance market activity and banking sector activity and between total insurance market activity and banking sector activity.

3.6 Methodology

3.6.1 Data

To determine the synergistic impact of insurance and banking sector market activities on Africa's economic growth, we construct a panel time-series data set by employing yearly data on measures of insurance market activities and banking sector market activities. The data set encompasses the 10 selected African countries (Algeria, Angola, Egypt, Kenya, Mauritius, Morocco, Namibia, Nigeria, South Africa, and Tunisia) that are responsible for almost all of the activities in Africa's financial sector. The data set covers the period from 1995 to 2016.

There are 2 popularly used measures of insurance market activity—insurance density (ratio of total insurance premiums to total population) and insurance penetration (ratio of total insurance premiums to GDP). Although both measures are relatively similar, differing only by the denominator, we however adopt insurance density as the measure of insurance market activity mainly because per-capita figures are relatively insensitive to territorial changes and control for the scale of the economy (Chang *et al.*, 2013). Moreover, the insurance industry can be broadly divided into 2, life and non-life insurance markets. We thus employ measures of life insurance market activity (life insurance density) and non-life insurance market activity (non-life insurance density) as well as an aggregate of both (total insurance density). Data on insurance density (life, non-life and total) was obtained from Sigma reports of the Swiss Reinsurance Company.

Banking sector activity has mostly been measured by past studies with variables such as banking sector domestic credit. Such measures however do not take factors such as the quality of financial services, the financial sector efficiency and stability into consideration. Banking sectors have evolved over time and have become multifaceted. Large banking sectors are of little use if they are not accessible to a large percent of economic agents. Also the contribution of banking sectors to economic growth across Africa would be insignificant if they lack depth or are inefficient. Banking sectors may even negatively impact the economy if they are unstable. We thus adopt the global financial development variables provided by the World Bank. The database can be accessed at http://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database. The database provides measures for financial development on the basis of financial access, financial depth, financial efficiency and financial stability. Of the numerous measures provided on each of these 4 categories, we specifically select bank accounts per 1000 adults as the measure for banking access, private credit by deposit money banks to GDP as the measure of banking sector depth, bank lending-deposit spread as the measure of banking sector efficiency and bank Z-score as the measure of banking sector stability.

To guide against the problem of multicollinearity that may arise from modeling these 4 different measures of banking sector activities in the same equation, or the possible shortcomings that could arise from using just one of them, we create a composite index of banking sector activity (BSA) from the 4 different measures.

The composite index is constructed via Principal Component Analysis (PCA). With PCA, we are able to convert the original individual measures into linear combinations that account for relatively large proportion of the variance in the original measures (Pradhan *et al*., 2014). It is formulated thus:

$$p_i = \sum_{i=1}^{n} a_{ij} x_i \qquad (2)$$

where p_i, $i = 1,2, \dots, k$, are principal components, a_{ij} are component loadings and x_i are the original measures.

The PCA procedure includes the following steps: generation of a detail matrix, construction of standardized variables, obtaining a correlation matrix, determination of eigenvalues and eigenvectors and determination of principal components (Hosseini and Kaneko, 2011, 2012). To control for differences in units of measurements, we use the various banking activity measures in their standardized forms. Each composite index is thereafter constructed using the formula:

$$CI = \sum_{i=1}^{n} a_{ij} \frac{x_{ij}}{\sigma(x)_i} \qquad (3)$$

where CI is composite index (BSA) and σ is standard deviation.

Other variables used in our estimations are GDP (dependent variable), inflation, government expenditure, total investment, trade openness and lag of real GDP (control variables). Data on GDP, trade openness and inflation, was taken from the World Development Indicator (http://data.worldbank.org). Data on government expenditure and total investment was obtained from world economic outlook database (https://www.imf.org). Table 12 provides a detailed description of the variables.

Table 12: Variables and their definitions

Variables	Definition
GDP	Gross domestic product in logarithms, with the rate of economic growth measured as percentage change (ΔGDP)
$LGDP_{t-1}$	Initial gross domestic product (GDP in dollars of the previous year) in logarithmic form, to capture convergence effect
LID	Life insurance density measured as life premiums per-capita
NLID	Non-life insurance density measured as non-life premiums per-capita
TID	Total insurance density measured as total premiums per-capita
BSA	Composite index of banking sector activity
BSA*LID	Interaction between life insurance market activity and banking sector activity
BSA*NLID	Interaction between non-life insurance market activity and banking sector activity
BSA*TID	Interaction between total insurance market activity and banking sector activity
INF	Inflation rate measured as percentage change in consumer price index
GEXP	Government expenditure measured as total expense and the net acquisition of nonfinancial assets as % of GDP
INV	Total investment measured as gross fixed capital formation, changes in inventories and acquisitions
TRADE	Trade openness measured as Exports + imports as % of GDP

3.6.2 Estimation Technique

Dynamic panel system GMM

The inter-relations between financial markets and economic growth have been extensively studied using generalized method of moments (GMM) estimators for dynamic panel data (Anderson and Hsiao, 1981; Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998; Zhang *et al*., 2012). The GMM technique is regarded as superior to the traditional OLS estimation technique for studying financial variables (Driffill *et al.*, 1998). Furthermore, according to Baum (2006), the GMM estimator is the most appropriate for studying dynamic panel models. It is particularly useful under these conditions; when one or more of the explanatory variables contain lagged values of the dependent variable, when the model suffers from endogeneity bias, and when serial correlation and (or) heteroscedasticity are present within the cross-sections (Roodman, 2006). It is also suitable for short macro panels (Lee and Hsieh, 2013). Other advantages of GMM include its ability to control for time and country-specific effects, and freedom to use lags of variables in the model as instruments.

We likewise adopt the panel-GMM estimation technique for two key reasons; first, because our regression equation includes lagged GDP as an explanatory variable, making it a dynamic model and second, because of the possibility of endogeneity bias due to simultaneous causality between financial market activities and economic growth.

There are two commonly used GMM estimators, the difference-GMM estimator (Arellano and Bond, 1991) which transforms data by subtracting past observations from current observations:

$$\Delta y_{it} = \alpha \Delta y_{it-1} + \beta' \Delta x_{it} + \Delta v_{it} \quad (4)$$

And the system-GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998) which transforms data by subtracting the mean of all future observations from the current observation (forward orthogonal deviations):

$$W_{it+1} \equiv C_{it}\left[W_{it} - \frac{1}{T_{it}}\Sigma_{S>t} W_{is}\right] \quad (5)$$

We adopt the system-GMM estimator because of its improved efficiency gains over the first-difference estimator (see Baltagi, 2008). We also employ the two-step variant of the GMM-estimator since it is more efficient than the one-step variant in the system-GMM.

The instrumental variables employed are the first and second lags of all explanatory variables. The Sargan test of over-identifying restrictions is used to test the overall validity of the instruments. Our choice of Sargan statistics instead of the Hansen *J* tests is first because Sargan statistics are not vulnerable to instrument proliferation as they are not dependent on the optimal weighting matrix estimate (Roodman, 2009), and second, because it has been consistently found that the Sargan test tends to be more conservative than the Hansen test which easily produces *J* statistics with implausibly perfect *p*-values of 1.000 (Zhang *et al*., 2012). The Arellano-Bond AR(2) statistics are computed to detect the presence of autocorrelation in the error terms.

Bootstrap panel Granger causality

Additional evidence on the interaction between insurance sector activities, banking sector activities and economic growth is provided by carrying out the Emirmahmutoglu and Kose (2011) panel causality test with bootstrapping. This test is the most suitable for our study since it does not require stationarity for all the series in the underlying VAR system and may be applied to panels comprising of stationary, non-stationary, cointegrated and non-cointegrated series (Seyoum *et al.*, 2014). The test is also valid in the presence of cross-sectional dependence and slope heterogeneity.

Emirmahmutoglu and Kose (2011) show that the Fisher (1932) test statistic may be used to test for panel Granger non-causality and specified thus:

$$\lambda = -2\sum_{i=1}^{N} ln_{(pi)} \quad i = 1,2,\dots,N. \tag{6}$$

pi represents the p value for the ith cross section and the test statistic has a chi-square distribution with 2N degrees of freedom.

Following Emirmahmutoglu and Kose (2011), we adopt the lag augmented VAR (LA-VAR hereafter) model with L_y+ $dmax_i$ lags in heterogeneous mixed panels. It is specified as follows:

$$BSA_{it} = a_{1i}^{BSA} + \sum_{j=1}^{L_{BSA}+dmax_i} B_{1ij} BSA_{it-j} + \sum_{j=1}^{L_{LIMA}+dmax_i} \gamma_{1ij} LIMA_{it-j} + \varepsilon_{1it} \tag{7}$$

$$LIMA_{it} = a_{2i}^{LIMA} + \sum_{j=1}^{L_{BSA}+dmax_i} B_{2ij} BSA_{it-j} + \sum_{j=1}^{L_{LIMA}+dmax_i} \gamma_{2ij} LIMA_{it-j} + \varepsilon_{2it} \tag{8}$$

$$BSA_{it} = a_{1i}^{BSA} + \sum_{j=1}^{L_{BSA}+dmax_i} B_{1ij} BSA_{it-j} + \sum_{j=1}^{L_{NIMA}+dmax_i} \gamma_{1ij} NIMA_{it-j} + \varepsilon_{1it} \tag{9}$$

$$NIMA_{it} = a_{2i}^{NIMA} + \sum_{j=1}^{L_{BSA}+dmax_i} B_{2ij} BSA_{it-j} + \sum_{j=1}^{L_{NIMA}+dmax_i} \gamma_{2ij} NIMA_{it-j} + \varepsilon_{2it} \tag{10}$$

$$BSA_{it} = a_{1i}^{BSA} + \sum_{j=1}^{L_{BSA}+dmax_i} B_{1ij} BSA_{it-j} + \sum_{j=1}^{L_{TIMA}+dmax_i} \gamma_{1ij} TIMA_{it-j} + \varepsilon_{1it} \tag{11}$$

$$TIMA_{it} = a_{2i}^{TIMA} + \sum_{j=1}^{L_{BSA}+dmax_i} B_{2ij} BSA_{it-j} + \sum_{j=1}^{L_{TIMA}+dmax_i} \gamma_{2ij} TIMA_{it-j} + \varepsilon_{2it} \tag{12}$$

The null hypothesis for each pair of bivariate Granger causality tests are:

$$H_0: \gamma_{1i1} = \gamma_{1i2} = \cdots = \gamma_{1ik_i} = 0 \; for \; i = 1,2,\dots,N \tag{13}$$

$$H_0: \beta_{2i1} = \beta_{2i2} = \cdots = \beta_{2ik_i} = 0 \; for \; i = 1,2,\dots,N \tag{14}$$

3.7 Results

The system-GMM regression outcomes are reported in Table 13. The table displays the results of three estimations. The first estimation (M1) includes life insurance density (LID) and its interaction with banking sector activity (BSA). The second estimation (M2) includes non-life insurance density (NLID) and its interaction with banking sector activity (BSA). The third estimation (M3) contains total insurance density (TID) and its interaction with banking sector activity index (BSA). The estimation results provide insight into the individual and joint impacts of insurance market activity and banking sector activity on economic growth.

Table 13: Dynamic panel GMM estimation results

Variables	**M1**	**M2**	**M3**
[β_1] BSA	0.042^{***}	0.043^{***}	0.047^{***}
	(0.001)	(0.001)	(0.002)
[β_2] LID	0.008^{***}		
	(0.000)		
[β_3] NLID		0.055^{***}	
		(0.000)	
[β_4] TID			0.009^{***}
			(0.000)
Interactions			
[β_5] BSA*LID	0.006^{***}		
	(0.000)		
[β_6] BSA*NLID		0.008^{***}	
		(0.000)	
[β_7] BSA*TID			0.010^{***}
			(0.001)
Control variables			
[β_8] $LGDP_{t-1}$	-1.006^{***}	-0.991^{***}	-1.017^{***}
	(0.002)	(0.000)	(0.002)
[β_9] INF	-0.046^{***}	-0.050^{***}	-0.042^{***}
	(0.001)	(0.001)	(0.001)
[β_{10}] GEXP	0.071^{***}	0.037^{***}	0.067^{**}
	(0.002)	(0.002)	(0.002)
[β_{11}] INV	0.007^{***}	0.021^{***}	0.011^{***}
	(0.002)	(0.003)	(0.002)

[β_{12}] TRADE	0.031***	0.064***	0.034***
	(0.002)	(0.003)	(0.002)
Wald tests for Joint significance			
$B_1= \beta_5=0$	29.204***		
$\beta_2= \beta_5=0$	46.46***		
$B_1= \beta_6=0$		185.214***	
$B_3= \beta_6=0$		16.505***	
$B_1= \beta_7=0$			17.636***
$B_4= \beta_7=0$			13.946***
Countries	10	10	10
Observations	148	148	148
Specification tests			
Sargan test statistic	2.872	4.124	3.396
P-value of Sargan test stat	0.579	0.390	0.335
AR(1) test statistic	1.727	-0.731	-0.514
P-value of AR(1) test stat	0.842	0.465	0.607
AR(2) test statistic	0.716	-1.632	0.412
P-value of AR(2) test stat	0.4742	0.103	0.680

*Notes: (1) *, ** and *** mean statistic relationship significant at 10%, 5%, 1%, respectively; (2) M1, M2 and M3 represent the regression models (1), (2)and (3), respectively (3) Standard errors of the corresponding coefficients are shown in parentheses.*

With respect to the financial variables, the three banking sector activity indices are positive and statistically significant (0.042, 0.043 and 0.047 in columns M1, M2 and M3 respectively). This signifies that the conditional marginal effect of the banking sector in the absence of the insurance sector (when LID, NLID and TID equal zero respectively) is positive and confirms that the banking sector on its own is a driver of economic growth.

Life insurance density, non-life insurance density and total insurance density all have positive and significant coefficients (0.008, 0.055 and 0.009 respectively). This indicates that the conditional marginal impact of insurance sector in the absence of the banking sector is positive (when BSA is zero). We may thus conclude that the insurance sector on its own drives economic growth.

With respect to the interaction terms, column M1 indicates that the interaction between BSA and LID is positive. It can be expressed mathematically as follows:

$$\left[\frac{\Delta y_{it}}{\Delta LID_{it}}\right] = 0.008 + 0.006[BSA] \tag{15}$$

$$\left[\frac{\Delta y_{it}}{\Delta BSA_{it}}\right] = 0.042 + 0.006[LID] \tag{16}$$

Our inference from these results is that; (i) the more developed the banking sector activity, the higher the point estimate of the effect of life insurance market activity on economic growth, and (ii) the more developed the life insurance market activity, the higher the point estimate of the effect of banking sector activity on economic growth.

Column M2 indicates that the interaction between BSA and NLID is positive. The mathematical representations are:

$$\left[\frac{\Delta y_{it}}{\Delta NLID_{it}}\right] = 0.055 + 0.008[BSA] \tag{17}$$

$$\left[\frac{y_{it}}{\Delta BSA_{it}}\right] = 0.043 + 0.008[NLID] \tag{18}$$

Again, we infer that the more developed the banking sector activity (non-life insurance market activity), the higher the point estimate of the effect of non-life insurance market activity (banking sector activity) on economic growth.

Finally, the positive interaction between BSA and TID in column M3 confirms that the complimentary pattern of relationships discovered is true overall. As shown in equations 19 and 20, the presence of the banking sector raises the conditional marginal impact of insurance market on economic growth overall and the presence of an insurance market (life and non-life) increases the conditional marginal impact of the banking sector on economic growth.

$$\left[\frac{y_{it}}{\Delta TID_{it}}\right] = 0.009 + 0.010[BSA] \quad (19)$$

$$\left[\frac{y_{it}}{\Delta BSA_{it}}\right] = 0.047 + 0.010[TID] \quad (20)$$

The Wald tests of joint significance reported in table 13 show that conditional marginal effects of the financial sector variables are statistically significant. In general, the results support the claim by Chen *et al*. (2012) and Lee (2013) that the interaction between the insurance and banking sectors stimulate economic growth.

With respect to the control variables, the coefficients of initial GDP are negative and significant in all three estimations (-1.006, -0.991 and -1.017 in columns M1, M2 and M3 respectively). This provides evidence in support of the convergence theory which claims that higher levels of initial income are associated with relatively lower levels of growth. All three coefficients of inflation are negative and significant (-0.046, -0.050 and -0.042 in columns M1, M2 and M3 respectively). This confirms that inflation negatively influences economic growth. The coefficients for government expenditure are all positive and statistically significant (0.071, 0.037 and 0.067 in columns M1, M2, M3 respectively). This indicates that government expenditure drives economic growth. All three coefficients of investment are positive and significant (0.007, 0.021, 0.011 in columns M1, M2, M3 respectively). We thus affirm that investment positively impacts economic growth. The three coefficients for trade are positive and statistically significant (0.031, 0.064 and 0.034 in columns M1, M2 and M3 respectively). Our conclusion is that trade openness supports economic growth. The conclusion that initial GDP and inflation are negatively associated with economic growth, while government expenditure, investment and trade openness are positively associated with economic growth, is generally consistent with findings made by studies on determinants of economic growth in developing countries (see Knight *et al.*, 1993; Barro, 1999; Burnside and Dollar, 2000; Chen and Feng, 2000; Barro, 2003; Rao and Hassan, 2011; Anyanwu, 2014).

The Sargan test results indicate that the validity of the instruments used in our estimations cannot be rejected. Also, all three estimations pass the second order autocorrelation test. The test results indicate that the absence of serial correlation in the error terms cannot be rejected.

The panel causality test results for the interaction between insurance market activity, banking sector activity and economic growth are presented in Table 14.

Table 14: Results from Emirmahmutoglu-Kose Granger causality tests

Hypothesis	**Statistic**	**P-Value**	**Conclusion**
BSA→LID	59.919***	0.000	Two way causality between BSA and LID
LID→BSA	78.803***	0.000	
BSA→NLID	65.954***	0.000	Two way causality between BSA and NLID
NLID→BSA	109.316***	0.000	
BSA→TID	196.946**	0.041	Two way causality between BSA and TID
TID→BSA	59.873 **	0.031	
BSA→GDP	154.764***	0.000	Two way causality between BSA and INF
GDP→BSA	103.384***	0.000	
LID→GDP	57.622*	0.088	Two way causality between LID and GDP
GDP→LID	69.053***	0.000	
NLID→GDP	172.009***	0.000	Two way causality between NLID and GDP
GDP→NLID	966.775***	0.000	
TID→GDP	47.218***	0.001	Two way causality between TID and GDP
GDP→TID	95.366***	0.000	
BSA→GDP	215.409***	0.000	Two way causality between BSA and GDP
GDP→BSA	136.551***	0.000	

*Notes: (1) *, ** and *** mean statistic relationship significant at 10%, 5%, 1%, respectively; (2) reported statistics are the Fisher statistics; the reported p-values are the bootstrap p-values.*

The null that BSA does not Granger cause GDP and the null that GDP does not Granger cause BSA are both rejected at 1% significance level. We conclude that the relationship between both variables is bi-directional. This finding confirms the influence of banking sector activities on economic growth and lends credence to the feedback hypothesis in the banking sector.

The null that LID does not Granger cause GDP and the null that GDP does not Granger cause LID are both rejected at 1% significance level. The null that NLID does not Granger cause GDP and the null that GDP does not Granger cause NLID are both rejected at 1% significance level. The null that TID does not Granger cause GDP and the null that GDP does not Granger cause TID are both rejected at 1% significance level. The bidirectional causality found between the insurance market activity (either aggregated or disaggregated) and GDP confirms that the insurance sector exerts some influence on economic growth. The results also confirm that the feedback hypothesis holds in the insurance sector.

The null that BSA does not Granger cause LID and the null that LID does not Granger cause BSA are both rejected at 1% significance level. The null that BSA does not Granger cause NLID and the null that NLID does not Granger cause BSA are both rejected at 1% significance level. The null that BSA does not Granger cause TID and the null that TID does not Granger cause BSA are both rejected at 5% significance level. We thus conclude that the relationship between the banking sector and insurance sector (aggregated or disaggregated) is bi-directional. This provides further evidence that there is a strong interaction between these two sectors.

3.8 Conclusion

In this paper, we examined the synergistic impact of insurance market activity and banking sector activity on economic growth of Africa using a dynamic panel data model. Our findings show that both of them have statistically significant positive individual effects on economic growth. Moreover, the interaction effects confirm that both insurance and banking sector activities have a complementary synergistic effect on economic growth. We find that both the insurance and banking sector function better together than separately. Improvements in the insurance sector (banking sector) does not only lead to better economic performance but also to a better banking sector (insurance sector) performance.

We further tested for interactions among the insurance sector, the banking sector and economic growth through panel causality tests and found that a positive bi-causal relationship exists between insurance market activities and banking sector activities. This further confirms the complementary nature of their interaction and supports the findings of Webb *et al.* (2002), Zou and Adams (2006), Bernoth and Pick (2011), and Lee and Chang (2015). The panel causality tests also showed that bidirectional causality exists between insurance market activities and economic growth, and between banking sector activities and economic growth.

We therefore conclude and recommend as follows; first, since the relationship between the insurance sector and the banking sector is complementary, policies that reinforce the complementary relationship between both sectors and neutralize the possible substitutive relationship that could occur between them should be actively pursued.

Second, since the feedback hypothesis is confirmed between the insurance sector and economic growth we suggest that the insurance sector's risk mitigating and compensating actions should be developed in order to directly improve growth through its individual effect and indirectly improve it via its effect on the banking sector.

Third, because the feedback hypothesis is also confirmed in the relationship between the banking sector and economic growth, we recommend that the banking sector's credit distribution capabilities should be strengthened. This will boost economic growth directly through its individual impact on growth and indirectly through its role in enhancing the insurance sector.

Fourth, policies that stimulate economic growth should be actively pursued as this will lead to an attendant expansion in the financial sector.

The confirmation of the feedback hypothesis in the relationship between insurance market activities and economic growth and between banking sector activities and economic growth is an indication that endogeneity exists in the financial sector-economic growth relationship. The results also suggest that banking sector, insurance market activity, and economic growth are endogenous, and therefore any single equation forecast of one or the other could be misleading.

Chapter 4

ASYMMETRIC CAUSALITY BETWEEN FINANCIAL SYSTEMS AND ECONOMIC PERFORMANCE: EMPIRICAL EVIDENCE FROM 9 AFRICAN COUNTRIES

4.1 Introduction

African nations place great emphasis on financial sector development and deepening in the quest for better economic performance. The financial sector is seen as vital to economic growth through the crucial role it plays in mobilizing savings, supporting trade in goods and services, facilitating payments, promoting efficient allocation of resources, providing indemnification against losses and pooling risks. Development assistance to Africa over the past few decades has been significantly concentrated on helping African countries strengthen their financial sectors.

Although policy makers and economists mostly agree that well developed financial systems (efficient financial institution and markets such as commercial banks, insurance firms and stock exchanges) are closely intertwined with economic growth, the nature of the finance-growth relationship remains debatable. Questions often arise over the direction of causality. Historically, on this issue, there are two opposite views. The first argues that financial sectors develop in response to the financial needs of firms and also because richer countries can afford expensive financial systems (Robinson, 1952). Robinson (1952) claimed that where enterprise leads, finance follows. Lucas (1988) describes finance as an overstressed determinant of economic growth. The second view posits that the level of development in a country's financial system in terms of its ability to identify and finance investments plays a crucial role in determining its level of economic growth (Bagehot, 1873; Schumpeter, 1911; Hicks, 1969). Miller (1998) argued, "The idea that financial markets contribute to economic growth is a proposition too obvious for serious discussion."

Financial sectors in Africa operate on relatively small scales, and as a consequence, exhibit the following characteristics: small financial markets with few participants, uncompetitive, inefficient and incomplete in structure, high regulatory costs and lack of ancillary components of financial infrastructure (Lovegrove *et al.,* 2007). This suggests that there is a possibility that African financial systems may have insignificant causal relationship with economic growth (neutrality hypothesis).

Over and beyond the debate on the pattern of causal relationships in the finance-growth nexus, a new wave of researchers are increasingly questioning the validity of the linearity assumption often imposed when testing the finance-growth nexus (Harrington and Niehaus, 2000; Deidda and Fattouh, 2002; Stengos and Liang, 2005; Jawadi *et al.,* 2009; Huang, 2012; Bluwstein, 2016). After all, it is generally known that people react more to negative news than positive ones (Hatemi-J, 2016). The presence of asymmetries in the relationship has been linked to several reasons. For example, Huang (2012) argues that the dynamics of stock price continuation are asymmetrical when business cycles and past performances are considered. Bluwstein (2016) shows that asymmetry exists in the financial transmission of asset price shock through bank lending. Negative shock pass-through during stress periods are greater than negative shock pass-through during normal periods. Harrington and Niehaus (2000) and Jawadi *et al.* (2009) suggest that the adjustment dynamics of the insurance sector is asymmetric and non-linear in nature.

A study that provides a clearer understanding of the relationship between finance and economic growth in Africa will have important policy implications. Findings from such research could influence future policy direction. As an example, strong evidence that the financial system influences economic growth could have significant impact on policy decisions taken about the political, legal and regulatory determinants of financial development in Africa. If on the other hand, convincing evidence that the financial system simply responds to economic activities is obtained, then policy makers may come to the realization that all efforts being expended to boost the financial system will not be worthwhile in the long-run, and more effort should instead be directed toward improving economic growth.

This study is intended to provide insight into the causal linkage between the financial systems of selected African countries and their economic growth, taking asymmetry into consideration.

The summary of the contribution of this paper is as follows;

First, we provide additional evidence on the sparsely researched finance-growth relationship in Africa. Second, we apply a panel causality framework that is robust to challenges posed by cross-sectional dependence and country-specific heterogeneity. Third, we take into account the possibility that the relationship between financial systems and economic growth in Africa may be asymmetric in nature. We apply panel causality testing that accounts for this possibility. Fourth, we provide evidence on the exact nature of inter-linkages between the financial systems and economic growth at country-specific level. We show that the pattern of causality varies across countries, with the possible outcomes being negative and (or) positive one-way causality and negative and (or) positive two-way causality.

4.1.1 An Overview of the African Financial Systems

The financial systems across Africa are diverse. Even though there may be some regional economic coalitions, each country's economy has its unique characteristics. Although a few African countries have been classified among the large emerging market economies of the world, (for instance, South Africa, Nigeria and Egypt), most are still economically underdeveloped. The World Development Indicators as at 2017 show that African countries are still characterized by low per-capita income and dominate among the least developed countries of the world.

A general assessment of the continent from these indicators shows improvement over the past few decades, however, with the oil-rich countries taking the lead in high GDP per capita. Since the year 2000, most African economies have been revitalized. The continent achieved average real annual GDP growth of 5.3% between 2000 and 2008, adding $78 billion annually to GDP (in 2015 prices). This economic progress can be linked to effectual economic and financial sector reforms. Post-global financial crisis, growth slowed to 3.3% between 2010 and 2015 or $69 billion (in 2015 prices). The decline in average growth since 2010 has been concentrated in two groups of economies—oil exporting African countries and the north-African countries still recovering from the effects of the political instability caused by the Arab Spring. The rest of Africa was able to maintain stable rates of GDP as their economies were resilient enough to withstand the crisis. Despite obvious gains, as at today, African economies remain the most underdeveloped in the world.

The economic progress experienced in the past decade opened up and expanded the African markets, making the economies attractive to foreign banks to penetrate while more local banks developed. The banking sector has become more competitive for stakeholders due to the large presence of foreign banks and their many subsidiaries across each country. The major players within the banking sector are now the privately-owned and foreign banks who dominate the deposit-taking section, while the Central Banks in conjunction with the ministries of finance and the central government formulate and implement policies within the financial system. Most of their reforms and restructuring have focused on the privatization of publicly-owned banks and recapitalization of all banks; these have improved the efficiency of the banks, especially in Nigeria and South Africa.

Government funds seem to be the backbone of many banks across Africa. Most of their capital base are from government-owned establishments and majority of these banks invest more in government securities and treasury bills. Compared to the developed countries' banking system, financial intermediation function of Africa's banking sector is very poor, the percentage of credit provided to private sector is relatively low due to improper channeling of funds. The African banking system is not dynamic and innovative enough to allow efficient allocation of financial resources in Africa.

The wide development of capital markets across Africa has made the stock market an important part of their financial sector growth. Policy measures introduced have been able to motivate this development over the last four decades. For instance, the initiative of market capitalization which led to the establishment of the Abidjan regional stock exchange was replicated in other regions which have also been able to consolidate their once delicate stock exchange markets into strong regional markets. The establishments of additional stock exchange markets have increased the total number of stock exchange in Africa from 8 in the early 1990s to 29 fully operational as at 2014, with South Africa and Egypt taking the lead in terms of listing and market capitalization.

When compared to other developing and developed countries, market capitalization of African stock markets and the number of companies listed on them are still relatively small. There were also some low points in the African financial system due to damages caused by the global financial crisis of 2008 which affected the stock exchange markets. During this period, large markets such as South Africa and Egypt witnessed a decline by about 40% to 50% (Allen *et al.,* 2011). Although they were able to survive the crisis, stock markets in Africa are still considered to be less developed from the outlook of Africa's development indicators.

The competitive market structure in the African insurance sub-sector has helped it to emerge fast in recent years, but it is still far from maturity compared to the insurance industry in the developed economies. Majority of insurance firms have now been privatized but government participation is still strong in many of them. African insurance sector is mostly designed to cover life and non-life insurance.

4.2 Empirical Literature on the Finance-Growth Nexus in Africa

Empirical literature provides wide-ranging evidence that some African economies have benefited from the development of their financial systems, with most of them following the supply-leading hypothesis. For some countries, either the banking system, stock market or insurance market has solely played the central role, while other economies have benefited from the symbiotic relationship between at least two of the sub-sectors within the financial system.

4.2.1 Financial Development and Economic Growth

In a general view of the relationship between financial development and economic growth, the supply-leading hypothesis is dominant among the eight Sub-Saharan African countries examined by Agbetsiafa (2004) in country-specific time series analysis. Odhiambo (2007), in separate time series analysis for Kenya, South Africa and Tanzania, also found evidence of a supply-leading response in the case of Tanzania, while a demand-following response was found for Kenya and South Africa. Atindéhou *et al.* (2005) observed the supply-leading hypothesis in eight of ECOWAS countries while the neutrality hypothesis was validated in three. Akinlo and Egbetunde (2010) established a long run relationship between financial development and economic growth in ten Sub-Saharan Africa countries, while they validated the supply-leading, demand-following and feedback hypotheses in a Granger causality analysis of the ten countries. Ghirmay (2004) also showed that a long-run relationship exists between financial development and economic growth in twelve of the thirteen Sub-Saharan countries examined, in which eight exhibited the supply-leading hypothesis, while six displayed feedback relationship.

4.2.2 Banking and Economic Growth

The banking sector has been confirmed to play a positive role in the economic growth of Africa (Kikwebati, 2004; Mensah *et al.*, 2012). Evidence from a panel of twenty-four sub-Saharan African countries showed a feedback relationship between the real per capita GDP and the domestic credit provided by the banking sector (Acaravci *et al.,* 2009). Balcilar *et al.* (2018) also validated the feedback hypothesis between banking and economic growth. Bank development significantly explains economic growth as seen from the time series analysis by Nyasha (2015a) for Kenya, Owusu and Odhiambo (2014) for Ghana, and Nyasha and Odhiambo (2015a) for South Africa. Time series data from Nigeria have proven that bank lending, bank credit to private sector and broad money account for most of the additions to economic growth from the financial system (Ibe, 2014; Mamman and Hashim, 2014). The bank sector seems to provide important services more than the stock market in these countries.

Makinde (2016) revealed that bank credit does not influence the growth activities of the primary sector except in agriculture, but overall, bank credit makes a positive impact on the Gross Domestic products (GDP). Kagochi *et al.* (2013) and Nyasha and Odhiambo (2014) found a distinct one-way causal link from economic growth to banking in Kenya. Oluitan (2012) also demonstrated that bank credit does not stimulate real output within the Nigerian economy, but real output and foreign capital flows are responsible for the financial sector development. Nyasha and Odhiambo

(2015b) however did not find causal link between bank-based financial development and economic growth in South Africa.

4.2.3 Stock Market and Economic Growth

On the relationship between stock market development and economic growth in Africa, Enisan and Olufisayo (2009), in separate time series analysis of seven sub-Saharan African countries, established a long run relationship between stock market development and economic growth in Egypt and South Africa. There was no cointegration between the financial indicators and economic growth for Core D'Ivoire, Kenya, Morocco, Nigeria and Zimbabwe. Evidence of supply-leading hypothesis, that is, causality running from stock market development to economic growth, was ascertained for Egypt and South Africa. The same analysis showed a feedback relation for Cote D'Ivoire, Kenya, Morocco and Zimbabwe while Nigeria had a weak evidence of growth-led finance. Nyasha and Odhiambo (2015b) found a unidirectional causal flow from stock market development to economic growth in South Africa. Nyasha (2015b) and Nyasha and Odhiambo (2017), in studies based on Kenya, have also shown that stock market development has a positive impact on economic growth.

In panel analysis of African countries, Adjasi and Biekpe (2006), Ngare *et al.* (2014) and Balogun *et al.* (2016) considered fourteen countries, thirty-six countries and seven sub-Saharan African countries respectively, and found positive effects of stock markets on economic growth. In comparison with countries without stock markets, Ngare *et al.* (2014) observed faster economic growth for countries with stock markets. Kagochi *et al.* (2013) examined a panel of seven sub-Saharan Africa countries which showed a feedback relationship between stock market and economic growth. The role of stock exchange market in the finance of real sector growth has also been found to be complementary (Atindéhou *et al.,* 2005). These imply that strategic financial development which strengthens the market-based finance have significant effects that can be transferred into the real sector in the long run.

4.2.4 Insurance and Economic Growth

Long run relationship has been established between insurance and economic growth in African countries (Biekpe, 2014; Alhassan and Biekpe, 2016; Ukpong and Acha, 2017). Akinlo and Apanisile (2014) showed that insurance has positive impact on economic growth in a panel of thirty sub-Saharan African countries. Balcilar *et al.* (2018) validated the feedback hypothesis in panel causality analysis of 11 Sub-Saharan African countries. Biekpe (2014) and Alhassan and Biekpe (2016) also confirmed the supply-leading hypothesis for most of the countries examined in separate time series analyses, while the rest of the countries validated the feedback hypothesis. Ukpong and Acha (2017) also showed a feedback relationship between GDP and total non-life insurance premiums in Nigeria. Validating the demand-following hypothesis, a unidirectional relationship was found to run from GDP to total life insurance premiums but there was no causal relationship found between GDP and total insurance investments. Insurance has been seen to have negative effects on economic growth. Olayungbo and Akinlo (2016) confirmed this for Algeria, Nigeria, Tunisia, and Zimbabwe but the negative effects were limited to the short run in the case of Kenya, Mauritius, and South Africa. The case of Egypt in their analysis is an exception because the supply-leading hypothesis was confirmed for Egypt. These evidences show that the development of the insurance market in Africa might be able to influence economic growth in the long-run.

4.3 Gap, Hypotheses, Data and Methodology

4.3.1 Identified Gap in Literature

The extensive review of literature on the causal relationships between financial sector and economic growth in Africa provided in the previous section clearly shows that this causal relationship has been studied extensively by imposing linearity restrictions. Testing the relationship within an asymmetric framework is where a gap still lies in the finance-growth literature.

4.3.2 Hypotheses

We propose a conceptual framework for evaluating the asymmetric causal relations between African financial systems and their economic performance. These relationships are tested through the null (H_0) hypotheses and alternative (H_1) hypotheses given thus:

H_0^A: There is no signigicant positive and (or) negative relationship between financial sytems and economic performance in Africa.

H_1^A: There is signigicant positive and (or) negative relationship between financial sytems and economic performance in Africa.

4.3.3 Data

To test the stated hypotheses, we employ annual data covering the period from 1993 to 2016 for nine selected African countries (Ghana, Kenya, Mauritius, Morocco, Namibia, Nigeria, South Africa, Tunisia and Zambia). The choice of countries and the start-end points included in the sample was determined solely by the availability of data. The financial system indicators are; banking sector credit (BC) which serves as the banking system indicator, turnover ratio of stocks traded (TOR) which serves as the stock market indicator, and total insurance density (TID) which is the insurance market indicator. Gross domestic product (GDP) serves as the measure of economic performance. All four variables are used in their natural logarithms. Data on BC and TOR were obtained from the global financial development variables provided by the World Bank. The database can be accessed at http://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database. TID data was acquired from Swiss Re's Sigma database (www.sigma-explorer.com/). GDP data was sourced from the 'World Development Indicators' (http://data.worldbank.org).

4.3.4 Methodology

There are several tests available to test for Granger (1969) causality within a panel system. Two most commonly used of such tests are the panel vector error correction model estimated via GMM estimators and Hurlin (2008) causality approach. The former takes neither cross-sectional dependence nor country-specific heterogeneity into consideration. It is thus susceptible to invalid estimation outcomes when the slope coefficients are heterogeneous. The latter on the other hand controls for heterogeneity but fails to deal with cross-sectional dependency. Panel bootstrap causality tests that adequately deal with this twin issues such as Kónya (2006) and Emirmahmutoglu and Kose (2011) are also widely used. These bootstrap causality tests however do not consider asymmetric dynamics. The approach recently introduced panel causality approach by Hatemi-J (2011) and Hatemi-J *et al.* (2016) is however not only robust to cross-sectional dependency and slope heterogeneity, it also reveals asymmetric dynamics in the underlying variables.

Following Hatemi-J (2011), two variables integrated of the first degree in a panel system can be specified as follows:

$$X_{i1,t} = X_{i1,t-1} + e_{i1,t} = X_{i1,0} + \sum_{j=1}^{t} e_{i1,j} \quad (1)$$

$$X_{i2,t} = X_{i2,t-1} + e_{i2,t} = X_{i2,0} + \sum_{j=1}^{t} e_{i2,j} \quad (2)$$

For i =1,…,9 where 9 represents the number of cross-sections (9 African countries), e_t is the error term. The positive and negative shocks are given as $e_{i1,t}^{+} = max(e_{i1,t}, 0)$, $e_{i2,t}^{+} = max(e_{i2,t}, 0)$, $e_{i1,t}^{-} = min(e_{i1,t}, 0)$, $e_{i2,t}^{-} = min(e_{i2,t}, 0)$

The cumulative partial sums of changes are constructed from these values as follows:

$$X_{i1,t}^{+} = X_{i1,0}^{+} + e_{i1,t}^{+} = X_{i1,0} + \sum_{j=1}^{t} e_{i1,j}^{+} \quad (3)$$

$$X_{i2,t}^{+} = X_{i2,0}^{+} + e_{i2,t}^{+} = X_{i2,0} + \sum_{j=1}^{t} e_{i2,j}^{+} \quad (4)$$

$$X_{i1,t}^{-} = X_{i1,0}^{-} + e_{i1,t}^{-} = X_{i1,0} + \sum_{j=1}^{t} e_{i1,j}^{-} \quad (5)$$

$$X_{i2,t}^{-} = X_{i2,0}^{-} + e_{i2,t}^{-} = X_{i2,0} + \sum_{j=1}^{t} e_{i2,j}^{-} \quad (6)$$

Next, the following vector autoregressive seemingly unrelated regression model of order p, VAR-SUR (P) is estimated to test causality. Causality between the positive components is tested as follows:

$$\begin{bmatrix} X_{i1,t}^{+} \\ X_{i2,t}^{+} \end{bmatrix} = \begin{bmatrix} \beta_{i0} \\ \gamma_{i0} \end{bmatrix} + \begin{bmatrix} \sum_{r=1}^{k} \beta_{i1,r} & \sum_{r=1}^{k} \beta_{i2,r} \\ \sum_{r=1}^{k} \gamma_{i1,r} & \sum_{r=1}^{k} \gamma_{i2,r} \end{bmatrix} x \begin{bmatrix} X_{i1,t-r}^{+} \\ X_{i2,t-r}^{+} \end{bmatrix} + \begin{bmatrix} e_{i1}^{+} \\ e_{i2}^{+} \end{bmatrix} \quad (7)$$

And causality between the negative components is similarly tested:

$$\begin{bmatrix} X_{i1,t}^{-} \\ X_{i2,t}^{-} \end{bmatrix} = \begin{bmatrix} \beta_{i0} \\ \gamma_{i0} \end{bmatrix} + \begin{bmatrix} \sum_{r=1}^{k} \beta_{i1,r} & \sum_{r=1}^{k} \beta_{i2,r} \\ \sum_{r=1}^{k} \gamma_{i1,r} & \sum_{r=1}^{k} \gamma_{i2,r} \end{bmatrix} x \begin{bmatrix} X_{i1,t-r}^{-} \\ X_{i2,t-r}^{-} \end{bmatrix} + \begin{bmatrix} e_{i1}^{-} \\ e_{i2}^{-} \end{bmatrix} \quad (8)$$

The lag order (p) is determined by minimizing a panel version of an information criterion. The null hypotheses that $X_{i2,t}^{+}$ $(X_{i2,t}^{-})$ do not Granger cause $X_{i1,t}^{+}(X_{i1,t}^{-})$ for cross-section i is given as $H_0 = \beta_{i2,r} = 0, \forall r,$ where r = 1,…,p. these null hypotheses are tested through country specific Wald tests with country specific bootstrap critical values. It is thus not necessary for the underlying variables to be stationary if used in their first differences. Cointegration is also not required between the variables if they are used in levels.

4.4 Empirical Results

The possibility of interdependence amongst countries in a panel system emanating from financial and economic integration is an important concern in panel estimations. The likelihood of such interactions is even more pronounced in countries within a particular region with relatively similar characteristics. Shocks arising from one country can be transmitted to other countries and not controlling for the effect of this issue can result in misleading inference. Cross-sectional dependency plays a vital role in the detection of causal relationships. We thus start by testing for cross-sectional dependency and country-specific heterogeneity. We test for the former using the following tests; Breusch-Pagan (1980) LM test, Pesaran (2004) Scaled LM test, Pesaran (2004) CD test and Pesaran *et al.* (2008) Bias-adjusted LM test. For the latter, we use the Pesaran and Yamagata (2008) standardized version of the Swamy (1970) homogeneity test (delta tests).

Test results are provided in table 15. As indicated in the table, the null hypotheses of no cross-sectional dependence and slope homogeneity are overwhelmingly rejected. These results suggest that shocks to one of the African countries included in the panel can be transmitted to one or more of the other countries within the panel. Also, the heterogeneous nature of the slopes means that the application of a panel framework that imposes homogeneity restrictions will produce unreliable parameter estimates.

Table 15: Cross-sectional dependence and homogeneity test results

CD Tests	**Test Stat. and Prob.**			
	BC	**TOR**	**TID**	**GDP**
LM (Breusch,Pagan 1980)	53.810**	69.577***	55.755**	165.905***
	(0.028)	(0.001)	(0.019)	(0.000)
CDlm (Pesaran 2004)	2.099**	3.957***	2.328***	15.309***
	(0.018)	(0.000)	(0.010)	(0.000)
CD (Pesaran 2004)	-2.555***	-0.065*	-1.116**	3.763***
	(0.005)	(0.082)	(0.013)	(0.000)
LMadj (PUY, 2008)	2.591***	-2.688	3.054***	0.039
	(0.005)	(0.996)	(0.001)	(0.485)
Slope homogeneity tests				
$\hat{\Delta}$	-0.045	6.192***	0.014	1.750**
	(0.518)	(0.000)	(0.495)	(0.040)
$\hat{\Delta}_{adj}$	-0.048	6.620***	0.015	1.871**
	(0.519)	(0.000)	(0.494)	(0.031)

*Notes: (1) The numbers in the brackets are the p-values. (2) ***, **, and * indicate rejection of the null of symmetry at the 1%, 5%, and 10% levels, respectively.*

According to Hatemi-J *et al.* (2016), obtaining both negative and positive decompositions of the data series requires testing for unit roots. Because of the presence of cross-sectional dependency in the data series, conventional first generation panel unit root tests become unsuitable. We thus carry out the cross-sectionally augmented IPS (Im *et al.*, 2003) panel unit root tests of Pesaran (2007). The unit root test results are presented in table 16. The results show non-stationarity in level and stationarity in first difference for all variables.

Table 16: Results from CIPS unit root tests with intercept and trend

	LEVEL	Δ
BC	-2.557	-2.971***
TOR	-1.849	-2.874***
TID	-2.025	-2.494**
GDP	-1.420	-5.589***

*Notes: (1) The numbers in the brackets are the p-values. (2) ***, **, and * indicate rejection of the null of symmetry at the 1%, 5%, and 10% levels, respectively.*

Finally, the asymmetric causal effects are reported in tables 17-22 and a summary of the findings is reported in table 23. Concerning the causal relations between the banking sector and GDP, negative feedback causal effects were detected in Mauritius, Morocco and Zambia, confirming negative feedback hypothesis. In Kenya, Nigeria and South Africa, negative one-way causality was detected from GDP to the banking sector, confirming negative demand-following hypothesis. Positive feedback causal effects were found in Ghana, Namibia, Morocco and Zambia confirming positive feedback hypothesis. In both Nigeria and South Africa, positive one-way causality running from the banking sector to GDP was found, confirming positive supply leading hypothesis. Only in Tunisia was the positive demand-following hypothesis confirmed and one-way causality from GDP to the banking sector recorded.

With regards to the causal relations between Turnover ratio and GDP: negative bidirectional causal relations was found in Ghana, Mauritius and Nigeria, confirming negative feedback hypothesis. Negative supply-leading hypothesis was however confirmed in Morocco, South Africa, Tunisia and Zambia. Positive bidirectional causality (positive feedback hypothesis) was detected in Morocco, Namibia, Nigeria and Tunisia. One-way causality from Turnover ratio to GDP (supply-leading hypothesis) was detected in South Africa and Zambia. Positive one-way causality from GDP to turnover ratio (positive demand-following hypothesis) was confirmed in Ghana and Mauritius.

With respect to the causal relations between total insurance density and GDP; on one hand, negative supply-leading hypothesis was confirmed in Ghana, Kenya, Mauritius, Tunisia and Zambia. Also, negative demand-following hypothesis was confirmed in Namibia and South Africa. On the other hand, positive feedback hypothesis was detected in Kenya, Morocco, Mauritius and Zambia and positive supply-leading hypothesis was confirmed in Ghana, Namibia, Nigeria, South Africa, Tunisia and Zambia.

Table 17: Asymmetric panel causality results

Country	**Null hypothesis**	**Test value**	**P-values**
Ghana	$[BC^- \not\Rightarrow GDP^-]$	1.392	0.238
	$[BC^+ \not\Rightarrow GDP^+]$	14.457	0.000
Kenya	$[BC^- \not\Rightarrow GDP^-]$	1.597	0.206
	$[BC^+ \not\Rightarrow GDP^+]$	2.199	0.138
Mauritius	$[BC^- \not\Rightarrow GDP^-]$	30.872	0.000
	$[BC^+ \not\Rightarrow GDP^+]$	0.018	0.894
Morocco	$[BC^- \not\Rightarrow GDP^-]$	3.050	0.081
	$[BC^+ \not\Rightarrow GDP^+]$	4.609	0.032
Namibia	$[BC^- \not\Rightarrow GDP^-]$	0.028	0.868
	$[BC^+ \not\Rightarrow GDP^+]$	10.348	0.001
Nigeria	$[BC^- \not\Rightarrow GDP^-]$	0.356	0.551
	$[BC^+ \not\Rightarrow GDP^+]$	20.808	0.000
South Africa	$[BC^- \not\Rightarrow GDP^-]$	0.006	0.940
	$[BC^+ \not\Rightarrow GDP^+]$	20.533	0.000

Tunisia	$[BC^{-} \not\Rightarrow GDP^{-}]$	1.731	0.188
	$[BC^{+} \not\Rightarrow GDP^{+}]$	0.793	0.373
Zambia	$[BC^{-} \not\Rightarrow GDP^{-}]$	21.572	0.000
	$[BC^{+} \not\Rightarrow GDP^{+}]$	4.062	0.044

Table 18: Asymmetric panel causality results

Country	**Null hypothesis**	**Test value**	**P-values**
Ghana	$[GDP^{-} \not\Rightarrow BC^{-}]$	1.567	0.211
	$[GDP^{+} \not\Rightarrow BC^{+}]$	3.113	0.078
Kenya	$[GDP^{-} \not\Rightarrow BC^{-}]$	2.738	0.098
	$[GDP^{+} \not\Rightarrow BC^{+}]$	30.566	0.000
Mauritius	$[GDP^{-} \not\Rightarrow BC^{-}]$	3.584	0.058
	$[GDP^{+} \not\Rightarrow BC^{+}]$	7.060	0.008
Morocco	$[GDP^{-} \not\Rightarrow BC^{-}]$	8.553	0.003
	$[GDP^{+} \not\Rightarrow BC^{+}]$	14.535	0.000
Namibia	$[GDP^{-} \not\Rightarrow BC^{-}]$	0.081	0.776
	$[GDP^{+} \not\Rightarrow BC^{+}]$	2.818	0.093
Nigeria	$[GDP^{-} \not\Rightarrow BC^{-}]$	7.319	0.007
	$[GDP^{+} \not\Rightarrow BC^{+}]$	0.228	0.633
South Africa	$[GDP^{-} \not\Rightarrow BC^{-}]$	3.899	0.048
	$[GDP^{+} \not\Rightarrow BC^{+}]$	0.064	0.801
Tunisia	$[GDP^{-} \not\Rightarrow BC^{-}]$	0.062	0.804
	$[GDP^{+} \not\Rightarrow BC^{+}]$	5.754	0.016
Zambia	$[GDP^{-} \not\Rightarrow BC^{-}]$	24.314	0.000
	$[GDP^{+} \not\Rightarrow BC^{+}]$	9.861	0.002

Table 19: Asymmetric panel causality results

Country	Null hypothesis	Test value	P-values
Ghana	$[TOR^{-} \neq> GDP^{-}]$	7.769	0.005
	$[TOR^{+} \neq> GDP^{+}]$	0.239	0.625
Kenya	$[TOR^{-} \neq> GDP^{-}]$	0.021	0.886
	$[TOR^{+} \neq> GDP^{+}]$	22.081	0.000
Mauritius	$[TOR^{-} \neq> GDP^{-}]$	16.531	0.000
	$[TOR^{+} \neq> GDP^{+}]$	0.502	0.478
Morocco	$[TOR^{-} \neq> GDP^{-}]$	4.545	0.033
	$[TOR^{+} \neq> GDP^{+}]$	20.905	0.000
Namibia	$[TOR^{-} \neq> GDP^{-}]$	0.652	0.419
	$[TOR^{+} \neq> GDP^{+}]$	12.736	0.000
Nigeria	$[TOR^{-} \neq> GDP^{-}]$	192.108	0.000
	$[TOR^{+} \neq> GDP^{+}]$	7.535	0.006
South Africa	$[TOR^{-} \neq> GDP^{-}]$	26.783	0.000
	$[TOR^{+} \neq> GDP^{+}]$	9.857	0.002
Tunisia	$[TOR^{-} \neq> GDP^{-}]$	17.417	0.000
	$[TOR^{+} \neq> GDP^{+}]$	31.910	0.000
Zambia	$[TOR^{-} \neq> GDP^{-}]$	7.215	0.007
	$[TOR^{+} \neq> GDP^{+}]$	23.564	0.000

Table 20: Asymmetric panel causality results

Country	Null hypothesis	Test value	P-values
Ghana	$[GDP^{-} \neq> TOR^{-}]_{a}$	4.250	0.039
	$[GDP^{+} \neq> TOR^{+}]_{a}$	10.270	0.001
Kenya	$[GDP^{-} \neq> TOR^{-}]_{a}$	0.607	0.436
	$[GDP^{+} \neq> TOR^{+}]_{a}$	1.101	0.294
Mauritius	$[GDP^{-} \neq> TOR^{-}]_{a}$	21.336	0.000
	$[GDP^{+} \neq> TOR^{+}]_{a}$	84.585	0.000
Morocco	$[GDP^{-} \neq> TOR^{-}]_{a}$	0.152	0.697
	$[GDP^{+} \neq> TOR^{+}]_{a}$	6.828	0.009

Namibia	$[GDP^{-} \nRightarrow TOR^{-}]_a$	0.272	0.602
	$[GDP^{+} \nRightarrow TOR^{+}]_a$	3.427	0.064
Nigeria	$[GDP^{-} \nRightarrow TOR^{-}]_a$	14.587	0.000
	$[GDP^{+} \nRightarrow TOR^{+}]_a$	5.061	0.024
South Africa	$[GDP^{-} \nRightarrow TOR^{-}]_a$	0.454	0.501
	$[GDP^{+} \nRightarrow TOR^{+}]_a$	0.654	0.419
Tunisia	$[GDP^{-} \nRightarrow TOR^{-}]_a$	1.075	0.300
	$[GDP^{+} \nRightarrow TOR^{+}]_a$	5.157	0.023
Zambia	$[GDP^{-} \nRightarrow TOR^{-}]_a$	0.000	0.983
	$[GDP^{+} \nRightarrow TOR^{+}]_a$	0.029	0.865

Table 21: Asymmetric panel causality results

Country	**Null hypothesis**	**Test value**	**P-values**
Ghana	$[TID^{-} \nRightarrow GDP^{-}]$	5.863	0.015
	$[TID^{+} \nRightarrow GDP^{+}]$	15.556	0.000
Kenya	$[TID^{-} \nRightarrow GDP^{-}]$	4.854	0.028
	$[TID^{+} \nRightarrow GDP^{+}]$	4.535	0.033
Mauritius	$[TID^{-} \nRightarrow GDP^{-}]$	5.749	0.016
	$[TID^{+} \nRightarrow GDP^{+}]$	24.951	0.000
Morocco	$[TID^{-} \nRightarrow GDP^{-}]$	1.087	0.297
	$[TID^{+} \nRightarrow GDP^{+}]$	11.741	0.001
Namibia	$[TID^{-} \nRightarrow GDP^{-}]$	0.173	0.677
	$[TID^{+} \nRightarrow GDP^{+}]$	17.233	0.000
Nigeria	$[TID^{-} \nRightarrow GDP^{-}]$	2.678	0.102
	$[TID^{+} \nRightarrow GDP^{+}]$	9.620	0.002
South Africa	$[TID^{-} \nRightarrow GDP^{-}]$	0.087	0.768
	$[TID^{+} \nRightarrow GDP^{+}]$	16.566	0.000
Tunisia	$[TID^{-} \nRightarrow GDP^{-}]$	11.785	0.001
	$[TID^{+} \nRightarrow GDP^{+}]$	5.322	0.021

Zambia	[$TID^- \not\Rightarrow GDP^-$]	11.626	0.001
	[$TID^+ \not\Rightarrow GDP^+$]	15.409	0.000

Table 22: Asymmetric panel causality results

Country	**Null hypothesis**	**Test value**	**P-values**
Ghana	[$GDP^- \not\Rightarrow TID^-$]	0.320	0.572
	[$GDP^+ \not\Rightarrow TID^+$]	0.061	0.804
Kenya	[$GDP^- \not\Rightarrow TID^-$]	0.026	0.872
	[$GDP^+ \not\Rightarrow TID^+$]	11.511	0.001
Mauritius	[$GDP^- \not\Rightarrow TID^-$]	1.067	0.302
	[$GDP^+ \not\Rightarrow TID^+$]	4.094	0.043
Morocco	[$GDP^- \not\Rightarrow TID^-$]	1.950	0.163
	[$GDP^+ \not\Rightarrow TID^+$]	9.684	0.002
Namibia	[$GDP^- \not\Rightarrow TID^-$]	7.306	0.007
	[$GDP^+ \not\Rightarrow TID^+$]	0.094	0.760
Nigeria	[$GDP^- \not\Rightarrow TID^-$]	2.299	0.129
	[$GDP^+ \not\Rightarrow TID^+$]	0.062	0.804
South Africa	[$GDP^- \not\Rightarrow TID^-$]	5.187	0.023
	[$GDP^+ \not\Rightarrow TID^+$]	1.390	0.238
Tunisia	[$GDP^- \not\Rightarrow TID^-$]	1.181	0.277
	[$GDP^+ \not\Rightarrow TID^+$]	2.020	0.155
Zambia	[$GDP^- \not\Rightarrow TID^-$]	1.731	0.188
	[$GDP^+ \not\Rightarrow TID^+$]	3.350	0.067

Table 23: Asymmetric causality summary

Null hypothesis	$p < 0.1$	$p < 0.05$	$p < 0.01$
$BC^{-} \not\Rightarrow GDP^{-}$	Mauritius, Zambia		Morocco
$GDP^{-} \not\Rightarrow BC^{-}$	Morocco,Nigeria, Zambia	South Africa	Kenya, Mauritius
$BC^{+} \not\Rightarrow GDP^{+}$	Ghana, Namibia, Nigeria, South Africa	Morocco, Zambia	
$GDP^{+} \not\Rightarrow BC^{+}$	Kenya, Mauritius, Morocco, Zambia	Tunisia	Ghana, Namibia
$TOR^{-} \not\Rightarrow GDP^{-}$	Ghana, Mauritius, Nigeria, South Africa, Tunisia, Zambia	Morocco	
$GDP^{-} \not\Rightarrow TOR^{-}$	Mauritius, Nigeria	Ghana	
$TOR^{+} \not\Rightarrow GDP^{+}$	Kenya, Morocco, Namibia, Nigeria, South Africa, Tunisia, Zambia		
$GDP^{+} \not\Rightarrow TOR^{+}$	Ghana, Mauritius, Morocco	Nigeria, Tunisia	Namibia
$TID^{-} \not\Rightarrow GDP^{-}$	Tunisia, Zambia	Ghana,Kenya, Mauritius	
$GDP^{-} \not\Rightarrow TID^{-}$	Namibia	South Africa	
$TID^{+} \not\Rightarrow GDP^{+}$	Ghana, Mauritius, Morocco, Namibia, Nigeria, South Africa, Zambia	Kenya, Tunisia	
$GDP^{+} \not\Rightarrow TID^{+}$	Kenya, Morocco	Mauritius	Zambia

4.5 Conclusion

This study examined asymmetric causal relationships between financial systems and economic performance in selected African countries over a 24-year period. The empirical findings and policy implications are summarized as follows:

The pattern of causality varies asymmetrically across the selected countries and the following hypotheses were confirmed; negative and positive demand-following hypotheses, negative and positive supply-following hypotheses, and negative and positive feedback hypotheses. The findings have the following implications.

First, negative shocks to the financial system either through the banking system, stock market or insurance market will negatively impact the economy in countries where negative supply-leading hypothesis is confirmed. Positive shocks to the financial system will have no significant impact on the economy. Policy making should therefore focus on guarding against negative shocks as its effects will be damaging to the economy.

Second, in countries where positive supply-leading hypothesis is confirmed, positive shocks to the financial system will cause improvements in the economy. Negative shocks will however have little or no effect on the economy. In this case, it becomes easier to use the financial development as a tool for economic improvement. This can be done by focusing on policies that improve the financial system.

Third, where negative demand-following hypothesis is confirmed, negative shocks to the economy will negatively impact the financial system. Impact of positive shocks to the economy on the financial system will however be insignificant. This implies that economic crisis can easily disrupt the proper functioning of the financial system. Thus, policies that promote strong capitalization will make the financial institutions strong enough to withstand possible crisis that may arise from business cycles.

Fourth, in countries where positive demand-following hypothesis holds true, positive shocks to the economy will cause improvements in the financial system but negative shocks to the economy will not be felt in the financial system. Policies targeting real sector development should be prioritized in such cases, as this will create more demand for financial services.

Fifth, a vicious cycle exists in countries where negative feedback hypothesis is confirmed. In such countries, negative shocks to the financial system will negatively affect the economy. The economic downturn will in turn further aggravate the shock to the financial system.

Lastly, a virtuous cycle will be experienced in countries where positive feedback hypothesis holds. Positive shocks to the financial system will lead to improvements in the economy and the improved economy will further stimulate growth in the financial system.

We argue that it is important to consider asymmetric dynamics when testing causality in finance-growth relationship. It is possible that the economy (financial system) would react differently to changes in financial system (economy) depending on whether it is a positive or negative change. Our recommendation is that in the case of supply-leading, policy target should be financial development so as to either stimulate economic growth or prevent economic decline, whereas in the case of demand-following, emphasis should be placed on growth-enhancing policies in order to either achieve financial development or prevent crisis in the financial system.

Chapter 5

ECONOMIC POLICY UNCERTAINTY AND INSURANCE

5.1 Introduction

The study of economic uncertainty and its resultant effect on economic activities has been on for decades. As far back as almost 100 years ago, in 1921, Frank Knight's 'Risk, Uncertainty and Profit' was already a leading scholarly work in the study of economic uncertainty. Knight (1921) tried to put the concept of uncertainty in proper perspective by defining it as an unknown risk without a known distribution of expected probabilities. Subsequently, many researchers such as Lucas and Prescott (1971), Bernanke (1983), Caballero (1991), Dixit and Pindyck (1994), Caporale and McKiernan (1998), Mason-Jones and Towill (2000), Fountas and Karanasos (2006), Bloom (2009), and Bai et al. (2011) also tried to answer the question of how uncertainty matters for various aspects of an economy.

Research and policy interests in the source, spread and persistence of uncertainty led to the need for a reliable and consistent means of measuring it. Facing this same challenge, Baker et al. (2013), while attempting to study the effect of uncertainty of economic activities, constructed a new index of economic policy uncertainty. The index is built on three underlying components—the frequency of newspaper reports on policy-related economic uncertainty, number of federal tax code provisions set to expire and disagreement among economic forecasters. The VAR estimates obtained by Baker et al. (2013) using this new index showed that rise in economic policy uncertainty post-recession had significant negative impacts on investment, hiring decisions and consumption spending. The overall significance of the study by Baker et al. (2013) however far outweighs the original findings as many researchers trying to examine the relationship between policy uncertainty and other economic variables have similarly adopted their index.

Policy-related uncertainties are a major component of overall economic uncertainties within a given society (Istrefi and Piloiu, 2014). While researchers are increasingly adopting the economic policy uncertainty index in studies on policy-related uncertainties, most of such studies, past and present, are focused on the macroeconomic effects of policy uncertainties. Most of the attention has been on the identification of impacts of economic policy uncertainty on macroeconomic variables such as growth, investment, consumption, unemployment, inflation, etc. Kang and Ratti (2013), Istrefi and Piloiu (2014), Karnizova and Li (2014), Balcilar et al. (2015), Brogaard and Detzel (2015), Leippold and Matthys (2015), Balcilar et al. (2016), and Kido (2016) are a few of such studies, amongst many others, on the effect of economic policy uncertainty on macroeconomic aggregates.

A substantial portion of uncertainty studies has also considered the relationship between uncertainty and different aspects of the financial system. The complex relationship between economic policy uncertainties and the financial system was further exposed by the global financial crisis of 2007-2009. Fiscal, monetary and regulatory policy uncertainties in Europe and the United States were identified as part of the reasons for the crisis and the slow recovery from it (Baker et al., 2016). Studies on the relationship between uncertainty and the financial sector are however mainly focused on the impacts of uncertainty on the banking system and its lending decisions (e.g. Quagliariello, 2009; Baum et al., 2013; Bordo et al., 2016), and the stock markets (e.g. Antonakakis et al., 2013; Arouri et al., 2014; Liu and Zhang, 2015; Antonakakis and Floros, 2016; Christou and Gupta, 2016). A recent study of Demir et al. (2018) has also studied the effects of uncertainty on bitcoin returns, while Bilgin et al. (2018) has examined how uncertainty affects the commodity price of gold. Only Gupta et al. (2016) has considered the effect of economic policy uncertainty on the insurance sector.

Studies examining the influence of policy-related uncertainties on insurance markets in any financial system are almost non-existent. However, the global insurance market, which has grown rapidly at an average of 10% per annum since 1950, with a global insurance premium value close to 5 Trillion USD as at 2016, is arguably the second most important financial institution—after the banks—in the financial system. A crisis in such a huge sector is capable of causing serious loss to stakeholders and serious damage to an economy; there is thus a greater likelihood that insurers will be tempted to act in a risk-averse manner.

Vast majority of insurers factor policy uncertainties into their premium determination as a means of mitigating risk. Premiums collected by insurers are used to fund investments in guaranteed or low-risk securities, and profits are made from interests and returns on these investments. The possibility that actual returns on these investments may differ from expected returns increases as economic policy uncertainty increases. The possibility of such differences means that insurers stand the chance of losing substantial portions of their investment. To keep profit level constant in case of unanticipated, unfavorable economic policy changes, higher premiums will be charged. In addition, for assuming higher risks on behalf of policyholders because of increased uncertainty, insurers are likely to charge some risk premium. As an example, the policy uncertainty surrounding the repeal and replacement of the affordable care act (ObamaCare) in the United States has caused many insurers to raise premiums while some others have threatened complete withdrawal from the market. There is thus a strong indication that insurance premiums are strongly influenced by economic policy uncertainties.

Another reason why economic policy uncertainty may affect the insurance market activities is that the insurance sector provides protection for households and businesses against different types of risks. It is reasonable therefore to assume that as uncertainty increases, the demand for insurance products will increase in response.

Empirically, a connection has been established between economic risks and the insurance sector. Lee et al. (2013) show that reduction in economic risks lowers insurance demand elasticity. Since policy uncertainties are a class of economic risks and economic risks influence insurance demand, it is highly likely that economic policy uncertainties may also influence insurance premiums. Also, Gupta et al. (2016) posit that since economic policy uncertainties exert some pressure on economic activities, it is logical to assume that it will also have some influence on insurance purchasing behavior.

On the other hand, the resilience shown by the insurance industry during the global financial crisis should make one curious. Even though growth rate of insurance premium is still below pre-crisis levels, the effect of the crisis on insurance premiums was relatively limited. One is thus tempted to assume that the insurance sector is well capable of absorbing shocks and may therefore be relatively immune to the adverse effects of uncertainty. This study aims to bridge the gap identified by providing a clear and robust perspective on the relatively un-researched impact of economic policy uncertainty on insurance premium in a panel data of 15 countries for the period 1998-2016.

This study contributes to extant literature in the following ways:

First, the study employs superior second generation panel model techniques rather than the commonly used first generation panel model techniques in examining the interaction between economic policy uncertainty and insurance premiums.

Second, the study confirms that the insurance sector is not immune to the effects of economic policy uncertainty as economic policy uncertainty exerts a significant influence on insurance premium (total, life and non-life). Economic policy uncertainty raises insurance premiums in both the short and long run although its long run impact is greater than the short run impact.

Third, the study indicates that economic policy uncertainty exerts a bigger influence on non-life insurance premium than on life insurance premium, suggesting that economic risks that non-life insurance covers are more sensitive to uncertainty than mortality and longevity risks that life-insurance cover.

Fourth, our findings confirm that national income per-capita, education, population, financial development and institutional quality all raise insurance premiums to increase while inflation lowers insurance premiums.

The rest of this study is organized as follows: Section 2 gives a description of the econometric model and data used in our analysis, Section 3 outlines the empirical methods used, results obtained and their interpretation, and in Section 4, main conclusions are presented.

5.2 Data

Our sample is made up of 15 countries for the period 1998-2016. The selected countries are Australia, Brazil, Canada, Chile, China, France, Germany, Ireland, Italy, Japan, Korea, Russia, Sweden, UK and USA. The choice of countries and period was made solely based on data availability. Although data on economic policy uncertainty is available for 20 countries, only the countries with relatively long historical data on economic policy uncertainty were chosen.

The variables of particular interest in our estimations are insurance premiums (life, non-life and total) and economic policy uncertainty. Insurance premiums (total, life and non-life) are the dependent variables. Insurance premium refers to the payments made by individuals or businesses for insurance policies and it represents the income received by insurers. Data on insurance premiums was sourced from 'Swiss Re, Sigma database'.

Economic policy uncertainty (EPU) is the regressor of interest. The economic policy uncertainty index used in our study follows the Baker et al. (2016) historical measure of uncertainty. This index uses only the frequency of newspaper reports component, the other two components included in Baker et al. (2013) index are dropped in order to extend the economic policy uncertainty measure across time and countries. The index is constructed from monthly newspaper searches for economic and policy uncertainty related issues. The index can be downloaded at https://www.policyuncertainty.com/us_monthly.html. 12-month averages were taken to convert the economic policy uncertainty monthly index into annual values.

A priori expectation is that a positive relationship exists between economic policy uncertainty and insurance premiums. As uncertainty increases, the demand for insurance products is expected to increase in response. Furthermore, insurers have the tendency to act in a risk-averse manner and raise premiums in order to compensate for uncertainties. These points suggest that the insurance sector is strongly impacted by uncertainties. On the other hand, the insurance sector has shown strong capacity for absorbing shocks, an indication that uncertainties may have little or no significant impact on it. The effect of economic policy uncertainty on insurance premiums is therefore indeterminate.

The plots of economic policy uncertainty index for each of the countries included in our sample are presented in figure 5, and figure 6 shows the trends of economic policy uncertainty and insurance premiums (total, life and non-life). Spikes witnessed in the indexes often seem to correspond with periods of major global events like the gulf wars, the 9/11 terrorist attacks, periods of political tensions, financial crises etcetera.

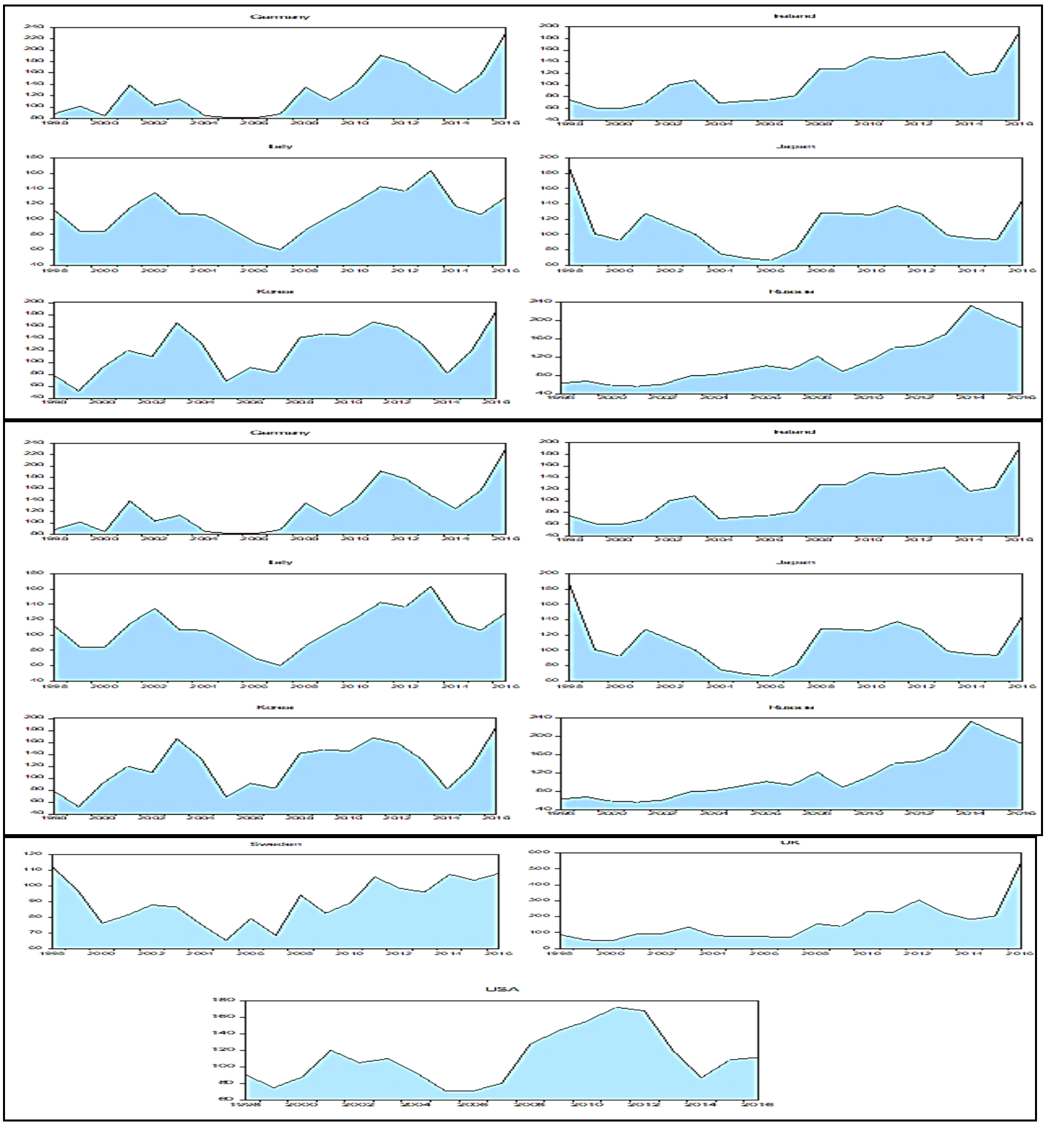

Figure 5: Time series plots of economic policy uncertainty index

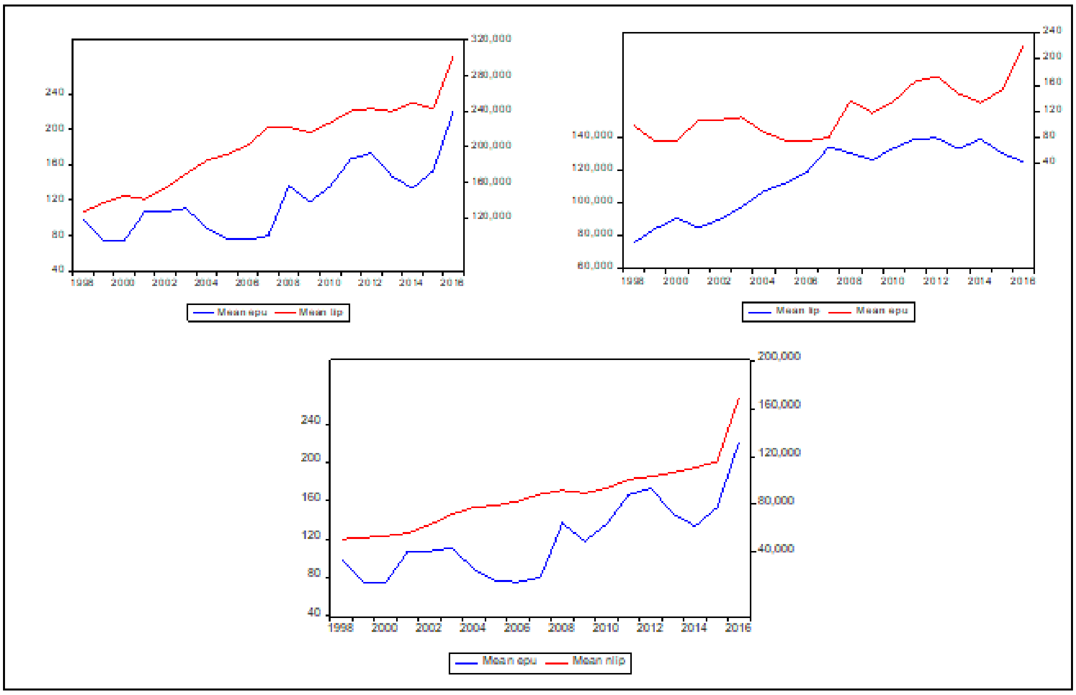

Figure 6: Trend of mean economic policy uncertainty index (EPU) and mean of non-life, life and total insurance premiums (NLIP, LIP and TIP) for selected countries.

Several control variables are also included in the empirical models. Two factors are considered in deciding on the choice of control variables. First, insurance premiums may increase or decrease either due to a change in insurance demand or due to insurers raising premiums (price x quantity). We therefore select control variables that either affect insurance demand or affect prices of insurance policies. Second, to be able to compare the impact of economic policy uncertainty on life and non-life insurance premiums separately, we choose control variables that are generally regarded as determinants of both life and non-life insurance. The variables included for control are explained below.

Net national income per-capita (NNIPC): higher income is expected to be positively correlated with insurance since it makes insurance products more affordable. In addition, as demand for insurance demand increases, insurers will be tempted to raise premiums in response. Feyen et al. (2011) and Dragos (2014) confirmed this relationship for life insurance, while Browne et al. (2000) and Esho et al. (2004) confirmed it for non-life insurance. According to Browne and Kim (1993), national income is preferable as a measure of income to GDP and GNP since it more accurately measures disposable income. We therefore measure income per-capita by dividing net national income (GNP minus indirect business taxes and depreciation) with population. Data on net national income and population was obtained from the World Development Indicator (http://data.worldbank.org).

Inflation rate (INF): Inflation is an indirect channel through which we may also estimate the impact of uncertainty on economic growth. Inflation is an important measure of macroeconomic instability. Macroeconomic instability causes uncertainty which leads to decrease in productivity, private investment and economic growth (Fischer, 1993; Ismihan et al., 2017). Inflation is expected to be negatively correlated with demand for insurance as it erodes the value of insurance products. As a response, insurers often adjust their policies by some price index overtime (Browne and Kim, 1993). Inflation data was taken from the World Development Indicator (http://data.worldbank.org).

Education (EDUC): we include education as a measure of financial literacy. Existing studies suggest that education increases demand for insurance for the following reasons; first, it lengthens the duration of dependency. Second, it leads to risk aversion. Third, it broadens the understanding of the population about the advantages of buying insurance. This conclusion was confirmed empirically by Truett and Truett (1990) and Browne and Kim (1993) for non-life insurance, and by Treerattanapun

(2011) and Curak et al. (2013) for life insurance. Data on education is from the World Development Indicator (http://data.worldbank.org).

Population (POP): According to Feyen et al. (2011), population size determines the market size of the insurance industry. Therefore, the larger the population size, the greater will be the demand for insurance products, ceteris paribus (Mantis and Farmer, 1968). As demand for insurance increases, there is the tendency for insurers to raise premiums. We thus include the total population for each country as an explanatory variable in our estimations and assume that it will be positively related to insurance premiums. We retrieved population data from the World Development Indicator (http://data.worldbank.org).

Financial development (FD): Well-developed financial systems improve the demand for insurance products. According to Alhassan and Biekpe (2016), financial development enhances the credit-based system. However, for financial intermediaries to provide financing to individuals and businesses, some form of guarantee is required in form of insurance to serve as security in case repayment becomes difficult. Insurance is therefore expected to generate more sales in countries with well-developed financial systems. While Alhassan and Biekpe (2016) confirmed this relationship for life-insurance, Outreville (1990) confirmed it for non-life insurance. We measure financial development with the financial development index computed by the international monetary fund and accessible at http://data.imf.org/?sk=388DFA60-1D26-4ADE-B505-A05A558D9A42&sId=1479329132326.

Institutional quality (IQ): The quality of institutions in an economy as proxied by regulatory and political variables have been established to have positive effects on insurance consumption. Effective regulatory and political environment is an important factor for insurance markets to thrive. The better the regulatory and political environment, the higher will be the willingness of individuals and firms to initiate business relationships. Beck and Webb (2003), Elango and Jones (2011), and Sepehrdoust and Ebrahimnasab (2015) have all confirmed this relationship. We measure institutional quality through the six dimensions of governance provided in the World Bank's Worldwide Governance Indicators (WGI) which are; voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. Rather than average the six dimensions to prevent multicolinearity that could arise from modelling the six dimensions in a single equation as is commonly done (see Easterly, 2002; Al-Marhubi, 2004; Bjørnskov, 2006; Langbein and Knack, 2010; Le et al., 2016), we instead create a composite index of institutional quality (IQ) through Principal Component Analysis (PCA). This approach ensures that the individual dimensions are converted into linear combinations that account for relatively large proportion of their variance.

5.3 Models, Methods and Results

5.3.1 Models

The following econometric models are specified in order to determine the extent to which insurance premiums (total, life and non-life) are susceptible to the impact of economic policy uncertainty, while controlling for the effect of several other variables:

$$M1: TIP_{it} = \beta_0 + \beta_1 EPU_{it} + \beta_2 NNIPC_{it} + +\beta_3 INF_{it} + \beta_4 EDUC_{it} + \beta_5 POP_{it} + \beta_6 FD_{it} + \beta_7 IQ_{it} + \varepsilon_{it}$$

(1)

$$M2: LIP_{it} = \beta_0 + \beta_1 EPU_{it} + \beta_2 NNIPC_{it} + +\beta_3 INF_{it} + \beta_4 EDUC_{it} + \beta_5 POP_{it} + \beta_6 FD_{it} + \beta_7 IQ_{it} + \varepsilon_{it}$$

(2)

$$M3: NLIP_{it} = \beta_0 + \beta_1 EPU_{it} + \beta_2 NNIPC_{it} + +\beta_3 INF_{it} + \beta_4 EDUC_{it} + \beta_5 POP_{it} + \beta_6 FD_{it} + \beta_7 IQ_{it} + \varepsilon_{it}$$

(3)

The logarithmic forms of the variables are used in the estimations, M1, M2 and M3 represent models 1,2 and 3 respectively, β_k (k=1, 2) are the estimated coefficients on the regressors and ε_{it} is the error term.

5.3.2 Cross-Sectional Dependency Test

One common issue that often arises in panel estimations is the likelihood that cross-sections included in the panel data are interdependent. Cross-sectional dependence could be due to factors such as spatial effects, omitted common effects and socio-economic network interactions (Chudik and Pesaran, 2013). As a matter of fact, the properties of the commonly used first generation panel unit root tests and cointegration tests are based on the assumption of cross-sectional independence. The wrongful relaxation of the cross-sectional dependence assumption has implications on estimates obtained and inferences made, because the variance-covariance matrix will likely increase with the number of cross-sections resulting in unreliable parameter estimates (Cerrato and Sarantis, 2002).

Prior to testing the stationary properties of the data series, this study first considers whether cross-sectional dependence is present in the panel data. This is to ensure that the appropriate panel unit root and cointegration tests are used. The following cross-sectional dependence tests are used; Breusch-Pagan (1980) Lagrange Multiplier (LM) test, Pesaran (2004) Scaled LM test, Pesaran (2004) CD test and Pesaran et al. (2008) Bias-adjusted LM test. The test statistics for each of the four are specified below.

$$LM = \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} T_{ij} \hat{p}_{ij}^2 \rightarrow \chi^2 \frac{N(N-1)}{2} \quad (4)$$

$$LM_s = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T_{ij} \hat{p}_{ij}^2 - 1) \rightarrow N(0,1) \quad (5)$$

$$CD_p = \sqrt{\frac{2}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} T_{ij} \hat{p}_{ij} \rightarrow N(0,1) \quad (6)$$

$$LM_{BC} = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T_{ij} \hat{p}_{ij}^2 - 1) - \frac{N}{2(T-1)} \rightarrow N(0,1) \quad (7)$$

Table 24 reports the cross-sectional dependence test results. Ample evidence is provided in support of rejecting the null of no cross-sectional dependence in all variables tested at ($p < 0.1$) significance level or better by at least three of the four tests in all cases. We thus conclude that our panel data model is plagued by cross-sectional dependence. The implication of this is that the commonly used first generation panel model techniques are unsuitable for our study.

Table 24. Cross-sectional dependence test results

	LM	**CD_{LM}**	**CD**	**LM_{ADJ}**
TIP	266.348***	11.134***	-2.151**	-1.094*
	(0.000)	(0.000)	(0.016)	(0.086)
LIP	209.755***	7.229***	-0.380**	-1.746
	(0.000)	(0.000)	0.035	(0.960)
NLIP	211.934***	7.379 ***	-2.645***	-0.075
	(0.000)	(0.000)	(0.004)	(0.530)
EPU	158.589***	3.698***	-2.357***	0.616**
	(0.001)	(0.000)	(0.009)	(0.026)
NNI	183.411***	5.411***	-2.126**	-1.659*
	(0.000)	(0.000)	(0.017)	(0.051)
INF	154.419***	3.410***	-1.440**	0.835
	(0.001)	(0.000)	(0.075)	(0.202)
EDUC	149.489***	3.070***	-0.630	-1.767
	(0.003)	(0.001)	(0.264)	(0.961)
POP	197.771***	6.402***	-1.744**	0.444
	(0.000)	(0.000)	(0.041)	(0.329)
FD	157.789***	3.643***	-1.813**	-0.370
	(0.001)	(0.000)	(0.035)	(0.644)
IQ	149.458***	3.068***	-1.509*	-2.542
	(0.003)	(0.001)	(0.066)	(0.994)

*** Significant at the 1% level

5.3.3 Panel Unit Root Tests

To determine the order of integration of the variables in the panel data, we utilize the so-called second-generation panel unit root tests that are robust to cross-sectional dependence. Specifically, we employ the Pesaran panel unit root tests—the cross-sectionally augmented Im et al. (2003) test (CIPS) and the cross-sectional augmented Dickey Fuller test (CADF). These tests have the ability to provide reliable and consistent estimates in the presence of cross-sectional dependence and/or slope heterogeneity.

The CADF unit root test as developed by Pesaran (2007) uses the Dickey Fuller/Augmented Dickey Fuller unit root test as its building block. It is a test for the null of non-stationarity and its test statistic is specified as:

$$CADF_i = t_i(N,T) = \frac{\left(y_{i,-1}^T \bar{M} y_{i,-1}\right)^{-1}\left(y_{i,-1}^T \bar{M} \Delta y_i\right)}{\sqrt{\sigma_i^2}\left(y_{i,-1}^T \bar{M} y_{i,-1}\right)^{-1}} \tag{8}$$

The Pesaran (2007) CIPS test is derived by averaging CADF test statistics for the entire panel. CIPS tests for a null of unit root against a heterogeneous alternative. The test statistic is specified as follows:

$$CIPS(N,T) = N^{-1} \sum_{i=1}^{N} t_i(N,T) = \frac{\sum_{i=1}^{N} CADF_i}{N} \tag{9}$$

Table 25 presents the results for both CADF and CIPS unit root tests. At levels, all the variables except inflation and institutional quality turn out as insignificant in both tests. Therefore, unit root is only rejected for inflation and institutional quality. At first difference however, all the variables turn out as significant at (p < 0.01) significance level in both tests, unit root is thus rejected for all the series. We therefore conclude that all the variables, except inflation and institutional quality are non-stationary; they are in fact I(1) processes.

Table 25. Results from unit root tests with trend and intercept

	CADF		CIPS	
	LEVEL	**Δ**	**LEVEL**	**Δ**
EPU	-1.024	-2.441***	-1.121	-3.589***
TIP	-1.513	-2.574***	-1.563	-2.883***
LIP	-1.773	-2.346***	-1.799	-2.772***
NLIP	-1.475	-2.682***	-1.416	-2.418***
NNI	-1.961	-3.613***	-2.297	-4.374***
INF	-3.031***	-3.628***	-3.803***	-5.253***
EDUC	-1.965	-2.239***	-2.549	-3.233***
POP	-2.244	-2.692***	-2.823**	-4.123***
FD	-1.936	-3.345***	-2.004	-5.122***
IQ	-3.474***	-3.256***	-3.021***	-4.622***

*** Significant at the 1% level.

5.3.4 Panel Cointegration Test

When all or some variables are non-stationary at levels, as is the case in our study, the coefficient estimates obtained are neither economically meaningful nor statistically accurate except in cases where they are cointegrated. The presence of cointegration confirms the existence of a long run relationship between the variables. To test for the presence of cointegration between the variables, we implement the Durbin-Hausman (DH) cointegration tests of Westerlund (2008). These tests provide robust results for data series affected by cross-sectional dependence, they are also valid when the variables display a mixed order of integration; the only condition required being that the dependent variable is non-stationary. The Durbin-Hausman tests are given as:

$$DH_p = \hat{S}_n(\tilde{\varphi} - \hat{\varphi})^2 \sum_{i=1}^{n} \sum_{t=2}^{T} \hat{e}_{it-1}^2 \text{ and } DH_g = \hat{S}_i(\tilde{\varphi}_i - \hat{\varphi}_i)^2 \sum_{i=1}^{n} \sum_{t=2}^{T} \hat{e}_{it-1}^2 \quad (10)$$

Where: DH_p is the panel statistic and DH_g is the group mean statistic. Their null hypothesis of no cointegration [$H_0: \varphi_i = 1$, for all I =1] is tested against the alternative of cointegration in all n units for DH_p $[H_i^p: \varphi_i = \varphi, \text{and } \varphi < 1]$ and against the alternative of cointegration in some of the cross-sectional units for DH_g $[H_i^p: \varphi < 1,$ for at least some i].

Outcomes of the Durbin Hausman cointegration tests are presented in Table 26. The tests are carried out with two types of deterministic specifications (constant only, and both constant and trend). The results of the DH_g tests for M1 are significant at ($p<0.01$) significance level according to both deterministic specifications. The DH_g tests for M2 and M3 are significant at ($p<0.05$) significance level according to both deterministic specifications. We therefore conclude based on these results that cointegration exists in at least some of the panel cross-sections in all three models (M1, M2 and M3).

Table 26. Durbin-Hausman test results

Cointegration test for M1		**Cointegration test for M2**		**Cointegration test for M3**	
Stat.	**Prob.**	**Stat.**	**Prob.**	**Stat.**	**Prob.**
Deterministic specification: Constant only					
-0.107	0.457	2.799	0.997	-0.536	0.296
-1.523^{***}	0.064	-1.536^{**}	0.062	-0.688^{**}	0.246
Deterministic specification: Constant and Trend					
-0.302	0.381	0.770	0.779	-1.677	0.047
-1.770^{***}	0.038	-1.737^{**}	0.041	-1.010^{**}	0.156

5.3.5 Error Correction Based Panel Estimations

To determine both short and long run impacts of the regressors on total insurance premium, we specify an autoregressive distributive lag (ARDL) dynamic panel model:

$$IP_{it} = \gamma_i + \sum_{j=i}^{p} \lambda_{ij} IP_{it-j} + \sum_{j=0}^{q} \delta'_{ij} X_{it-j} + \varepsilon_{it} \qquad (11)$$

Where; IP_{it} represents log of insurance premiums (total, life and non-life), i refers to the number of groups (1,2,3,…,N) , t is the number of periods(1,2,3,…,T), X_{it} stands for the vector of explanatory variables (EPU, NNIPC, INF, EDUC, POP, FD and IQ), δ_{it} represents the vector of coefficients and γ_i stands for the group specific effect.

We thereafter specify an error correction form of the ARDL model as:

$$\Delta IP_{it} = \emptyset_i (IP_{it-1} - \theta'_i X_{it}) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta IP_{it-j} + \sum_{j=0}^{q-1} \delta'^*_{ij} \Delta X_{it-j} + \varepsilon_{it} \qquad (12)$$

Where:

$\emptyset_i = -\left(1 - \sum_{j=i}^{p} \lambda_{ij}\right)$ = speed of adjustment, if $\emptyset_i$ = 0, there is no proof of long run relationship.

$\Theta_i = \frac{\sum_{j=0}^{q} \delta_{ij}}{1 - \sum_k \lambda_{ik}}$, $\lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im}$ and $\delta'^*_{ij} = -\sum_{m=j+1}^{q} \delta_{im}$

In eq. (12), the term $\emptyset_i (IP_{it-1} - \theta'_i X_{it})$ measures the adjustment in insurance premiums to the deviation from its long run relationship with the independent variables and the terms, $\sum_{j=1}^{p-1} \lambda^*_{ij} \Delta IP_{it-j}$ *and* $\sum_{j=0}^{q-1} \delta'^*_{ij} \Delta X_{it-j}$ capture the short run dynamics of the model.

We then estimate eq. (12) through estimation techniques designed for non-stationary heterogeneous panels—panel Mean Group (PMG), Mean Group (MG) and Dynamic Fixed Effect (DFE) estimators.

It is noteworthy that while the MG estimator accommodates heterogeneity in the short and long run parameter estimates, the DFE estimator places restrictions on the speed of adjustment, the short run and the long run parameter estimates. The PMG estimator like the MG estimator accommodates heterogeneity in short run parameter estimates and like the DFE estimator imposes restrictions on the long run parameter estimates.

Table 27 presents the estimation results. In all three estimations, the reported speeds of adjustment estimates are negative and significant at ($p < 0.05$) significance level or better. This is an indication that a long run relationship exists between the variables and a confirmation of the cointegration results earlier obtained. The results also indicate that economic policy uncertainty positively affects total insurance premiums in the long run. 1 percent increase in EPU causes TIP to rise by 0.131 percent, 0.163 percent and 0.139 percent according to PMG, MG and DFE estimations respectively. The PMG estimate is significant at ($p < 0.05$), the MG and DFE estimates at ($p < 0.01$).

Table 27. PMG, MG, and DFE estimates of the ARDL (1, 1) regression equation

	(1)	(2)	(3)
	PMG	**MG**	**DFE**
Adjustment coefficient	-.0396***	-0.198**	-0.048***
Long-run coefficients			
EPU	0.131**	0.136***	0.139***
NNI	0.867***	1.743**	0.801***
INF	-0.115***	-0.710**	-0.038**
EDUC	2.729***	0.380*	1.444**
POP	0.528***	0.253*	0.051*
FD	2.880***	2.564*	0.537***
IQ	1.789***	3.320**	1.507***
Short-run coefficients			
ΔEPU_{t-1}	0.004*	0.002*	0.003*
ΔNNI_{t-1}	0.186***	0.513**	0.135**
ΔINF_{t-1}	-0.167*	-0.114*	-0.006*
$\Delta EDUC_{t-1}$	1.201***	0.348**	0.857**
ΔPOP_{t-1}	0.232***	0.478*	-0.058
ΔFD_{t-1}	1.399***	0.464**	0.396**
ΔIQ_{t-1}	0.130*	0.920**	0.534*
Hausman test	MG VS PMG		MG VS DFE
Chi2	4.57		0.55
Prob>chi2	0.335		0.968

*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

The results also indicate a positive relationship between economic policy uncertainty and total insurance premiums in the short run. One period lagged effect of a percentage change in EPU results in 0.004 percent, 0.002 percent and 0.003 percent change in TIP in the following periods according to PMG, MG and DFE estimations respectively.

Concerning the control variables, the PMG, MG and DFE estimation outcomes show that national income per-capita, education, population, financial development and institutional quality all have positive and significant impacts on total insurance premiums in both the short and long run. Inflation, on the other hand, has a negative and significant short and long run impact on total insurance premiums. In all cases, the long-run impacts are generally bigger than the short-run impacts. All the results are significant at ($p<0.1$) significance or better, except for the short-run effect of population reported by DFE that turns out as insignificant.

5.3.6 Homogeneity

PMG and DFE estimators, which are characterized by varying degrees of slope homogeneity, are consistent and more efficient than the MG estimator in cases where slopes are homogeneous. They however become inconsistent in cases where the slopes are heterogeneous rather than homogeneous, whereas the MG estimator remains consistent irrespective of the status of the slope. The Hausman test is employed to determine the differences in the specified models by testing the null of homogeneity restrictions between PMG and MG and between DFE and MG. The Hausman test results are also reported in Table 27. The test statistics fail to reject the null of homogeneity restrictions in both cases. We may therefore conclude that the slope parameters are homogeneous and that the results provided by both PMG and DFE estimators are as consistent and more efficient as the MG results.

5.3.7 Robustness Tests: Estimations based on Non-Life and Life Insurance Premiums

To further examine the effect of uncertainty on insurance premium, we disaggregate total insurance premiums into non-life insurance premiums (NLIP) and life insurance premiums (LIP). Eq. (12) is then re-estimated with the logarithmic forms of life and non-life insurance premiums serving as dependent variables. The superior PMG and DFE estimators are used in the estimations. Results are shown in Table 28. The negative and significant adjustment coefficients once again confirm the existence of a long run relationship between the variables.

Table 28. Robustness test for the PMG and DFE estimations with NLIP and LIP

	NLIP		LIP	
	PMG	**DFE**	**PMG**	**DFE**
Adjustment coefficient	-0.270***	-.088***	-0.253***	-0.525***
Long-run coefficients				
EPU	0.836***	0.601**	0.542***	0.539**
NNI	0.392*	0.721***	0.272*	0.773***
INF	-1.329***	-0.073**	-0.553***	-0.336*
EDUC	1.655**	2.75***	1.524**	1.770***
POP	0.661**	0.273**	0.698**	1.777**
FD	1.744*	1.294***	2.847*	1.601**
IQ	4.715*	4.316***	4.508***	6.818*
Short-run coefficients				
ΔEPU_{t-1}	0.197**	0.105**	0.137*	0.101*
ΔNNI_{t-1}	0.197**	0.140**	0.194***	0.141**
ΔINF_{t-1}	-0.158*	-0.038	-0.128*	-0.169**
$\Delta EDUC_{t-1}$	0.617	1.051***	0.691***	3.704
ΔPOP_{t-1}	0.346**	0.078*	0.281***	0.184**
ΔFD_{t-1}	1.408**	1.267***	2.185**	1.167**
ΔIQ_{t-1}	0.383*	1.422**	1.927*	0.681**

*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

The findings also affirm that a significant positive relationship exists between economic policy uncertainty and non-life insurance premiums and between economic policy uncertainty and life insurance premiums in the long run. The PMG estimates show that for every percentage increase in EPU, NLIP rises by 0.836 percent and LIP rises by 0.542 percent in the long-run. The DFE estimates on the other hand show that a percentage increase in EPU causes NLIP to increase by 0.601 percent and LIP to increase by 0.539 percent in the long-run.

The findings provide sufficient evidence in support of a short run positive relationship between economic policy uncertainty and both non-life and life insurance premiums. From the PMG estimates, we may infer that the one period lagged impact of a percentage change in EPU results in 0.197 percent change in NLIP in the following periods. The DFE estimate on the other hand suggests that it changes by 0.105 percent in the following periods. As for LIP, the PMG estimate suggests that the one period lagged impact of 1 percent change in EPU causes LIP to change by approximately 0.137 percent in the following periods while the DFE estimate shows that it changes by 0.101 percent in the following periods.

The reported coefficients further indicate that non-life and life insurance premiums are positively influenced by national income per-capita, education, population, financial development and institutional quality but negatively affected by inflation in both the long-run and the short-run.

5.3.8 Panel Granger Causality Testing

Granger causality tests, as introduced by Granger (1969), help to detect the capability of the past values or lags of a particular variable to predict another. As a means to detect the existence and direction of such causal relationships between economic policy uncertainty and insurance premiums (total, life and non-life), we employ the bootstrap panel causality procedure based on meta-analysis in heterogeneous mixed panels proposed by Emirmahmutoglu and Kose (2011). This approach is an extension of the Toda and Yamamoto (1995) approach for testing coefficient restrictions in a level VAR model for an integrated or cointegrated process. It adequately deals with cross-sectional dependency, heterogeneity, and provides valid estimates for data series integrated of a mixed order like ours. A modified Wald

(MWALD) test in a lag augmented VAR (LA-VAR) which has a conventional asymptotic chi-square distribution when a VAR (p + dmax) is estimated is used in the procedure. P represents the lag order while dmax stands for the maximal order of integration suspected to occur in the process.

Emirmahmutoglu and Kose (2011) show that the Fisher (1932) test statistic as specified below may be used to test for panel Granger non-causality

$$\lambda = -2\sum_{i=1}^{N} ln_{(pi)} \quad i = 1,2, \dots, N. \tag{13}$$

pi is the p value for the ith cross section; the test statistic has a chi-square distribution with 2N degrees of freedom.

The equation system for this causality approach is made up of two equations specified as follows:

$$Y_{1,t} = \alpha_{1,1} + \sum_{i=1}^{ly_1+dmax_j} \beta_{1,1,i} Y_{1,t-i} + \sum_{i=1}^{lx_1+dmax_j} \delta_{1,1,i} X_{1,t-i} + \sum_{i=1}^{lz_1+dmax_j} \gamma_{1,1,i} Z_{1,t-i} + \varepsilon_{1,1,t}$$

$$Y_{2,t} = \alpha_{1,2} + \sum_{i=1}^{ly_1+dmax_j} \beta_{1,2,i} Y_{2,t-i} + \sum_{i=1}^{lx_1+dmax_j} \delta_{1,2,i} X_{2,t-i} + \sum_{i=1}^{lz_1+dmax_j} \gamma_{1,2,i} Z_{2,t-i} + \varepsilon_{1,2,t}$$

$$\vdots \qquad\qquad\qquad\qquad \vdots$$

$$Y_{N,t} = \alpha_{1,N} + \sum_{i=1}^{ly_1+dmax_j} \beta_{1,N,i} Y_{N,t-i} + \sum_{i=1}^{lx_1+dmax_j} \delta_{1,N,i} X_{N,t-i} + \sum_{i=1}^{lz_1+dmax_j} \gamma_{1,N,i} Z_{N,t-i} + \varepsilon_{1,N,t}$$

(14)

$$X_{1,t} = \alpha_{2,1} + \sum_{i=1}^{ly_2+dmax_j} \beta_{2,1,i} Y_{1,t-i} + \sum_{i=1}^{lx_2+dmax_j} \delta_{2,1,i} X_{1,t-i} + \sum_{i=1}^{lz_2+dmax_j} \gamma_{2,1,i} Z_{1,t-i} + \varepsilon_{2,1,t}$$

$$X_{2,t} = \alpha_{2,2} + \sum_{i=1}^{ly_2+dmax_j} \beta_{2,2,i} Y_{2,t-i} + \sum_{i=1}^{lx_2+dmax_j} \delta_{2,2,i} X_{2,t-i} + \sum_{i=1}^{lz_2+dmax_j} \gamma_{2,2,i} Z_{2,t-i} + \varepsilon_{2,2,t}$$

$$\vdots \qquad\qquad\qquad\qquad \vdots$$

$$X_{N,t} = \alpha_{2,N} + \sum_{i=1}^{ly_2+dmax_j} \beta_{2,N,i} Y_{N,t-i} + \sum_{i=1}^{lx_2+dmax_j} \delta_{2,N,i} X_{N,t-i} + \sum_{i=1}^{lz_2+dmax_j} \gamma_{2,N,i} Z_{N,t-i} + \varepsilon_{2,N,t}$$

(15)

Where Y_{it} represents the indicators for total, life and non-life insurance premiums respectively, X_{it} represents economic policy uncertainty index and Z_{it} represents the control variables. N refers to the number of cross-sections, t refers to the time period while l stands for the lag length.

The possible bivariate causal relationships that could exist between the variables of primary interest (economic policy uncertainty and insurance premiums (total, life and non-life)) at either country or panel level are as follows:

(i) One-way Granger causality from X to Y when all $\beta_{2,i}$s are zero, but not all $\delta_{1,i}$s are zero.

(ii) One-way Granger causality from Y to X when all $\delta_{1,i}$s are zero, but not all $\beta_{2,i}$s are zero.

(iii) Two-way Granger causality between X and Y if some of the $\delta_{1,i}$s and $\beta_{2,i}$s are not zero.

After ascertaining the maximal order of integration of variables in the system for each cross-section unit through unit root tests, we estimate the regression equations via OLS and determine the lag orders through Schwarz information criteria.

Results for the panel causality tests are presented in Table 29. Only the panel level results are reported, since it is already established that the panel is homogeneous in nature.

From table 29, economic policy uncertainty has a one-way causal effect on total insurance premiums in the panel of countries; it also has a similar effect on life-insurance premiums. Two-way causal relationships however exist between economic policy uncertainty and non-life insurance premiums.

Table 29. Results from Panel Granger causality tests

Hypothesis	Statistic	Conclusion
EPU→TIP	97.475**	One-way causality between EPU and TIP
TIP→EPU	83.853	
EPU→NLIP	84.082**	Two-way causality between EPU and NLIP
NLIP→EPU	81.677**	
EPU→LIP	81.012**	One-way causality between EPU and LIP
LIP→EPU	69.037	

*** Significant at the 1% level; ** Significant at the 5% level.

5.4 Conclusion

Just as the world has witnessed the increased importance of the insurance sector over the past few decades, it has also witnessed a sharp rise in risks and uncertainties. Because of this increased importance of the insurance sector, the body of literature centered on the insurance sector has risen in recent years, albeit with conflicting findings. In addition, apart from the very recent study by Gupta et al. (2016), empirical studies addressing the influence of economic policy uncertainty on insurance premiums changes is almost non-existent. In order to address these challenges, we apply econometric techniques that are superior to those commonly used in the past.

Our findings lead to the following conclusions and recommendations:

First, we found out that the insurance sector is not immune to the effects of economic policy uncertainty as economic policy uncertainty exerts a significant influence on insurance premiums (total, life and non-life). Economic policy uncertainty raises insurance premiums in both the short and long run, although its long run impact is greater than the short run impact. This supports the position of extant literature that economic policy uncertainty is correlated with the financial system (see Quagliariello, 2009; Antonakakis et al., 2013; Baum et al., 2013; Arouri et al., 2014; Liu and Zhang, 2015; Antonakakis and Floros, 2016; Bordo et al., 2016; Christou and Gupta, 2016; Bilgin et al., 2018; Demir et al., 2018). Baker et al. (2016), while constructing the economic policy uncertainty index, identified the following factors as the main causes of economic policy uncertainty; uncertainty about fiscal matters, uncertainty about healthcare policy, uncertainty about entitlement programmes, and concerns about sovereign debt and currency crises. It is important that policy makers pay attention to these issues because the uncertainty they create in the economy affects the financial system.

Second, we found out that economic policy uncertainty exerts a bigger influence on non-life insurance premiums than on life insurance premiums. This conclusion is in line with the findings of Gupta et al. (2016) that economic risks that non-life insurance covers are more sensitive to uncertainty than mortality and longevity risks that life-insurance cover. One key implication of this is that economic policy uncertainty will raise the cost of doing business through the additional cost of insurance that investors who demand non-life insurance have to pay. This will be detrimental to long-run economic growth. It is therefore important for policy makers to ensure that economic policy uncertainty does not eventually slow down economic growth.

Third, our findings show that national income per-capita, education, population, financial development and institutional quality all raise insurance premiums to increase while inflation lowers insurance premiums. These findings are in accordance with extant literature (see Outreville, 1990; Browne and Kim, 1993; Browne et al., 2000; Esho et al., 2004; Elango and Jones, 2011; Feyen et al., 2011; Treerattanapun, 2011; Curak et al., 2013; Sepehrdoust and Ebrahimnasab, 2015; Alhassan and Biekpe, 2016). Financial development and institutional quality and education particularly have the biggest impacts on insurance premiums. For a country that intends to grow its insurance industry, closer attention should be given to these three factors as they may hold the key to rapid growth in the industry.

To provide further detailed insight into the effects of economic policy uncertainty, future research can consider how the sub-indices of economic policy uncertainty such as fiscal policy uncertainty, monetary policy uncertainty, trade policy uncertainty and exchange rate policy uncertainty affect the insurance sector.

Chapter 6

CONCLUSION

This thesis examined the interaction between insurance and economic growth in Africa, and the interaction between insurance and economic policy uncertainty in a panel of selected countries. This chapter provides a summary of the conclusions reached on a chapter by chapter basis.

İn chapter two, the relationship between Africa's economic growth and insurance-market activity (life, non-life, and total) was examined. Applying panel-estimation techniques that are robust to heterogeneity and cross-sectional dependence to a model of panel data for 11 African countries between 1995 and 2016, significant evidence was found in support of such a relationship. Total-insurance penetration has a long-term impact on economic growth, and when disaggregated into its components (life- and non-life-insurance penetration), evidence was found in support of short-term and long-term impacts on economic growth in both cases. Our study also confirms the feedback hypothesis, as we found a positive, bi-directional causality between insurance-market activity and economic growth. We also found that the contribution from non-life-insurance market activity toward economic growth far outweighs that of life-insurance market activity.

In chapter three, with the aid of the dynamic panel-GMM estimation technique, the synergistic effect of both the insurance and banking sectors on economic growth was tested in a panel of 11 African countries that are responsible for most of the activities in the continent's financial sector. The insurance-banking growth nexus was also examined through panel causality tests. The results showed that life insurance market and the banking sector are complimentary and that the non-life insurance market and the banking sector are also complimentary. We found that overall, the relationship between the insurance and banking sectors in Africa is a complimentary one and that their synergistic impact on economic growth is positive. The feedback hypothesis was also confirmed in the relationship between the insurance sector and economic growth and between the banking sector and economic growth.

In chapter four, we examined asymmetric causal relationships between financial systems and economic performance in nine African countries over a 24-year period. We found that it is important that asymmetric causal effects are taken into account when empirically examining the finance-growth nexus since it is possible that the economy (financial system) would react differently to changes in financial system (economy), depending on whether it is a positive or negative change. We therefore proposed testing for asymmetric causality by using cumulative sums of positive and negative shocks via a bootstrap simulation approach. The results showed that the pattern of causality varies across the selected countries and the following hypotheses were confirmed: negative and positive demand-following hypotheses, negative and positive supply-following hypotheses, and negative and positive feedback hypotheses.

Finally, in chapter five, we investigated the impact of economic policy uncertainty on insurance premiums, controlling for the effect of real income, in a panel of 15 countries over the period 1998-2016 by employing heterogeneous panel estimation techniques with cross-sectional dependence. The cointegration test results confirmed that a long-run relationship exists between the variables. Findings from the error correction based panel estimations showed that the insurance sector is not immune to the effects of economic policy uncertainty and real income. Economic policy uncertainty initially raises insurance premiums in the short run but eventually lessens it in the long run whereas real income increases insurance premiums both in the short and long run, although its long run impact is greater than the short run impact. Also, economic policy uncertainty exerts a bigger influence on non-life insurance premium than on life insurance premium.

REFERENCES

Acaravci, S. K., Ozturk, I., & Acaravci, A. (2009). Financial Development and Economic Growth: Literature Survey and Empirical Evidence from Sub-Saharan African Countries. *South African Journal of Economic and Management Sciences*, 12(1), 11-27.

Acemoglu, D. (1996). A microfoundation for social increasing returns in human capital accumulation. *The Quarterly Journal of Economics*, 111(3), 779-804.

Adjasi, C. K., & Biekpe, N. B. (2006). Stock Market Development and Economic Growth: The Case of Selected African Countries. *African Development Review*, 18(1), 144-161.

Agbetsiafa, D. (2004). The Finance Growth Nexus: Evidence from Sub-Saharan Africa. *Savings and Development*, 271-288.

Akinlo, A. E., & Egbetunde, T. (2010). Financial Development and Economic Growth: The Experience of 10 Sub-Saharan African Countries Revisited. *The Review of Finance and Banking*, 2(1).

Akinlo, T., & Apanisile, O.T. (2014). Relationship between insurance and economic growth in sub-Saharan African: A panel data analysis. *Modern Economy* 5(2): 120-127.

Alhassan, A. L., & Biekpe, N. (2016). Insurance Market Development and Economic Growth: Exploring Causality in 8 Selected African Countries. *International Journal of Social Economics*, 43(3), 321-339.

Allen, F., Otchere, I., & Senbet, L. W. (2011). African Financial Systems: A Review. *Review of Development Finance*, 1(2), 79-113.

Al-Marhubi, F. (2004). The Determinants of Governance: A Cross-Country Analysis. *Contemporary Economic Policy,* 22(3), 394-406.

Al-Yousif, Y. K. (2002). Financial development and economic growth: Another look at the evidence from developing countries. *Review of Financial Economics*, 11(2), 131-150.

Anderson, T. W., & Hsiao, C. (1981). Estimation of dynamic models with error components. *Journal of the American statistical Association*, 76(375), 598-606.

Ang, J. B. (2008). What are the mechanisms linking financial development and economic growth in Malaysia? *Economic Modelling*, 25(1), 38-53.

Ang, J. B., & McKibbin, W. J. (2007). Financial liberalization, financial sector development and growth: Evidence from Malaysia. *Journal of Development Economics*, 84(1), 215-233.

Antonakakis, N., & Floros, C. (2016). Dynamic interdependencies among the housing market, stock market, policy uncertainty and the macroeconomy in the United Kingdom. *International Review of Financial Analysis*, 44, 111-122.

Antonakakis, N., Chatziantoniou, I., & Filis, G. (2013). Dynamic co-movements of stock market returns, implied volatility and policy uncertainty. *Economics Letters*, 120(1), 87-92.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2), 277-297.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1), 29-51.

Arena, M. (2008). Does insurance market activity promote economic growth? A cross-country study for industrialized and developing countries. *The Journal of Risk and Insurance,* 75(4), 921-946.

Arouri, M., Rault, C., & Teulon, F. (2014). Economic policy uncertainty, oil price shocks and GCC stock markets. *Economics Bulletin*, 34(3), 1822-1834.

Atindéhou, R. B., Gueyie, J. P., & Amenounve, E. K. (2005). Financial Intermediation and Economic Growth: Evidence from Western Africa. *Applied Financial Economics*, 15(11), 777-790.

Bagehot, W. (1873). *Lombard Street: A Description of the Money Market*. Scribner, Armstrong & Company.

Bai, Y., Kehoe, P., & Arellano, C. (2011). Financial markets and fluctuations in uncertainty. In *2011 Meeting Papers* (No. 896). Society for Economic Dynamics.

Baker, S. R., Bloom, N., & Davis, S. J. (2016). Measuring economic policy uncertainty. *The Quarterly Journal of Economics*, 131(4), 1593-1636.

Baker, S., Bloom, N., & Davis, S. J. (2013, January). What triggers stock market jumps? In *Work in progress presented at the January 2013 ASSA meetings*.

Balcilar, M., Gupta, R., Kyei, C., & Wohar, M. E. (2016). Does economic policy uncertainty predict exchange rate returns and volatility? Evidence from a nonparametric causality-in-quantiles test. *Open Economies Review*, 27(2), 229-250.

Balcilar, M., Gupta, R., Lee, C. C., & Olasehinde-Williams, G. (2018). Insurance-Growth Nexus in Africa, *Working Papers 2018-01*. University of Pretoria, Department of Economics. <Https://Ideas.Repec.Org/P/Pre/Wpaper/201801.Html

Balcilar, M., Modise, M. P., Gupta, R., & Muteba Mwamba, J. W. (2015). Predicting South African equity premium using domestic and global economic policy uncertainty indices: Evidence from a Bayesian graphical model. *Working Paper No, 201596.* Department of Economics, University of Pretoria.

Balogun, W., Dahalan, J., & Hassan, S. (2016). Stock Market Development, Liberalization and Financial Development in the Selected Sub-Saharan African Countries. *Romanian Economic and Business Review*, 11(2), 52.

Baltagi, B. H. (2008). *Econometric analysis of panel data*. Chichester: John Wiley and Sons.

Barro, R. J. (1991). Economic growth in a cross section of countries. *The Quarterly Journal of Economics*, 106(2), 407-443.

Barro, R.J. (1990). Government spending in a simple model of endogeneous growth. *Journal of Political Economy* 98(5, Part 2): S103-S125.

Barro, R.J. (1996). Determinants of economic growth: A cross-country empirical study. *NBER Working Paper 5698.* National Bureau of Economic Research.

Barro, R.J., & Sala-i-Martin, X. (1992). Public finance in models of economic growth. *The Review of Economic Studies,* 59(4): 645-661.

Baum, C. F. (2006). *An Introduction to Modern Econometrics Using Stata*. College Station, TX: Stata press.

Baum, C., Caglayan, M., & Ozkan, N. (2013). The role of uncertainty in the transmission of monetary policy effects on bank lending. *The Manchester School*, 81(2), 202-225.

Beck, T., & Levine, R. (2004). Stock markets, banks, and growth: Panel evidence. *Journal of Banking and Finance*, 28(3), 423-442.

Beck, T., & Webb, I. (2003). Economic, demographic, and institutional determinants of life insurance consumption across countries. *The World Bank Economic Review*, 17(1), 51-88.

Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2005). Financial and legal constraints to growth: Does firm size matter? *The Journal of Finance*, 60(1), 137-177.

Beenstock, M., Dickinson, G., & Khajuria, S. (1988). The relationship between property-liability insurance premiums and income: An international analysis. *The Journal of Risk and Insurance*, 55(2): 259-272.

Bernanke, B. S. (1983). Irreversibility, uncertainty, and cyclical investment. *The Quarterly Journal of Economics*, 98(1), 85-106.

Bernoth, K., & Pick, A. (2011). Forecasting the fragility of the banking and insurance sectors. *Journal of Banking and Finance*, 35(4), 807-818.

Biekpe, A. L. A. N. (2014). Insurance Market Development and Economic Growth: Exploring Causality in 8 Selected African Countries. *Growth,* 43(3), 321-339.

Bilgin, M. H., Gozgor, G., Lau, C. K. M., & Sheng, X. (2018). The effects of uncertainty measures on the price of gold. *International Review of Financial Analysis,* 58, 1-7.

Bjørnskov, C. (2006). The multiple facets of social capital. *European journal of political economy*, 22(1), 22-40.

Bloom, N. (2009). The impact of uncertainty shocks. *Econometrica*, 77(3), 623-685.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115-143.

Bluwstein, K. (2016). Asymmetric Macro–Financial Linkages How Useful is the Financial Sector for the Economy?

Bojanic, A. N. (2012). The impact of financial development and trade on the economic growth of Bolivia. *Journal of Applied Economics*, 15(1), 51-70.

Bordo, M. D., Duca, J. V., & Koch, C. (2016). Economic policy uncertainty and the credit channel: Aggregate and bank level US evidence over several decades. *Journal of Financial Stability*, 26, 90-106.

Breusch, T. S., & Pagan, A. R. (1980). The Lagrange Multiplier Test and its Applications to Model Specification in Econometrics. *The Review of Economic Studies*, 47(1), 239-253.

Brogaard, J., & Detzel, A. (2015). The asset-pricing implications of government economic policy uncertainty. *Management Science*, 61(1), 3-18.

Browne, M. J., & Kim, K. (1993). An international analysis of life insurance demand. *The Journal of Risk and Insurance*, 60(4), 616-634.

Browne, M. J., Chung, J., & Frees, E. W. (2000). International property-liability insurance consumption. *Journal of Risk and Insurance*, 73-90.

Bruneau, C. (2010). Study of the impact of inflation and GDP growth on property-liability and life insurance premiums over the last 30 years: case of the G7 countries.

Caballero, R. J. (1991). On the sign of the investment-uncertainty relationship. *The American Economic Review*, 81(1), 279-288.

Calderón, C., & Liu, L. (2003). The direction of causality between financial development and economic growth. *Journal of Development Economics*, 72(1), 321-334.

Caporale, T., & McKiernan, B. (1998). Interest rate uncertainty and the founding of the Federal Reserve. *The Journal of Economic History*, 58(4), 1110-1117.

Cerrato, M., & Sarantis, N. (2002). The Cross Sectional Dependence Puzzle, *Discussion Paper No 02-1*. Centre for International Capital Markets, London Guildhall University.

Chang, T., Lee, C. C., & Chang, C. H. (2014). Does insurance activity promote economic growth? Further evidence based on bootstrap panel Granger causality test. *The European Journal of Finance*, 20(12): 1187-1210.

Chen, P. F., Lee, C. C., & Lee, C. F. (2012). How does the development of the life insurance market affect economic growth? Some international evidence. *Journal of International Development*, 24(7), 865-893.

Cheng, X., & Degryse, H. (2010). The impact of bank and non-bank financial institutions on local economic growth in China. *Journal of Financial Services Research*, 37(2-3), 179-199.

Ching, K. S., Kogid, M., & Furuoka, F. (2010). Causal relation between life insurance funds and economic growth: Evidence from Malaysia. *ASEAN Economic Bulletin*, 27(2), 185-199.

Christou, C., & Gupta, R. (2016). Forecasting Equity Premium in a Panel of OECD Countries: The Role of Economic Policy Uncertainty *(No. 201622)*.

Chudik, A., & Pesaran, M. H. (2013). Large panel data models with cross-sectional dependence: a survey.

Curak, M., Dzaja, I., & Pepur, S. (2013). The Effect of Social and Demographic Factors on Life Insurance Demand in Croatia International Journal of Business and Social Science Vol. 4 No. 9. Republic of Croatia.

Deidda, L., & Fattouh, B. (2002). Non-Linearity between Finance and Growth. *Economics Letters*, 74(3), 339-345.

Demetriades, P. O., & Hussein, K. A. (1996). Does financial development cause economic growth? Time-series evidence from 16 countries. *Journal of Development Economics*, 51(2), 387-411.

Demir, E., Gozgor, G., Lau, C. K. M., & Vigne, S. A. (2018). Does economic policy uncertainty predict the Bitcoin returns? An empirical investigation. *Finance Research Letters.*

Demirgüç-Kunt, A., & Maksimovic, V. (1998). Law, finance, and firm growth. *The Journal of Finance*, 53(6), 2107-2137.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American statistical association*, 74(366a), 427-431.

Dixit, A. K., & Pindyck, R. S. (1994). *Investment under uncertainty*. Princeton university press.

Dragos, S. L. (2014). Life and non-life insurance demand: the different effects of influence factors in emerging countries from Europe and Asia. *Economic research-Ekonomska istraživanja,* 27(1), 169-180.

Driffill, J., Psaradakis, Z., & Sola, M. (1998). Testing the expectations hypothesis of the term structure using instrumental variables. *International Journal of Finance & Economics*, 3(4), 321-325.

Dumitrescu, E. I., & Hurlin, C. (2012). Testing for Granger non-causality in heterogeneous panels. *Economic Modelling*, 29(4), 1450-1460.

Easterly, W. (2002). The cartel of good intentions: the problem of bureaucracy in foreign aid. *The Journal of Policy Reform,* 5(4), 223-250.

Elango, B., & Jones, J. (2011). Drivers of insurance demand in emerging markets. *Journal of Service Science Research,* 3(2), 185-204.

Emirmahmutoglu, F., & Kose, N. (2011). Testing for Granger causality in heterogeneous mixed panels. *Economic Modelling*, 28(3), 870-876.

Enisan, A. A., & Olufisayo, A. O. (2009). Stock Market Development and Economic Growth: Evidence from Seven Sub-Sahara African Countries. *Journal of Economics and Business,* 61(2), 162-171.

Esho, N., Kirievsky, A., Ward, D., & Zurbruegg, R. (2004). Law and the determinants of property-casualty insurance. *Journal of risk and Insurance,* 71(2), 265-283.

Feyen, E., Lester, R., & Rocha, R. (2011). *What drives the development of the insurance sector? An empirical analysis based on a panel of developed and developing countries.* The World Bank.

Fisher, R. A. (1932). *Statistical methods for research workers* (4th ed.). Oliver and Boyd, Edinburgh.

Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of monetary economics*, *32*(3), 485-512.

Fountas, S., & Karanasos, M. (2006). The relationship between economic growth and real uncertainty in the G3. *Economic Modelling*, 23(4), 638-647.

Ghirmay, T. (2004). Financial Development and Economic Growth in Sub-Saharan African Countries: Evidence from Time Series Analysis. *African Development Review*, 16(3), 415-432.

Goldsmith, R. W. (1969). *Financial structure and development.* New Haven: Yale University Press.

Granger, C. W. (1969). Investigating Causal Relations by Econometric Models and Cross-Spectral Methods. *Econometrica: Journal of the Econometric Society*, 424-438.

Grossman, G. M., & Helpman, E. (1993). *Innovation and Growth in the Global Economy*. Cambridge: MIT press.

Gupta, R., Lahiani, A., Lee, C. C., & Lee, C. C. (2016). Asymmetric dynamics of insurance premium: The impacts of output and economic policy uncertainty *(No. 201673).*

Gyimah-Brempong, K. (2002). Corruption, economic growth, and income inequality in Africa. *Economics of Governance*, 3(3): 183-209.

Haiss, P., & Sümegi, K. (2008). The relationship between insurance and economic growth in Europe: A theoretical and empirical analysis. *Empirica*, 35(4), 405-431.

Han, L., Li, D., Moshirian, F., & Tian, Y. (2010). Insurance development and economic growth. *The Geneva Papers on Risk and Insurance-Issues and Practice*, 35(2), 183-199.

Harrington, S. E., & Niehaus, G. (2000). Volatility and Underwriting Cycles. In *Handbook of Insurance* (Pp. 657-686). Springer, Dordrecht.

Hatemi-J, A. (2011). Actest: Gauss Module to Apply Asymmetric Causality Tests.

Hatemi-J, A., Ajmi, A. N., El Montasser, G., Inglesi-Lotz, R., & Gupta, R. (2016). Research Output and Economic Growth in G7 Countries: New Evidence from Asymmetric Panel Causality Testing. *Applied Economics*, 48(24), 2301-2308.

Hicks, J. A. (1969). *A Theory of Economic History*. Clarendon Press Oxford, U.K.

Hosseini, H. M., & Kaneko, S. (2011). Dynamic sustainability assessment of countries at the macro level: A principal component analysis. *Ecological Indicators*, 11(3), 811-823.

Hosseini, H. M., & Kaneko, S. (2012). Causality between pillars of sustainable development: Global stylized facts or regional phenomena? *Ecological Indicators*, 14(1), 197-201.

Huang, A. Y. (2012). Asymmetric Dynamics of Stock Price Continuation. *Journal of Banking & Finance*, 36(6), 1839-1855.

Hurlin, C. (2008). Testing for Granger Non-Causality in Heterogeneous Panels. *Working Papers Halshs-00224434, Version 1*.

Ibe, R. C. (2014). Impact of Bank Credit on Economic Growth in Nigeria: Application of Reduced Vector Autoregressive (Var) Technique Dr. Bc Emecheta. *European Journal of Accounting Auditing and Finance Research*, 2(9), 11-21.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics*, 115(1), 53-74.

International Monetary Fund. (2016). World Economic Outlook database, Retrieved from https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx.

Ismihan, M., Dinçergök, B., & Cilasun, S. M. (2017). Revisiting the finance–growth nexus: the Turkish case, 1980–2010. *Applied Economics*, *49*(18), 1737-1750.

Istrefi, K., & Piloiu, A. (2014). Economic policy uncertainty and inflation expectations.

Jawadi, F., Bruneau, C., & Sghaier, N. (2009). Nonlinear Cointegration Relationships between Non-Life Insurance Premiums and Financial Markets. *Journal of Risk and Insurance*, 76(3), 753-783.

Kagochi, J. M., Nasser, O. M. A., & Kebede, E. (2013). Does Financial Development hold the Key to Economic Growth? The Case of Sub-Saharan Africa. *The Journal of Developing Areas*, 61-79.

Kang, W., & Ratti, R. A. (2013). Oil shocks, policy uncertainty and stock market return. *Journal of International Financial Markets, Institutions and Money*, 26, 305-318.

Karnizova, L., & Li, J. C. (2014). Economic policy uncertainty, financial markets and probability of US recessions. *Economics Letters*, 125(2), 261-265.

Kido, Y. (2016). On the link between the US economic policy uncertainty and exchange rates. *Economics Letters*, 144, 49-52.

Kikwebati, M. (2004). Stock Markets, Banking Systems, and Economic Growth in Sub-Saharan Africa.

King, R. G., & Levine, R. (1993a). Finance and growth: Schumpeter might be right. *The Quarterly Journal of Economics*, 108(3), 717-737.

King, R. G., & Levine, R. (1993b). Finance, entrepreneurship and growth. *Journal of Monetary Economics*, 32(3), 513-542.

Knight, F. H. (1921). *Risk, uncertainty and profit.* New York: Hart, Schaffner and Marx.

Knight, M., Loayza, N., & Villanueva, D. (1993). Testing the neoclassical theory of economic growth: a panel data approach. *Staff papers*, 40(3), 512-541.

Kok, S.C., Kogid, M., & Mulok, D. (2011). Insurance funds and economic growth in Malaysia: Further empirical evidence. *Interdisciplinary Review of Economics and Management*, 1(1): 1-9.

Kónya, L. (2006). Exports and Growth: Granger Causality Analysis on OECD Countries with a Panel Data Approach. *Economic Modelling*, 23(6), 978-992.

Körner, T., & Schnabel, I. (2009). *When do state-owned banks hamper economic growth?* 7th Workshop on "Money, Banking and Financial Markets," Halle Institute for Economic Research.

KPMG (2014) *Sector Report: Insurance in Africa*, Available at: http://docplayer.net/1176120-Sector-report-insurance-in-africa-kpmg-com-africa.html.

KPMG (2015) *KPMG Africa's Banking in Africa Report*, Available at: http://www.blog.kpmgafrica.com/kpmg-africas-banking-in-africa-report-2015/.

KPMG (2017) *Insurance Market in Africa: Where is the boom?*, Available at: http://www.blog.kpmgafrica.com/insurance-market-in-africa-where-is-the-boom/.

Kugler, M., & Ofoghi, R. (2005). *Does insurance promote economic growth? Evidence from the UK.* Money Macro and Finance (MMF) Research Group Conference, Money Macro and Finance Research Group.

Langbein, L., & Knack, S. (2010). The worldwide governance indicators: Six, one, or none? *The Journal of Development Studies,* 46(2), 350-370.

Le, T. H., Kim, J., & Lee, M. (2016). Institutional quality, trade openness, and financial sector development in Asia: An empirical investigation. *Emerging Markets Finance and Trade,* 52(5), 1047-1059.

Lee, C. C. (2011). Does insurance matter for growth: Empirical evidence from OECD countries. *The B.E. Journal of Macroeconomics,* 11(1): Article 18.

Lee, C. C. (2013). Insurance and real output: The key role of banking activities. *Macroeconomic Dynamics*, 17(2), 235-260.

Lee, C. C., & Chang, C. H. (2015). Financial policy and insurance development: Do financial reforms matter and how? *International Review of Economics and Finance*, 38, 258-278.

Lee, C. C., & Chiu, Y. B. (2012). The impact of real income on insurance premiums: Evidence from panel data. *International Review of Economics & Finance*, 21(1), 246-260.

Lee, C. C., & Hsieh, M. F. (2013). The impact of bank capital on profitability and risk in Asian banking. *Journal of International Money and Finance*, 32, 251-281.

Lee, C. C., Chiu, Y. B., & Chang, C. H. (2013). Insurance demand and country risks: A nonlinear panel data analysis. *Journal of International Money and Finance*, 36, 68-85.

Lee, C. C., Lee, C. C., & Chiu, Y. B. (2013). The link between life insurance activities and economic growth: Some new evidence. *Journal of International Money and Finance*, 32: 405-427.

Leippold, M., & Matthys, F. (2015). Economic Policy Uncertainty and the Yield Curve.

Levine, R. (1997). Financial development and economic growth: Views and agenda. *Journal of Economic Literature*, 35(2), 688-726.

Levine, R., Loayza N., & Beck, T. (2000). Financial intermediation and growth: Causality and causes. *Journal of Monetary Economics*, 46(1), 31-77.

Liang, Q., & Jian-Zhou, T. (2006). Financial development and economic growth: Evidence from China. *China Economic Review*, 17(4), 395-411.

Liu, G. C., Lee, C. C., & He, L. (2016). The synergistic effects between insurance and credit markets on economic growth: Evidence from China. *Global Economic Review*, 45(1), 1-18.

Liu, G., & Zhang, C. (2016). The dynamic linkage between insurance activities and banking credit: Some new evidence from global countries. *International Review of Economics and Finance*, 44, 40-53.

Liu, L., & Zhang, T. (2015). Economic policy uncertainty and stock market volatility. *Finance Research Letters*, 15, 99-105.

Loayza, N. V., & Ranciere, R. (2006). Financial development, financial fragility, and growth. *Journal of Money, Credit and Banking*, 38(4), 1051-1076.

Lovegrove, A., Fuchs, M., Long, M., Schwartz, J., Weaver, J., Didenko, R., & Denton-Clark, J. (2007). Financial Sector Integration in Two Regions of Sub-Saharan Africa: How Creating Scale in Financial Markets can Support Growth and Development. *Making Finance Work for Development, World Bank.*

Lucas Jr, R. E. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22(1), 3-42.

Lucas Jr, R. E., & Prescott, E. C. (1971). Investment under uncertainty. *Econometrica: Journal of the Econometric Society*, 659-681.

Makinde, H. O. (2016). Implications of Commercial Bank Loans on Economic Growth in Nigeria (1986-2014). *Journal of Emerging Trends in Economics and Management Sciences*, 7(3), 124-136.

Mamman, A., & Hashim, Y. A. (2014). Impact of Bank Lending on Economic Growth in Nigeria. *Research Journal of Finance and Accounting*, 5(18), 174-182.

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics*, 107(2), 407-437.

Mantis, G., & Farmer, R. N. (1968). Demand for life insurance. *Journal of Risk and Insurance,* 247-256.

Mason-Jones, R., & Towill, D. R. (2000, January). Coping with uncertainty: Reducing “bullwhip” behaviour in global supply chains. In *Supply Chain Forum: An International Journal* (Vol. 1, No. 1, pp. 40-45). Taylor and Francis.

McKinnon, R. I. (1973). *Money and Capital in Economic Development.* Washington: Brookings Institution Press.

Mensah, E., Abor, J., Aboagye, A. Q. Q., & Adjasi, C. K. (2012). Enhancing the Economic Growth of Africa: Does Banking Sector Efficiency Matter? In

Finance and Development in Africa (Pp. 1-23). Emerald Group Publishing Limited.

Miller, M. H. (1998). Financial Markets and Economic Growth. *Journal of Applied Corporate Finance*, 11, 8-14.

Mukhopadhyay, B., Pradhan, R. P., & Feridun, M. (2011). Finance–growth nexus revisited for some Asian countries. *Applied Economics Letters*, 18(16), 1527-1530.

Ndoricimpa, A. (2017). Threshold effects of inflation on economic growth in Africa: Evidence from a dynamic panel threshold regression approach. *Working Paper No. 249.* African Development Bank Group.

Ngare, E., Nyamongo, E. M., & Misati, R. N. (2014). Stock Market Development and Economic Growth in Africa. *Journal of Economics and Business*, 74, 24-39.

Nyasha, S. (2015a). Are Banks and Stock Markets Complements or Substitutes? Empirical Evidence from Three Countries. URL: Http://Hdl.Handle.Net/10500/18926 *Working Paper* (accessed July 16, 2018)

Nyasha, S. (2015b). Banks, Stock Market Development and Economic Growth in Kenya: An Empirical Investigation. URL: http://hdl.handle.net/10500/19635 (accessed online on July 16, 2017)

Nyasha, S., & Odhiambo, N. M. (2014). Do Banks and Stock Markets Spur Economic Growth? Kenya's Experience. *International Journal of Sustainable Economy*, 7(1), 54-65.

Nyasha, S., & Odhiambo, N. M. (2015a). The Impact of Banks and Stock Market Development on Economic Growth in South Africa: An ARDL-Bounds Testing Approach.

Nyasha, S., & Odhiambo, N. M. (2015b). Banks, Stock Market Development and Economic Growth in South Africa: A Multivariate Causal Linkage. *Applied Economics Letters,* 22(18), 1480-1485.

Nyasha, S., & Odhiambo, N. M. (2017). Banks, Stock Market Development and Economic Growth in Kenya: An Empirical Investigation. *Journal of African Business*, 18(1), 1-23.

Odhiambo, N. M. (2007). Supply-Leading versus Demand-Following Hypothesis: Empirical Evidence from Three SSA Countries. *African Development Review*, 19(2), 257-280.

Olayungbo, D. O. (2015). Insurance and economic growth nexus in Nigeria: Asymmetric non-linear relationship under heterogeneous agents. *African Development Review*, 27(3): 248-261.

Olayungbo, D. O., & Akinlo, A. E. (2016). Insurance Penetration and Economic Growth in Africa: Dynamic Effects Analysis using Bayesian TVP-VAR Approach. *Cogent Economics & Finance*, 4(1), 1150390.

Oluitan, R. O. (2012). Bank Credit and Economic Growth: Evidence from Nigeria. *International Business and Management,* 5(2), 102-110.

Omoke, P. C. (2012). Insurance market activity and economic growth: Evidence from Nigeria. *Acta Universitatis Danubius: Oeconomica,* 8(2): 34-47.

Outreville, J. F. (1990). The economic significance of insurance markets in developing countries. *The Journal of Risk and Insurance*, 57(3), 487-498.

Outreville, J. F. (2011). The relationship between insurance growth and economic development: 80 empirical papers for a review of the literature. *ICER Working Paper No. 12/2011*. ICER-International Centre for Economic Research.

Owusu, E. L., & Odhiambo, N. M. (2014). Stock Market Development and Economic Growth in Ghana: An ARDL-Bounds Testing Approach. *Applied Economics Letters*, 21(4), 229-234.

Pan, G., & Su, C. W. (2012). *The relationship between insurance development and economic growth: A cross-region study for China.* 2012 China International Conference on Insurance and Risk Management.

Panopoulou, E. (2009). Financial variables and euro area growth: A non-parametric causality analysis. *Economic Modelling*, 26(6), 1414-1419.

Pesaran, M. H. (2004). General Diagnostic Tests for Cross Section Dependence in Panels. *CESIFO Working Paper Series No. 1229; IZA Discussion Paper No. 1240.* Available At: Http://Ssrn.Com/Abstract=572504 (Accessed On 08/06/2018).

Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, 22(2), 265-312.

Pesaran, M. H., & Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics,* 68(1), 79-113.

Pesaran, M. H., & Yamagata, T. (2008). Testing Slope Homogeneity in Large Panels. *Journal of Econometrics*, 142(1), 50-93.

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, 94(446), 621-634.

Pesaran, M. H., Ullah, A., & Yamagata, T. (2008). A bias-adjusted LM test of error cross-section independence. *The Econometrics Journal*, 11(1), 105-127.

Pradhan, R. P., Arvin, B. M., Norman, N. R., & Nishigaki, Y. (2014). Does banking sector development affect economic growth and inflation? A panel cointegration and causality approach. *Applied Financial Economics*, 24(7), 465-480.

Pradhan, R. P., Arvin, B. M., Norman, N. R., Nair, M., & Hall, J. H. (2016). Insurance penetration and economic growth nexus: Cross-country evidence from ASEAN. *Research in International Business and Finance*, 36, 447-458.

Pradhan, R. P., Arvin, M. B., & Norman, N. R. (2015). Insurance development and the finance-growth nexus: Evidence from 34 OECD countries. *Journal of Multinational Financial Management*, 31, 1-22.

Pradhan, R. P., Arvin, M. B., Bahmani, S., Bennett, S. E., & Hall, J. H. (2017). Insurance–growth nexus and macroeconomic determinants: Evidence from middle-income countries. *Empirical Economics*, 52(4), 1337-1366.

Pradhan, R. P., Arvin, M. B., Hall, J. H., & Bahmani, S. (2014). Causal nexus between economic growth, banking sector development, stock market development, and other macroeconomic variables: The case of ASEAN countries. *Review of Financial Economics*, 23(4), 155-173.

Pradhan, R. P., Arvin, M. B., Nair, M., Hall, J. H., & Gupta, A. (2017). Is there a link between economic growth and insurance and banking sector activities in the G-20 countries? *Review of Financial Economics*, 33(1), 12-28.

Pradhan, R. P., Bahmani, S., & Kiran, M. U. (2014). The dynamics of insurance sector development, banking sector development and economic growth: Evidence from G-20 countries. *Global Economics and Management Review*, 19(1-2), 16-25.

Pradhan, R. P., Dasgupta, P., & Samadhan, B. (2013). Finance, development and economic growth in BRICS: A panel data analysis. *Journal of Quantitative Economics*, 11(1-2), 308-322.

Pradhan, R. P., Kiran, M. U., Dash, S., Chatterjee, D., Zaki, D. B., & Maradana, R. (2015). Development of insurance sector and economic growth: The G-20 experience. *South Asian Journal of Management*, 22(1), 73-96.

Pradhan, R. P., Mukhopadhyay, B., Gunashekar, A., Samadhan, B., & Pandey, S. (2013). Financial development, social development, and economic growth: The causal nexus in Asia. *Decision*, 40(1-2), 69-83.

Pradhan, R. P., Tripathy, S., Chatterjee, D., Zaki, D. B., & Mukhopadhyay, B. (2014). Development of banking sector and economic growth: The ARF experience. *Decision*, 41(3), 245-259.

Quagliariello, M. (2009). Macroeconomic uncertainty and banks' lending decisions: The case of Italy. *Applied Economics*, 41(3), 323-336.

Rajan, R. G., & Zingales, L. (1998). Financial development and growth. *The American Economic Review*, 88(3), 559-586.

Rebelo, S. (1991). Long-run policy analysis and long-run growth. *Journal of Political Economy*, 99(3), 500-521.

Robinson, J. (1952). The generalization of the general theory. In *The rate of interest and other essays* (pp. 67-142). London: MacMillan.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002-1037.

Roodman, D. (2006). How to do xtabond2: An introduction to difference and system GMM in Stata. *Working Paper No. 103.* Center for Global Development.

Roodman, D. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*, 71(1), 135-158.

Rule, D. (2001). Risk transfer between banks, insurance companies and capital markets: An overview. *Financial Stability Review*, 11, 137-159.

Samargandi, N., Fidrmuc, J., & Ghosh, S. (2015). Is the relationship between financial development and economic growth monotonic? Evidence from a sample of middle-income countries. *World Development*, 68, 66-81.

Sarafidis, V., & Wansbeek, T. (2012). Cross-sectional dependence in panel data analysis. *Econometric Reviews,* 31(5): 483-531.

Schumpeter, J. A. (1911). *The Theory of Economic Development; An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle.* Translated by Opie, R. Harvard University Press, Cambridge, p. 1934.

Schumpeter, J. A. (1934). *The theory of economic development.* Cambridge, MA: Harvard University Press.

Sepehrdoust, H., & Ebrahimnasab, S. (2015). Institutional practices and life insurance consumption: An analysis using developing countries scores. *Trends in Applied Sciences Research*, 10(2), 99-108.

Seyoum, M., Wu, R., & Lin, J. (2014). Foreign direct investment and trade openness in Sub-Saharan economies: A panel data Granger causality analysis. *South African Journal of Economics*, 82(3), 402-421.

Shaw, E. S. (1973). *Financial Deepening in Economic Development.* New York: OUP.

Shen, C. H., & Lee, C. C. (2006). Same financial development yet different economic growth: Why? *Journal of Money, Credit and Banking,* 38(7): 1907-1944.

Sibindi, A. B. (2014). Life insurance, financial development and economic growth in South Africa. *Risk Governance & Control: Financial Markets & Institutions,* 4(3), 7-15.

Sibindi, A.B., & Godi, N. J. (2014). Insurance sector development and economic growth: Evidence from South Africa. *Corporate Ownership & Control,* 11(4), 530-538.

Skipper, H. D. (1997). Foreign insurers in emerging markets: Issues and concerns. *IIF Occasional Paper No. 1.* International Insurance Foundation.

Song, F., & Thakor, A. V. (2010). Financial system architecture and the co-evolution of banks and capital markets. *The Economic Journal,* 120(547), 1021-1055.

Stengos, T., & Liang, Z. (2005). Financial intermediation and economic growth: a semiparametric approach. In *New trends in macroeconomics* (pp. 39-52). Springer, Berlin, Heidelberg.

Swamy, P. A. (1970). Efficient Inference in a Random Coefficient Regression Model. *Econometrica: Journal of the Econometric Society*, 38(2), 311-323.

Swiss Re Sigma. (2016). World Insurance premiums [Data file], Retrieved from www.sigma-explorer.com.

Tennant, D., & Abdulkadri, A. (2010). Empirical exercises in estimating the effects of different types of financial institutions' functioning on economic growth. *Applied Economics*, 42(30), 3913-3924.

The World Bank. (2016). World Development Indicators [Data file], Retrieved from https://data.worldbank.org/indicator.

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of econometrics*, 66(1-2), 225-250.

Transparency International. (2016). Corruption Perceptions Index [Data file], Retrieved from https://www.transparency.org/news/feature/corruption_perceptions_index_2016.

Treerattanapun, A. (2011). The impact of culture on non-life insurance consumption.

Truett, D. B., & Truett, L. J. (1990). The demand for life insurance in Mexico and the United States: A comparative study. *Journal of Risk and Insurance*, 321-328.

Ukpong, M. S., & Acha, I. A. (2017). Insurance and Economic Development in Nigeria: Co-Integration and Causality Analysis. *Scholedge International Journal of Management & Development ISSN 2394-3378*, 4(4), 28-39.

Ward, D., & Zurbruegg, R. (2000). Does insurance promote economic growth? Evidence from OECD countries. *The Journal of Risk and Insurance*, 67(4), 489-506.

Webb, I. P., Grace, M. F., & Skipper, H. D. (2002). The effect of banking and insurance on the growth of capital and output. *Working Paper No. 02-1*. Centre for Risk Management and Insurance, Robinson College of Business, Georgia State University, Atlanta.

Westerlund, J. (2007). Testing for error correction in panel data. *Oxford Bulletin of Economics and statistics*, 69(6), 709-748.

Wolde-Rufael, Y. (2009). Re-examining the financial development and economic growth nexus in Kenya. *Economic Modelling*, 26(6), 1140-1146.

Zhang, J., Wang, L., & Wang, S. (2012). Financial development and economic growth: Recent evidence from China. *Journal of Comparative Economics*, 40(3), 393-412.

Zou, H., & Adams, M. B. (2006). The corporate purchase of property insurance: Chinese evidence. *Journal of Financial Intermediation*, 15(2), 165-196.