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Insurance-growth nexus in Ghana: An autoregressive distributed lag bounds cointegration approach

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Abstract

This paper examines the long-run causal relationship between insurance penetration and economic growth in Ghana from 1990 to 2010. Using the autoregressive distributed lag (ARDL) bounds approach to cointegration by Pesaran et al. (1996, 2001), the study finds a long-run positive relationship between insurance penetration and economic growth which implies that funds mobilized from insurance business have a long run impact on economic growth. A unidirectional causality was found to run from aggregate insurance penetration, life and non-life insurance penetration to economic growth to support the 'supply-leading' hypothesis. The findings have implications for insurance market development in Ghana.

JEL classification: C22 ;G22 ;O11 ;O16

Keywords: Insurance; Economic growth; ARDL; Causality; Ghana; Africa

1. Background of the study

The importance of insurance business is not only limited to risk absorption, allocation and transfer but also the mobilization of funds for use by financial markets to induce investment and growth. Despite the obvious benefits of the insurance businesses to an economy, insurance penetration among African countries[2] still remain very low.[3] This does not only hinder the continent from optimizing the benefits of insurance activities to businesses and individuals but also results in the loss in the ability of these developing countries to mobilize the funds from insurance business for the usage by financial markets. The growth in global insurance premiums by 82%[4] between 1997 and 2004 was driven by emerging markets with growth rate of 57% compared to 27% for industrialized countries (Arena, 2008). This underlines the growing importance of the insurance industry globally and more importantly in emerging markets as a means for capital accumulation. This has accordingly shifted the focus of academic researchers to the examination of the impact of insurance market development on economic growth from authors such as Ward and Zurbruegg (2000), Webb et al. (2002), Liedtke (2007) and Arena (2008).

With the long held proposition that finance has a major role to play in economic growth, little is known empirically on the impact of insurance on the growth of African economies. The transmission mechanism between the finance-growth nexus has been hypothesized to be either 'supply leading' which asserts that economic growth is caused by developments in the financial sector or 'demand following' where financial development is granger caused by economic growth. The impact of banking and stock market developments on economic growth has received enormous attention in finance-growth nexus literature (King and

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[1] Tel.: +233 264766174.
[2] Excluding South Africa.
[3] Insurance penetration in Africa was 1.2% in 2011 (Swiss Re, 2012).
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[4] 104% and 60% growth in the life and non-life businesses, respectively. Computations were based on data from Swiss Re.

Levine, 1993a,b; Levine, 1999; Levine and Zervos, 1998; Beck and Levine, 2004; Adjasi and Biekpe, 2006; Seetanah et al., 2009) in both developed and developing countries.

Similar to studies on the banks and stock markets, the causality between insurance penetration and growth still remain inconclusive. While some studies have found causality running from insurance to growth (Ward and Zurbruegg, 2000; Ghosh, 2013; Chang et al., 2013) others have found causality from growth (Horng et al., 2012; Chang et al., 2013) with some finding evidence of bi-directional causality between insurance penetration and growth (Ward and Zurbruegg, 2000; Lee, 2011; Chang et al., 2013). Other studies have also found no evidence of causality (Chang et al., 2013). Despite the importance of insurance to the stability of financial systems[5] through the provision of risk management services, little is known of its linkage with growth in Africa. The studies examining insurance-growth nexus have mainly been based on data from developed economies (Kugler and Ofoghi, 2005; Han et al., 2010; Lee, 2011). Most studies examining the finance-growth nexus in Africa (Adjasi and Biekpe, 2006; N'Zue, 2006; Odhiambo, 2007; Seetanah, 2009; Ahmed and Wahid, 2011; Kagochi et al., 2013) have focused on bank and stock market development. Although few studies have been carried out on the insurance industry in Ghana (Akotey et al., 2011, 2013; Ansah-Adu et al., 2012; Akotey and Abor, 2013), they have mostly focused on micro level characteristics. None of the studies has thus far explored the relationship with economic growth let alone the causal link between the two. This study therefore pioneers the study on insurance markets at the macro level in Ghana. While the insurance-growth nexus has varied in the developed country studies, to the best of author's knowledge, no study has explored the causality between insurance and growth in an African context. This study therefore seeks to fill this obvious gap in empirical literature by providing further evidence on causal link between insurance penetration and economic growth from a developing African country.

In recognition of the need for this study, the autoregressive distributed lag (ARDL) bounds approach to cointegration was employed to test for the existence of level relationship between insurance penetration and economic growth as well as estimating both short-run and long-run relationships. Additionally, the fully modified ordinary least squares (FMOLS) of Phillips and Hansen (1990) was also employed to test the robustness of the of the long-run ARDL estimates. These two techniques have been found to be reliable for small sample sizes estimations as employed in this study. Finally, causality test was employed to test the 'demand-following' and 'supply-leading' for insurance-growth in Ghana.

The main results of this study indicate that aggregate insurance consumption has long-run positive impact on economic growth whereas non-life insurance activities contributes to higher economic growth compared to life insurance activities in the long-run. Additionally, causality test finds evidence in support of the 'supply-leading' hypothesis in respect of aggregate insurance consumption, life and non-life insurance consumption to imply that developments in insurance markets precedes economic growth in Ghana.

The rest of the paper is organized as: Section 2 provides an overview of insurance penetration in Ghana, Section 3 examines the theoretical basis and empirical studies on insurance-growth nexus. Section 4 outlines the methodology on the ARDL approach to cointegration. Section 5 discusses the empirical results while Section 6 focuses on conclusions and policy implications of the findings.

2. Overview of insurance in Ghana

The Royal Guardian Enterprise Insurance[6] was established in 1924 to pioneer insurance business in Ghana. Subsequently, the Gold Coast Insurance Company, General Insurance Company and Cooperative Insurance Society were established in 1955, 1957 and 1958, respectively. A merger between Coast Insurance Company and Cooperative Insurance Society in 1962 led to the birth of the State Insurance Company (SIC). Currently, there are 25 Non-Life companies, 18 Life companies, 2 Reinsurance companies, 54 Brokerage companies, 1 Loss Adjuster, 1 Reinsurance Broker and about 4000 insurance agents (http://www.nicgh.org). First regulated under the Insurance Law 1989 (PNDC Law 227) and currently operating under the Insurance Act, 2006 (Act 724), the industry is regulated by the National Insurance commission (NIC). In the new Act, an upward review of the minimum capital requirement for an insurance company from the current cedi equivalent of US$1 million to the cedi equivalent of US$5 million. Table 2.1 presents the premium growth for both Life and non-life businesses from 2003 to 2011. While the non-life insurance business continues to generate more premium income compared to the life business, the share exhibited continuous decline. In 2003, total non-life insurance was 80.12% of gross insurance premiums compared to the life business of 19.88%. By end of 2011, the share of non-life business had fallen to 57.01% while that of the life business had rising up to 42.99% from 19.88% in 2003. This attest to growing importance of the life insurance sub-sector within the insurance industry.

As shown in Table 2.1, non-life premium income grew by 32.3% in 2011 whiles that of the life sector premium income grew by 44.2% in 2011 backing a trend of consistent growth from 2003 as depicted in the table. Overall, the growth in the life sub-sector has consistently out-grown the non-life sub-sector. The growth in the life businesses is attributed to high rate of product innovation and development in the life sub-sector which has shifted the focus of life policies from policies to cover for death to include includes endowment, funeral and other policies which serves as savings plans for policy holders.

In analyzing the investment portfolio of the industry over a snap shot period from 2010 to 2011, Table 2.2 shows that both life and non-life businesses has more short-term investments compared to their long-term investments. Life businesses however held more short investments compared to long-term

[5] Skipper (1997).

[6] Currently known as Enterprise Insurance Company Limited.

Table 2.1
Premium growth by insurance sub-sectors (2003–2011).

Years	Life (% of gross premiums)	Growth rate (%)	Non-life (% of gross premiums)	Growth rate (%)
2003	19.88	–	80.12	–
2004	24.11	57.4	75.96	29.7
2005	25.57	40.1	74.51	32.1
2006	30.24	58.7	69.85	34.2
2007	32.23	38.7	67.77	28.2
2008	32.79	35.1	67.21	31.6
2009	35.65	34	64.35	18
2010	40.89	53.2	59.11	22.6
2011	42.99	44.2	57.01	32.3

Source: National Insurance Commission (2003–2011).

investments. Most of the life long-term investments are held in equity securities, with investments in listed companies accounting for 61.03% and 41.47% of long-term investments in 2010 and 2011 respectively whereas equity investments in non-listed firms accounts for 28.43% and 19.11% in 2010 and 2011, respectively. With respect to short-term investments, both life and non-life businesses also hold more in treasury bills and fixed deposits.

The life insurance sub-sector has more short-term investments compared to their long-term investments. This implies indicates while they may be more liquid in the short term, the sustainability of the business in the long term could be endangered due inadequate long-term investments to cater for the long-term liabilities commonly associated with the business structure. Comparing investment across both sectors, while non-life businesses hold longer-term investments compared to life businesses, the life business had more short-term investments compared to the non-life sub-sector.

Fig. 2.1 examines the trend of aggregate insurance penetration, life insurance penetration and non-life from 1990 to 2010. All the three indicators of insurance activity in Ghana exhibited a rising trend with some breaks which points to existence underwriting cycles.[7] Table 2.3 depicts insurance penetration in six (6) selected African countries from 2005 to 2010. With the exception of South Africa, insurance penetration in the other African countries remains very low. Insurance premiums in South Africa averaged 13.146% of its gross domestic product from 2005 to 2010 making South Africa the country with one of the highest insurance penetration in the world. Ghana lags behind with insurance penetration accounting for less than one percent of its gross domestic product over the 6-year period.

Table 2.2
Investment structure of insurance industry (2010–2011).

	Life		Non-life	
	2011	2010	2011	2010
Long-term investments[a]				
Quoted shares (%)	41.57	61.03	57.13	81.04
Unquoted shares (%)	19.11	28.43	40.17	14.46
Government bonds (%)	26.12	4.64		1.45
Others (%)	5.19	5.61	1.02	1.87
Corporate bonds (%)	8.00	0.30	1.68	1.17
Short-term investments[b]				
Treasury bills (%)	17.95	18.58	51.97	41.31
Fixed deposits (%)	80.74	79.24	47.20	56.48
Call accounts (%)	–	1.71	0.67	0.57
Unit trusts (%)	0.01	0.48	–	–
Bonds (%)	1.31	–	0.15	1.64
Long-term investments (% of TI)	36.55	30.33	42.08	47.08
Short-term investments (% of TI)	63.45	69.67	57.92	52.92

Source: Author's Computation from NIC (2011) report.
TI represents total investments (short-term and long-term investments).
[a] All figures are expressed as percentage of long-term investments.
[b] All figures are expressed as percentage of short-term investments

3. Theoretical review of finance-growth nexus

Theoretical literature has proposed three schools of thought on the transmission mechanism between finance and growth. The first school of thought known as the 'demand-following' hypothesis posits that the growth in the real economy stimulates the demand for financial services and that an expanding economy creates the demand for financial services (Robinson, 1952; Romer, 1990). As real income rises, households and firms demand for financial services increases, hence the development of the financial sector through the creation financial assets and liabilities.

However, 'supply-leading' hypothesis argues that well developed financial markets provides avenue for efficient utilization of funds from surplus spending units to deficit spending units to propel growth (Patrick, 1966). Through financial systems, the cost of acquiring information is reduced to ensure effective allocation of resources.[8] This would enable easy access to information on the performance of investment portfolios, facilitate funds transfer between deficit and surplus spending units and risk diversification. These functions of financial systems help to maximize resource usage, leading to increased investments and growth. The third school of thought, known as the "feedback" hypothesis posits that causality runs from both directions. It is argued that well-developed financial systems promote economic

[7] The underwriting cycle refers to periods of high and low supply of insurance services.

[8] The ability of investors to invest in profitable firms depends largely on their access to good information about market conditions. This information is costly for individual investors to access without financial markets.

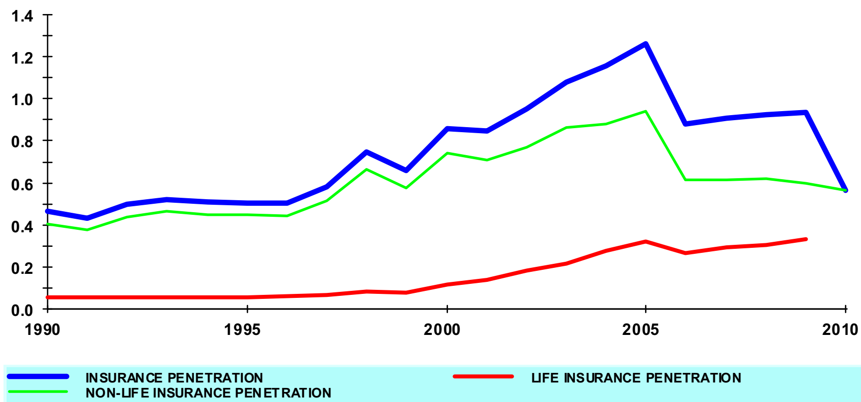

Fig. 2.1. Insurance penetration in Ghana (1990–2010).
Source: Author's Computation based on GFD Database, 2013.

Table 2.3
Insurance penetration in selected African countries (2002–2010).

	2005	2006	2007	2008	2009	2010	Average
Cote D' Ivoire	1.207	1.212	1.239	1.346	1.325	1.433	1.294
Ghana	1.264	0.878	0.905	0.922	0.933	0.563	0.911
Malawi	1.476	1.517	1.658	1.757	2.005	1.052	1.578
Nigeria	0.538	0.508	0.504	0.638	0.754	0.682	0.604
Tunisia	1.409	1.476	1.491	1.489	1.484	1.663	1.502
South Africa	12.315	14.193	13.087	13.491	14.195	11.595	13.146

Source: Author's Computation based on GFD database, 2013.

expansion through technological changes, product and services innovation (Schumpeter, 1912) which stimulates demand for financial services (Levine, 1997). In responding to the demands for financial services, growth is also enhanced resulting in the feedback causality (Luintel and Khan, 1999).

The insurance industry, as a financial intermediary, provides risk management services to businesses and household. Through this function, funds mobilized on premium generation are made available to other agents of the financial system for investments purposes. Additionally, the risk management functions of insurance business ensure business continuity which is necessary to promote enterprise and business growth. However, growth in real economy could also have direct impact on insurance consumption. Higher incomes and profits by businesses will tend to stimulate their demand for insurance products. As individual earn higher salaries through economic expansion, their ability to purchase insurance products is enhanced. For businesses, as the growth in the real economy leads to greater expansion in their operations, so does their risk levels increases. Hence, the need for risk transfers in the form insurance consumption.

3.1. *Insurance-growth nexus: related studies*

The application of the finance-growth nexus to insurance data has received scant attention in empirical literature. Ward and Zurbruegg (2000) examined the insurance-growth nexus for OECD countries from 1961 to 1996. Through cointegration analysis, uni-directional causality was found to run from insurance consumption to economic growth in Canada and Japan whereas a weaker bi-directional relationship was found for Italy. There was however no evidence of causality for the other countries.[9] However, Kugler and Ofoghi (2005) find a long-run relationship between insurance market development and economic growth for most components using Johansen's cointegration tests. The author's analysis was based premium classification for all business lines. This result was inconsistent with Ward and Zurbruegg (2000) which the authors attributed to an aggregation problem.

Arena (2008) in examining the causality between insurance consumption and economic growth employed the generalized method of moments (GMM) on a panel data of 55 countries from 1976 to 2004. The author finds that insurance consumption to have significant positive causal effect on economic growth to be driven by high-income countries for life insurance consumption whereas non-life insurance consumption was caused by both high-income and developing countries drive the results. In examining the historical relationship between bank lending, insurance and growth in Sweden using annual time-series data from 1830 to 1998, Adams et al. (2009) conclude that insurance consumption granger caused both economic growth and bank lending which could be attributed to capital accumulation.

Han et al. (2010) analyzed the effect of insurance consumption on economic growth on a dataset of 77 developing and developed countries from 2004 to 2005. By separating aggregate insurance penetration into life and non-life density, they estimated a system GMM with both developing and devel-

[9] Australia, Austria, France, Switzerland, UK and USA.

oped country samples. They found the coefficients of insurance density (life and non-life) to be significantly higher for developing countries compared to developed countries underlying the importance of insurance to growth in developing countries. By employing panel cointegration techniques, Lee (2011) examined the relationship between insurance consumption and growth for selected OECD countries from 1979 to 2006. The author finds bi-directional long-run and short-run relationship between insurance consumption and economic growth. However, by disaggregating insurance consumption into life and non-life insurance consumption, non-life penetration was found to have greater impact on growth compared to life insurance penetration.

Azman-Saini and Smith (2011) also employed a panel data on 51 developed and developing countries from 1981 to 2005 to examine the impact of insurance market development on economic growth. The authors found that a positive relationship between insurance development and economic growth which they explained is transmitted through improvements in productivity for developed countries whereas the channel for developing countries was through capital accumulation for investments. Horng et al. (2012) employed the Vector Autoregressive on Taiwanese data from 1961 to 2006 to examine the insurance-growth nexus by testing the demand-following hypothesis versus supply-leading hypothesis. The authors found short-run causality running from economic growth to insurance demand to support the 'demand-following' hypothesis. In employing the returns on insurers stock to proxy for insurance market activity, Zhou et al. (2012) examined the linkage between insurance penetration and economic growth as well as how law environment and governance quality moderates the insurance-growth nexus. Through a dynamic panel estimation, the authors find that well defined law environment and governance quality improves the impact of insurance penetration in promoting economic growth with the effect more pronounced in developed markets than developing markets. Their results also support that the supply leading hypothesis.

More recently, Chang et al. (2013) applied the bootstrap panel Granger causality test in investigating the link between insurance penetration and economic growth for 10 OECD countries[10] from 1979 to 2006. Evidence of uni-directional causality running from insurance to growth was found for some countries[11] with causality from growth to insurance also found for Canada,[12] Italy[13] and the USA.[14] Bi-directional causality was only found for USA with no evidence of causality found for Belgium,[15] Canada,[16] Italy[17] and Sweden.[18] Ghosh (2013) also examined the insurance-growth nexus from the life insurance penetration in India to establish long-run causal relationships. By employing vector autoregressive model, the author finds the existence of level relationship between life insurance penetration and economic growth as well as a uni-directional causality running from life insurance penetration to economic growth.

In a survey of 85 on the insurance-growth nexus, Outreville (2013) identified 15 studies that explored the causal link between insurance penetration and economic growth with most of the studies applying a panel data analysis. The few time series studies were carried on in insurance markets in UK, Singapore, Sweden and Malaysia. In summary, both theory and empirical studies remain inconclusive on the direction of causality between finance and economic growth, more so on the relationship between insurance and economic growth which has received little attention especially in Africa. Against this backdrop, this paper contributes to existing literature by examining the causality between insurance penetration and economic growth from a developing country's perspective. This study adds to scant literature on the insurance-growth nexus by finding an answer to the question, is insurance market development in Ghana 'demand-following' or 'supply-leading' or both?

4. Methodology

4.1. Data

This study employs annual time-series data on aggregate, life and non-life insurance penetration, GDP growth, trade volume, gross fixed capital formation and consumer price index as a proxy for inflation from 1990 to 2010. Data on insurance penetration were sourced from the global financial development database (GFDD) from the World Bank website while the other macroeconomic variables were sourced from the world development indicators (WDI) database. The study period was influenced by the starting period for the data on the insurance penetration from 1990 in the database.

4.2. Empirical model

In estimating the empirical relationship between insurance penetration and economic growth in Ghana, the linear time-series model of Han et al. (2010), Horng et al. (2012) and Ghosh (2013) was used. The control variables namely gross capital formation,[19] inflation and trade volume were adopted from Adjasi and Biekpe (2006) and Enisan and Olufisayo (2009) studies on stock market development and economic growth in Africa. The three variables were used as control since their omission could bias the results of the causality and cointegration analysis and lead to simultaneity bias (Gujarati, 1995). Inflation is employed because of its role in influencing aggregate demand. Trade, which captures openness of an economy, is important in stimulating growth through the extension of the market, the

[10] France, Japan, Netherlands, Switzerland, UK, Canada, Italy, USA, Sweden and Belgium.

[11] For France, Japan, Netherlands, Switzerland, and UK.

[12] From only life insurance penetration to growth.

[13] From total and life insurance penetration.

[14] From aggregate and non-life insurance.

[15] For all forms of insurance (aggregate, life and non-life insurance).

[16] Aggregate and non-life insurance consumption.

[17] Non-life insurance consumption.

[18] Life insurance consumption.

[19] Gross capital formation used instead of gross fixed capital formation as employed by Adjasi and Biekpe (2006) due data unavailability for Ghana over the study period.

Table 4.1
Variables description.

Variables	Measurement	Symbol
Economic growth	$\Delta\log(GDP_t)$	*growth*
Insurance penetration	log(total insurance premium/GDP)	$\ln ip$
Life insurance penetration	log(life insurance premium/GDP)	$\ln lip$
Non-life insurance penetration	log(non-life insurance premium/GDP)	$\ln nlip$
Investments	log(gross capital formation)	$\ln gcap$
Inflation	$\Delta\log(CPI_t)$	*inf*
Trade	log(exports + imports)/GDP	$\ln trd$

labour division improved and the productivity increased. Gross capital formation reflects the stock of wealth accumulation for investments to enhance economic growth.

The functional form of the model is specified below

$$growth_t = \beta' IP_t + \gamma X_t + \varepsilon_t \quad (1)$$

where $growth_t$ is economic growth in year t, IP_t is the insurance penetration (further decomposed into life and non-life insurance penetration) in year t, X is a vector of controls (gross capital formation, inflation and trade) and ε_t is a disturbance term. The variables in Eq. (1) are transformed by their logarithm to make for easy interpretation of regression coefficients in standardized form of percentage to form Eq. (2).

$$growth_t = \alpha_0 + \alpha_1 \ln ip_t + \alpha_2 \ln gcap_t + \alpha_3 \ln f_t + \alpha_4 \ln trd_t + \varepsilon_t \quad (2)$$

According to Kugler and Ofoghi (2005), the risk transfer and indemnification functions of insurance is captured by its non-life component whereas the financial intermediation aspect is reflected in the life insurance business. The components of aggregate insurance are thus used to model Eqs. (3) and (4) below to capture their respective relationships with economic growth.

$$growth_t = \beta_0 + \beta_1 \ln lip_t + \beta_2 \ln gcap_t + \beta_3 inf_t + \beta_4 \ln trd_t + \in_t \quad (3)$$

$$growth_t = \gamma_0 + \gamma_1 \ln nlip_t + \gamma_2 \ln gcap_t + \gamma_3 inf_t + \gamma_4 \ln trd_t + \mu_t \quad (4)$$

where ε_t, $\in_t$ *and* μ_t are the error terms for Eqs. (2), (3) and (4), respectively. The description of the model variables is presented in Table 4.1.

4.3. Unit root and ARDL cointegration test

In testing for level relationship, the autoregressive distributed lag (ARDL) bounds test proposed by Pesaran et al. (1996, 2001) was employed to primarily deal with the small sample size used in the study which makes it impossible to use other cointegration procedures of Johansen and Juselius (1990) and Johansen (1991). The employment of the ARDL technique is well grounded on several empirical studies that have applied the bounds approach to cointegration to relatively small sample sizes.[20] Although the ARDL of Pesaran et al. (1996, 2001) does not require any order of integration since the procedure is suitable for either $I(0)$ or $I(1)$ or mixed integration (Pesaran and Pesaran, 1997), the presence of $I(2)$ makes the ARDL unsuitable for such series. Hence in order to test for the stationarity of the variables to make sure the series are free of $I(2)$ variables, the study employed the Augmented Dickey-Fuller (DF) (1979) test and the Phillips-Perron (PP) (1988) test. The null hypotheses in both the ADF and the PP tests are that the series is unit root. To reject the null hypotheses, the computed test statistics should be greater than the critical value. The key focus of the PP test is the modification of the t-ratio so that the asymptotic distribution of the test statistic is not affected by serial correlation.

Under the bounds test, the asymptotic distribution for the F-statistic is non-standard under the null hypothesis of no level relationship between the variables. The null hypothesis of no level relationship is rejected if the F-statistic is higher than the upper boundary $I(1)$. With respect to Eq. (1), the ARDL framework for examining the insurance-growth nexus is specified as

$$\begin{aligned}\Delta growth_t = {} & \alpha_0 + \sum_{i=1}^{p}\theta_i \Delta growth_{t-1} + \sum_{i=0}^{p}\mu_i \Delta \ln ip_{t-1} \\ & + \sum_{i=0}^{p}\pi_i \Delta \ln gcap_{t-1} + \sum_{i=0}^{p}\delta_i \Delta inf_{t-1} \\ & + \sum_{i=0}^{p}\varphi_i \Delta \ln trd_{t-1} + \lambda_0 growth_{t-1} \\ & + \lambda_1 \ln ip_{t-1} + \lambda_2 \ln gcap_{t-1} + \lambda_3 inf_{t-1} \\ & + \lambda_4 \ln trd_{t-1} + \varepsilon_t \end{aligned} \quad (5)$$

where Δ is the difference operator while ε_t is white noise error term. The level relationships between the model variables can be conducted based on the F-statistic by imposing restrictions on the estimated long-run coefficients of one period lagged level of the variables equal to zero, stated below as:

$$H_0: \lambda_0 = \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0, \quad \text{No level relationship}$$

Against the alternative hypothesis as:

$$H_0: \lambda_0 \neq \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq 0, \quad \text{Level relationship}$$

The resulting F computed is compared with the simulated critical values from Narayan (2005) generated specifically for such a small sample data employed in this study. If the computed F statistics is below the lower bound value $I(0)$, the null hypothesis of no level relationship cannot be rejected. However, the computed F statistics is higher than the upper bound value $I(1)$, the null hypothesis of no level relationship is rejected implying that economic growth and its determinants are

[20] Pattichis (1999) – 20 observations, Mah (2000) – 17 observations, Narayan and Smyth (2004) and Narayan (2004) – 31 observations, Tang and Nair (2002) and Narayan and Narayan (2004) – 29 observations, and Enisan and Olufisayo (2009) – 24 observations.

Table 5.1
Descriptive statistics.

	growth	*ip*	*lip*	*nlip*	*gcap*	*inf*	*trade*
Mean	0.047	0.761	0.153	0.607	9.254	0.202	0.759
Median	0.045	0.798	0.100	0.607	9.179	0.171	0.719
Maximum	0.081	1.264	0.333	0.943	9.791	0.467	1.161
Minimum	0.032	0.432	0.053	0.379	8.912	0.096	0.402
Std. Dev.	0.012	0.254	0.107	0.169	0.252	0.100	22.013
Skewness	1.202	0.312	0.533	0.479	0.732	1.150	0.154
Kurtosis	4.354	1.945	1.594	2.150	2.481	3.725	2.012
Jarque–Bera	6.341	1.252	2.593	1.365	2.008	4.845	0.892
Probability	0.042	0.535	0.273	0.505	0.366	0.089	0.640

Note: $growth = \Delta\log(GDP_t)$, $\ln ip = \log$(total insurance penetration/GDP), $\ln lip = \log$(life insurance penetration/GDP), $\ln nlip = \log$(non-life insurance penetration/GDP). $\ln trd = \log$(trade/GDP), $\ln gcap = \log$(gross capital formation), $inf = \Delta\log(CPI_t)$.

cointegrated, hence long-run equilibrium. The test of level relationship is inconclusive if the F statistics lies between the lower and upper bound values. After providing evidence of level relationship, both long run and short run error correction are estimated based on the specification below:

$$growth_t = \alpha_0 + \sum_{i=1}^{m}\omega_1 growth_{t-1} + \sum_{i=0}^{n}\omega_2 \ln ip_{t-1} + \sum_{i=0}^{z}\omega_3 \ln gcap_{t-1} + \sum_{i=0}^{p}\omega_4 inf_{t-1} + \sum_{i=0}^{q}\omega_5 \ln trd_{t-1} + \mu_t \quad (6)$$

$$\Delta growth_t = \alpha_0 + \sum_{i=1}^{m}\omega_1 \Delta growth_{t-1} + \sum_{i=0}^{n}\omega_2 \Delta \ln ip_{t-1} + \sum_{i=0}^{z}\omega_3 \Delta \ln gcap_{t-1} + \sum_{i=0}^{p}\omega_4 \Delta inf_{t-1} + \sum_{i=0}^{q}\omega_5 \Delta \ln trd_{t-1} + \upsilon_t ECT_{t-1} + \mu_t \quad (7)$$

where μ_t the error is term and υ_t represents the coefficient of the error correction term ECT_{t-1} which is the speed of adjustment into long-run equilibrium from the short run. The presence of cointegration from the bounds test results indicates that causality exists at least in one direction (Engle and Granger, 1987). Therefore, causality test is performed within the vector error correction model (VECM) framework to examine the causal relationship between insurance penetration and economic growth.

The fully modified ordinary least squares (FMOLS) estimation of Phillips and Hansen (1990) was also employed in providing robustness to the ARDL estimation as well as its suitability for small sample data as employed in this study. The FMOLS method developed by Phillips and Hansen (1990) is for the estimation of long-run estimates of $I(1)$ variables. The FMOLS[21] deals with endogeneity and serial correlation problems as well the sample size bias. Based on Pesaran and Pesaran (2009), we employ the Parzen lag window over Bartlett and Turkey lag windows in the estimation of the FMOLS.

[21] For the mathematical modelling of the FMOLS, see Phillips and Hansen (1990).

5. Results and discussion

Presented in Table 5.1 is a descriptive of the variables used in the regression model. Over the study period, the aggregate average insurance penetration was 0.7605% indicating that the contribution of the insurance sectors in terms of premium mobilization was less than 1% of gross domestic product. This is predominantly driven by non-life insurance consumption which accounted for 0.6071% of gross domestic product whereas the life sector accounted for a meagre 0.1534%. This implies that the non-life business drives the insurance industry in Ghana by accounting for about 80% of gross insurance premiums. Also presented is the descriptive statistics of control variables with average economic growth rate of 4.7% within a range of 3.2% and 8.1%.

Table 5.2
ADF test and PP unit root tests.

Variables	*T*-statistic			
	I(0)		*I*(1)	
	ADF	PP	ADF	PP
growth	−0.359	−0.323	−4.074***	−3.930***
ln *ip*	−1.462	−1.463	−3.755**	−3.780**
ln *lip*	0.191	0.080	−4.252***	−4.256***
ln *nlip*	−1.632	−1.588	−5.003***	−4.991***
ln *gcap*	0.209	0.491	−5.801***	−5.631***
inf	−2.680*	−2.810*	−5.025***	−5.096***
ln *trd*	−1.959	−1.961	−3.872***	−3.905***

$growth = \Delta\log(GDP_t)$, $\ln ip = \log$(total insurance penetration/GDP), $\ln lip = \log$(life insurance penetration/GDP), $\ln nlip = \log$(non-life insurance penetration/GDP), $\ln trd = \log$(trade/GDP), $\ln gcap = \log$(fixed capital formation), $inf = \Delta\log(CPI_t)$. The asterisks indicate the rejection of the null hypothesis of unit root.
* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

Table 5.3
Bounds results for level relationship.

$k=4$		90%		95%	
		$I(0)$	$I(1)$	$I(0)$	$I(1)$
	F-stat	2.3224	3.6294	2.9872	4.5385
$F_G(G/(\ln ip, \ln gcap, inf, \ln trd))$	10.279***				
$F_G(G/(\ln lip, \ln gcap, inf, \ln trd))$	11.312***				
$F_G(G/(\ln nlip, \ln gcap, inf, \ln trd))$	6.652***				

Note: $G = \Delta\log(GDP_t)$, $\ln ip = \log$(total insurance penetration/GDP), $\ln lip = \log$(life insurance penetration/GDP), $\ln nli = \log$(non-life insurance penetration/GDP), $\ln trd = \log$(trade/GDP), $\ln gcap = \log$(fixed capital formation), $inf = \Delta\log(CPI_t)$. $I(0)$ and $I(1)$ represent lower and upper bounds, respectively. Critical values are extracted from Narayan (2005); k is number of regressors.
*** Rejection of null hypothesis of no cointegration relationship at 1%.

Table 5.4
Long run estimates.

	Dependent variable: economic growth					
	Autoregressive distributed lag (ARDL)			Fully modified ordinary least squares (FMOLS)		
	Model 2	Model 3	Model 4	Model 2	Model 3	Model 4
$\ln ip$	0.068***			0.063*		
$\ln lip$		0.025***			0.019*	
$\ln nlip$			0.045**			0.031*
$\ln gcap$	0.005***	0.003***	0.007***	0.035***	0.009	0.030***
inf	−0.014	−0.018**	−0.017	−0.016	−0.012	−0.008
$\ln trd$	−0.022***	−0.007**	−0.030***	−0.784**	−0.027*	−0.047**
Constant	−0.048*	−0.04	−0.055 *	−0.076	0.034	−0.161***

$growth = \Delta\log(GDP_t)$, $\ln ip = \log$(total insurance penetration/GDP), $\ln lip = \log$(life insurance penetration/GDP), $\ln nli = \log$(non-life insurance penetration/GDP). $\ln trd = \log$(trade/GDP), $\ln gcap = \log$(fixed capital formation), $inf = \Delta\log(CPI_t)$. ARDL(1,1,0,0,1) selected for Model (1), ARDL(1,1,0,0,1) for (2) and ARDL(1,0,0,0,0) for Model (3) based on the Schwarz Bayesian Criterion. FMOLS estimation was based on the Parzen lag window.
* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

5.1. Unit root and bound test results

The ADF test and the PP unit root tests results at levels $I(0)$ and first differenced $I(1)$ are presented in Table 5.2. The results indicate that all the variables exhibit unit root per the ADF and PP tests at $I(0)$ except inflation albeit at only 10%. At $I(1)$ in both ADF and PP tests, all the variables are stationary at 1% except aggregate insurance penetration which is stationary at 5%.

The ARDL bounds cointegration test results are presented in Table 5.3. The computed F statistics for all the three models are greater than $I(1)$, hence the null hypothesis of no level relationship is rejected to imply the existence of long-run level relationship between insurance penetration and economic growth. This is consistent with the findings of Ward and Zurbruegg (2000), Kugler and Ofoghi (2005), Arena (2008), Adams et al. (2009) and Han et al. (2010) in examining the insurance-growth nexus whereas N'Zue (2006) and Odhiambo (2007) also found long-run relationship between other forms financial development and growth in a sample of African countries.

The results of the bounds test results provides evidence of a causal link[22] between insurance penetration and economic growth in Ghana and that any distortions in the short-run is corrected for an error correction term in the long-run.

5.2. Long run estimates

From Table 5.4 the long-run estimates in the ARDL estimation, aggregate insurance penetration was found to have significant positive relationship with economic growth at 1%. The coefficient of 0.068 implies that a percentage increase in insurance penetration will lead to a 0.068% growth in the real economy. For the FMOLS estimation, the positive long-run relationship between aggregate insurance penetration and economic growth was significant at 10% with a coefficient of 0.063. This result imply that through its function of savings mobilization and risk transfer, insurance markets stimulates growth in the real economy in the long-run. This result is consistent with the findings of Azman-Saini and Smith (2011) who found the transmission from insurance penetration to economic growth in developing countries results through capital accumulation.

Although both life and non-life insurance penetration have significant long-run positive impact on growth at 1% in the ARDL models 2 and 3 respectively, the non-life insurance penetration was found to have greater long-run impact on economic growth as indicated by the coefficient of 0.045 for the non-life model compared to the coefficient of 0.025 in the life model. In

[22] According to Engle and Granger (1987), causality must exist in at least one direction if there is evidence of long-run relationship.

Table 5.5
Short-run error correction models.

	Dependent variable: economic growth		
	Model 2	Model 3	Model 4
Δln *ip*	0.024 [1.967]*		
Δln *lip*		−0.4075 [−1.301]	
Δln *nlip*			0.104 [3.640]***
Δln *gcap*	0.044 [5.584]***	−.0767 [−1.327]	0.0317 [5.303]***
Δ*inf*	−0.028 [−1.425]	0.2249 [0.832]	−0.0127 [−0.532]
Δln *trd*	−0.052 [−2.323]**	−1.6883 [−3.057]***	−0.1044 [−4.156]***
ECT_{t-1}	−0.6271 [−4.495]***	−0.6568 [−4.426]***	−0.5150[−7.169]***
Model diagnostics			
F statistics	35.683***	35.373***	13.279***
R-squared	0.9225	0.9279	0.7798
Adj. *R*-squared	0.8772	0.8819	0.7211
DW stat	2.645	1.927	2.3818
AR: *F*	0.1375 (0.717)	2.0419 (0.187)	0.8201 (0.383)
FORM: *F*	2.075 (0.175)	0.5193 (0.489)	0.0026 (0.960)
HET: *F*	0.5381 (0.473)	0.4642 (0.505)	0.1932 (0.665)
Chow: *F*	0.24599 (0.933)	0.4807 (0.783)	0.3085 (0.898)

Note: *T*-ratios are in squared brackets and *P* values in parentheses. DW = Durbin Watson statistics, AR = autocorrelation test, FORM = functional form, HET = heteroskedasticity test, Chow = Chow's 2nd test of predictive failure.
* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

the FMOLS estimation, both life and non-life insurance penetration had significant positive relationship with economic growth at only 10%. In line with the ARDL estimation, the coefficient of non-life insurance penetration was higher compared to life insurance penetration. This implies that for every premium generated on writing both life and non-life insurance business, funds mobilized from non-life insurance activities translates into higher economic growth compared to funds generated from life insurance activities in the long-run. This study postulates that the high level of long-term investments[23] by non-life companies compared to life companies accounts for the differences. By this, the non-life insurance consumption has taken over the long-term capital accumulation functions of the life insurance consumption in Ghana. The high non-life insurance penetration compared to the life insurance penetration also explains why non-life business has greater impact on economic growth compared to the life business.[24]

Gross capital formation was found to have significant positive relationship with economic growth under both the ARDL and FMOLS estimations. Inflation was negatively related to growth but only significant in model 2 at 5% under ARDL. Trade was also negatively related to economic growth at significance levels ranging between 5% and 1% in the ARDL estimations and significant at 5% models 1 and 3 and 10% in model 2 under FMOLS. The negative relationship between economic growth and trade is consistent with the findings of Adjasi and Biekpe (2006) in a panel study on selected Sub-Saharan African countries.

5.3. Short run estimates and diagnostics

Consistent with the long-run results, aggregate insurance and non-life insurance penetration exhibited significant positive relationship with economic growth in the short-run at 10% and 1% respectively. However, life insurance penetration exhibited negative but insignificant relationship with growth in the short run. Gross capital formation exhibited significant positive relationship with growth at 1% with coefficients of 0.044 and 0.0317 in models 2 and 4 respectively. Although both inflation and trade volume had negative relationship with growth in the short run, only trade volume exhibited statistical significance. The coefficients of ECT_{t-1} are all negative and significant at the 1% level. Short-run disequilibrium is corrected in the long run equilibrium at a rate of 62.71% in the following period in the model with aggregate insurance penetration (model 2). However, the model with non-life insurance penetration (model 4) achieves slower convergence to long-run equilibrium at a rate of 51.50% compared to the model with life insurance penetration (model 3) which converges to long-run equilibrium at a rate of 65.68%. This indicates that life insurance translates into faster economic growth compared to non-life insurance in the long-run (Table 5.5).

All the estimated short-run elasticities were subjected to diagnostics test for the reliability of the estimated coefficients under both the Langrange multiplier (LM) version and *F*-version tests. Although both versions of the test have the same asymptotic distribution, the *F* version is preferred to the LM version in small samples on the basis of Monte Carlo simulations (Pesaran and Pesaran, 1997). As applied by Pattichis (1999) to a small sample (20 observations), the *F* version was reported in this study. At a 5% significance level, the *F*-test gives no evidence of serial correlation, functional form misspecification and

[23] Table 2.2 shows that non-life businesses hold more long-term investments compared to life businesses.
[24] Similar results are also found by Ward and Zurbruegg (2000), Beck and Webb (2002) and Lee (2011).

Table 5.6
Granger causality within VECM.

Null hypothesis	χ^2	Decision on H_0
ln *lip* does not granger cause *growth*	7.715***	Reject
ln *lip* does not granger cause *growth*	4.499**	Reject
ln *nlip* does not granger cause *growth*	6.018**	Reject
growth does not granger cause ln *lip*	2.181	Do not reject
growth does not granger cause ln *lip*	0.0015	Do not reject
growth does not granger cause ln *nlip*	0.502	Do not reject

** Significance at 5%.
*** Significance at 1%.

heteroskedasticity. Additionally, since the small sample size and the number of explanatory variables employed could impact on the predictive ability of the models, the Chow's (1960) second test for predictive failure was examined to test the predictive ability of the regression models. From the model diagnostics, the insignificance of the *F*-test provides evidence no structural breaks which affirms the predictive adequacy of all models. Chow's (1960) forecast test[25] test of parameter constancy also supports the Chow's test results.

Further stability tests using the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMQ) plots of Brown et al. (1975) for the three models are shown in Appendix Fig. A1. The movements of the CUSUM or CUSUMSQ outside the critical lines of 5% significance level denotes parameter instability. As depicted in the graphs (Appendix Fig. A1), since both CUSUM and CUSUMSQ lie within the 5% critical lines, the model coefficients are stable. All the *F* statistics are significant at 1% and adjusted *R*-squared's of 0.8772, 0.8819 and 0.7211 for models 2, 3 and 4 respectively imply that higher variations in growth are significantly explained by the models estimated. A correlation matrix attached as appendix (Table A2) indicates the absence of multicollinearity.[26]

5.4. Causality test

Table 5.6 presents the results of testing of the 'demand-following' and 'supply-leading' hypotheses. The null hypothesis of insurance penetration does not "granger-cause" economic growth is rejected at 1% for aggregate insurance and 5% for both life and non-life insurance. However, the null hypothesis of economic growth does not "granger-cause" insurance penetration cannot be rejected. This indicates a uni-directional short-run causality from aggregate insurance penetration to economic growth in Ghana. This is in line with the findings of Ward and Zurbruegg (2000),[27] Adams et al. (2009), Lee (2011) and Chang et al. (2013).[28] Consistent with Chang et al. (2013),[29] and Ghosh (2013) uni-directional causality is also concluded to run from life and non-life insurance penetration to economic growth. These results imply that developments of insurance markets promote economic growth in Ghana through the accumulation of funds (Azman-Saini and Smith, 2011), risk transfer and indemnification to support the 'supply-leading' hypothesis. These results are also in conformity with the findings of N'Zue (2006) and Odhiambo (2007)[30] and Ahmed and Wahid (2011) that finance-growth nexus in some African countries is 'supply-leading'.

6. Conclusion and policy implications

This paper examined the causal relationship between insurance penetration and economic growth in Ghana on an annual time series data from 1990 to 2010. Due to the small sample size, the ARDL bounds approach to cointegration by Pesaran et al. (1996, 2001) was employed to test for the existence of long-run relationship between insurance penetration and economic growth. The bounds test found a cointegrated relationship between economic growth and insurance penetration in Ghana re-enforcing the importance of insurance activities in stimulating economic growth in the long run through capital accumulation. The FMOLS was also employed to test for the robustness for the long-run relationships because of its reliability and robustness for small sample data. Consistent across both estimation techniques, aggregate insurance penetration was found to have positive long-run relationship with economic growth. While both life and non-life insurance penetration exhibited positive long-run relationships with economic growth, non-life insurance penetration was found to have had a greater impact on economic growth compared to life insurance penetration. Disequilibrium in the short-run model with aggregate insurance penetration was corrected at a faster rate as indicated by the error correction term of rate of 62.71%. The speed of adjustment to long run equilibrium was 65.68% and 51.50% for models with life and non-life insurance penetration respectively. Uni-directional causality was found to run from aggregate insurance penetration, life and non-life insurance penetration to economic growth to support the 'supply-leading' hypothesis. This study thus concludes that development of the insurance sector is an important factor in propelling the growth in the real economy. The evidence provided for the 'supply-leading' hypothesis makes a strong case for researchers to delve into the determinants of insurance consumption in developing countries. These factors when identified would inform policy decisions on reforms of the insurance market to position the industry to drive economic growth. We further recommend for strategies aimed at strengthening the regulatory framework of insurance operations. Finally, the promotion of educational programmes aimed at creating the awareness on the benefits of insurance consumption and consumer interest in insurance should also be the focus of both government and regulatory authority. The inherent limitation of this study is the small sample size used which limited the ability

[25] The test results are available on request.
[26] According to Kennedy (2008), the correlation coefficient of less than 0.70 does not reflect multicollinearity.
[27] Canada.
[28] France, Japan, Netherlands, Switzerland, and UK.
[29] France, Japan, Netherlands, Switzerland, and UK.
[30] Found a uni-directional causality from financial development to economic growth in Tanzania.

of employing other co-integration techniques which requires larger sample sizes to provide robustness to the bounds cointegration technique. However, various statistical test carried out attest for both the predictive ability and stability of the regression coefficients.

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Appendices.

Table A1
ARDL equation.

	ARDL(1,1,0,0,1) Model 2	ARDL(1,1,0,0,1) Model 3	ARDL(1,0,0,0,0) Model 4
growth (−1)	−0.713 (−2.916)***	−1.159 (−4.458)***	−0.369 (−1.578)
ln *ip*	0.015 (0.767)		
ln *lip* (−1)	0.043 (2.401)**		
ln *lip*		−0.062 (−0.805)	
ln *lip* (−1)		0.234 (2.613)**	
ln *nlip*			0.061 (2.461)**
ln *gcap*	0.022 (4.447)***	0.017 (4.637)***	0.023 (4.241)***
inf	−0.023 (−1.048)	−0.039 (−2.218)**	−0.024 (−0.864)
ln *trd*	−0.004 (−0.107)	0.050 (1.445)	−0.095 (−3.057)***
ln *trd* (−1)	−0.083 (−2.048)*	−0.088 (−2.738)**	
F-stat	6.43***	9.19***	5.27***
R-squared	0.7480	0.8213	0.5842
R-bar-squared	0.6316	0.7319	0.4734

T-statistics are in parenthesis.
* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

Table A2
Correlation matrix.

	growth	ln *ip*	ln *lip*	ln *nlip*	ln *gcap*	*inf*	ln *trd*
growth	1.000						
ln *ip*	0.335	1.000					
ln *lip*	0.618***	0.926***	1.000				
ln *nlip*	0.272	0.949***	0.779***	1.000			
ln *gcap*	0.746***	0.487**	0.476***	0.366	1.000		
inf	−0.467**	−0.402*	−0.484**	−0.366	−0.414*	1.000	
ln *trd*	0.046	0.446***	0.515**	0.358***	0.204	−0.097	1.000

* Significance at 10%.
** Significance at 5%.
*** Significance at 1%.

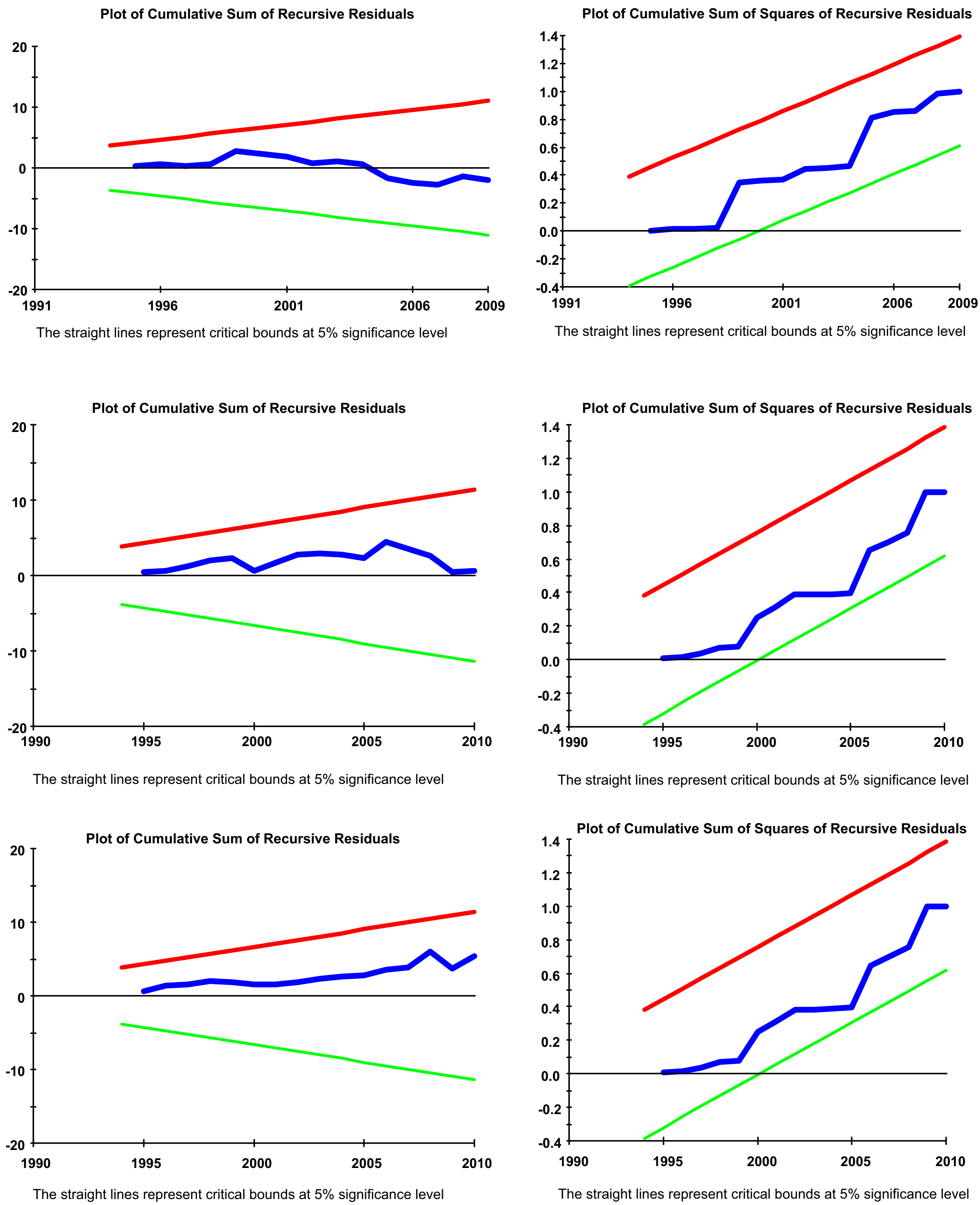

Fig. A1. Plots of CUSUM and CUSUM square.

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