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INSURANCE MARKET DEVELOPMENT AND MACROECONOMIC INTERACTIONS IN TWENTY-SIX COUNTRIES*

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This paper examines the cointegrating and causal relationships between insurance market development (IMD) and economic growth based on panel-data estimation techniques. It also investigates the dynamic interrelationships amongst a number of important macroeconomic variables on IMD-growth nexus. The sample consists of 26 countries observed over the period 1980-2013. We use six different indicators of IMD, covered under both insurance density and insurance penetration, to validate the robustness of our results. Our findings affirm a long-run equilibrium relationship between insurance market development, economic growth, and six other macroeconomic variables selected, namely broad money supply (relative to national income), real interest rates, inflation rates, urban population growth, youth dependency ratios, and government consumption expenditure (relative to national income). We use a panel vector auto-regression model to examine the nature of Granger causality among the variables. Most significantly, we find that IMD and some macroeconomic variables Granger-cause economic growth in the long run, irrespective of which measure of IMD we use.

Keywords: Insurance Market Development, Economic Growth, Panel Data
JEL Classification: L96, O32, O33, O43

1. INTRODUCTION

The relationship between financial sector development and economic growth has been intensively studied, and has generated many empirical studies since the 19th century. For decades, there has been a heated debate about whether or not financial sector development actually leads the real sector in the process of economic

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development. There is no consensus on the causal relationship between financial sector development and economic growth (see, for instance, Ang, 2008; Jung, 1986; King and Levine, 1993; Levine, Loayza, and Beck, 2000; Pradhan, Arvin, Norman, and Nishigaki, 2014; Valickova, Havranek, and Horvath, 2015; Wolde-Rufael, 2009). A sub-sector of the financial sector that has received relatively little attention is the insurance market – very few studies examine the causal relationship between insurance market development and economic growth; some exceptions are studies by Lee, Lee and Chiu (2013) and Ward and Zurbruegg (2000). One credible reason for this glaring omission is that the insurance market is a complex industry and has only developed fairly recently (Outreville, 1990). However, following the volatile growth of insurance in recent years, the insurance market has become an increasingly important part of financial development. The insurance industry provides a wide range of financial services and forms a key source of investment in capital markets today (Beck and Webb, 2003; Feyen, Lester and Rocha, 2011). It can be neglected no longer.

Intuitively, development in the insurance industry would be a key contributor to, and a signal of, economic growth (Azman-Saini and Smith, 2011; Grant, 2012; Haiss and Sümegi, 2008; Outreville, 2013). The insurance market provides[1] at least two important functions that tend to trigger economic growth. First, through financial transfers and indemnification activities, insurance services foster and enhance economic growth (see Ward and Zurbruegg, 2000). Secondly, life insurance products encourage long-term saving and the reinvestment of substantial funds in public and private sector projects (Beck and Webb 2003), which also enhance growth.

In the present study, we build on studies by Adams, Andersson, Andersson, and Lindmark (2009), Allen and Santomero (2001), Andersson, Eriksson, and Lindmark (2010), Haiss and Sümegi (2008), Horng, Chang, and Wu (2012), Hussels, Ward, and Zurbruegg (2005), Liu et al. (2014), and Lee (2013) by empirically testing the cointegrating and causal relationships between insurance market development[2] (IMD) and economic growth in the presence of six other important macroeconomic variables and in a multi-country context. Given the pronounced global development of the insurance market since the 1980s, we use cross-country data over the period from 1980 to 2013 to analyze formally the causal relationships between these variables.[3]

[1] Das, Davies, and Podpiera (2003), Liedtke (2007), Skipper (1997), and Zweifel and Eisen (2012) discuss more ways in which insurance market activities contribute to economic growth.

[2] Here we use the phrase 'development' liberally. To be clear, in our paper 'insurance market development' may alternatively be referred to as 'insurance market activity'. Obviously, the level of activity here is indicative of the state of development. As we will explicitly note later, we use both life insurance and non-life insurance activities to investigate insurance market development.

[3] See also Pradhan, Arvin, and Norman (2015) who examine the causal relationship between insurance market development, economic growth, and financial market development for a panel of OECD countries. The present study differs from Pradhan, Arvin, and Norman (2015) in that we cover a different set of countries. Moreover, fundamentally, we examine the role of six important macroeconomic variables in

The insurance market[4] has influenced economies in every aspect (Beck and Webb, 2003; Beenstock, Dickinson and Khajuria, 1986; Chen, Cheng, Pan and Wu, 2013; Chang, Lee and Chnag, 2014; Han, Li, Moshirian and Tian, 2010; Kugler and Ofoghi, 2005; Lee, 2011; Nektarios, 2010, Njegomir and Stojic, 2010; Outreville, 1996; Pagano, 1993; Park, Borde and Choi, 2002; Petkovski and Jordan, 2014; Soo, 1996, Sümegi and Haiss, 2008; Wasow and Hill, 1986; Zeits, 2003; and Zheng, Liu and Deng, 2009). It contributes to economic growth, both as a financial intermediary, and as a provider of risk transfer and indemnification, by allowing different risks to be managed more efficiently and by mobilising domestic savings (Ward and Zurbruegg, 2000). A relationship between IMD[5] and economic growth[6] has been documented in the financial literature, using an array of econometric techniques (see, for example, Azman-Saini and Smith, 2011; Arena, 2008; Avram, Nguyen and Skully, 2010; Boon, 2005; Chen, Lee and Lee, 2012; Ching, Kogid and Furuoka, 2010; Curak, Loncar and Poposki, 2009; Enz, 2000; Han et al., 2010; Haiss and Sümegi, 2008; Kreinin, Lansing and Morgan, 1957; Lee, Lee and Chiu, 2013; Lee, Tsong, Yang and Chang, 2013; Lee, Chang and Chen, 2012; Cheng et al., 2013; Lee, 2011; Lee and Chiu, 2012; Lee, Kwon and Chung, 2010; Richterkova and Korab, 2013; Ward and Zurbruegg, 2000; and Webb, Grace and Skipper, 2005). Overall, the empirical evidence has demonstrated a positive long-run association between indicators of insurance market development and economic growth. In general, most of the papers in our survey suggest that insurance market development is growth-enhancing, and therefore consistent with the general proposition of 'more finance, more growth' (Law and Singh, 2014). In our paper, we revisit this topic by incorporating a number of macroeconomic variables in the insurance-growth nexus. Thus, we study the IMD-growth nexus side-by-side with six other macroeconomic variables that could affect IMD and growth (or could be affected by IMD and growth).

Another notable feature of our study is its use of panel-data estimation techniques. We consider a panel of 26[7] countries over the period from 1980 to 2013. The dynamic

explaining heterogeneity in the association between IMD and economic growth.

[4] Insurance, like other financial services, has grown relative to financial institutions in general. The governments of many developing countries have historically held the view that the financial systems they have inherited could not serve their countries' development needs adequately. Hence they have directed considerable effort to changing the structure of these financial systems and controlling their operations in order to channel savings to investments which are crucial components of development programs (Outreville 1990; UNCTD 1988).

[5] IMD refers to a process associated with improvements in the quantity, quality, and efficiency of the insurance sector.

[6] The large literature focusing on the various determinants of economic growth is not surveyed here. See, for example, Barro (1991), and Barro and Sala-i-Martin (1995).

[7] The countries are Australia, Brazil, Canada, China, Colombia, Ecuador, Egypt, France, Guatemala, India, Indonesia, Italy, Japan, Malaysia, Mauritius, Mexico, Morocco, Panama, the Philippines, South Africa, South Korea, Thailand, Tunisia, Turkey, the United Kingdom, and the United States.

interrelationships amongst the variables are investigated by using panel cointegration and panel Granger causality techniques – methods that are not commonly used in this literature. Panel methods allow for robust estimates by using variation between countries, as well as variation over time. Our panel techniques use more sophisticated econometrics than those used in conventional approaches adopted in many earlier papers, since our new approach increases the degree of freedom and improves the efficiency of the Granger causality test.

The remainder of the paper is organized as follows: the next section presents an overview of insurance market development; the literature is reviewed in Section 3; the data and the model are presented in Section 4; the estimation strategy and the empirical results are discussed in Section 5; and the final section offers conclusions and recommendations based on the results.

2. AN OVERVIEW OF INSURANCE MARKET DEVELOPMENT IN THE SELECTED 26 COUNTRIES

We use two traditional measures to present the importance and status of insurance market development in national economies (Outreville, 2013). The first measure is insurance density, which refers to the average annual per capita premium in a country and is expressed in US dollars. This measure shows how much each inhabitant of a country spends on insurance on average, and reveals the absolute importance of insurance market activities. The second measure is insurance penetration, which is the ratio of direct premiums written to the gross domestic product (GDP). This refers to the relative importance of the insurance market activities in national economies. The section provides an overview of insurance market development in the selected 26 countries, with reference to both insurance density and insurance penetration. We use both life insurance and non-life insurance activities to investigate insurance market development in the selected 26 countries.

Tables 1 and 2 show that both life insurance and non-life insurance activities are generally low in developing countries, but are relatively high in most developed countries. The figures on both insurance density and penetration show an impressive increase in insurance market activities in almost all countries from 1980 to 2013. The relatively high performer countries are Australia, Canada, France, Japan, South Africa, South Korea, the United Kingdom, and the United States. Their performance is comparatively higher than that of the all country average. This is true for both insurance density (life and non-life) and insurance penetration (life and non-life). On the contrary, countries such as China, Ecuador, Egypt, Indonesia, Turkey and Tunisia are very low performers in this regard. The average of these countries are far away from the all country average. Figure 1 presents the total insurance coverage (both insurance density and insurance penetration) of the 26 countries from 1980 to 2013.

Table 1. Trends in Insurance Density

Countries	Periods											
	1980-1992		1993-1997		1998-2002		2003-2007		2008-2013		Overall Average	
	LID	NID	LID	NID	LID	NID	LID	NID	LID	NID	LID	NID
Australia	379.50	448.98	660.65	698.03	1149.6	685.30	1402.2	848.65	1819.7	1269.1	951.43	723.9
Brazil	3.130	20.20	13.02	55.15	13.00	41.31	45.66	69.25	182.2	165.05	43.898	61.22
Canada	396.29	493.2	574.3	690.7	677.9	766.4	1050.9	1403.2	1450.8	1906.9	746.2	945.7
China	0.7	1.278	3.03	4.26	10.72	7.13	31.91	17.09	94.97	59.6	25.18	16.06
Colombia	3.55	15	8.88	37.3	12.92	36.86	18.67	47.74	49.98	104.4	16.13	42.08
Ecuador	0.785	8.792	2	18.06	2.123	19.97	5.309	34.84	13.66	67.6	4.809	29.7
Egypt	1.683	7.507	1.523	5.643	2.421	6.001	4.369	6.408	9.377	11.82	3.522	7.611
France	338.8	418.3	1287.9	745.3	1283.8	661.2	2362.1	1055.5	2662.1	1313.5	1324.9	753.8
Guatemala	3.252	6.428	3.037	11.96	3.585	14.16	4.236	20.85	7.246	29.69	4.119	14.6
India	2.384	1.398	4.319	1.95	7.9	2.405	24.75	4.7	45.34	8.82	14.34	3.424
Indonesia	1.084	3.077	4.844	6.945	4.053	4.473	13.35	8.078	41.76	14.09	11.06	6.53
Italy	66.11	229.4	260.5	431.1	693.3	485.2	1417.2	771.7	1711.4	815.9	675.96	479.9
Japan	1425.5	427.1	3518.1	914.7	2972.5	749	2819.5	767.8	3515.3	911.1	2543.5	681.7
Malaysia	26.67	33.74	88.57	83.46	118.9	68.91	189.7	99.74	297.3	152.3	121.1	76.85
Mauritius	22.17	28.63	66.54	74.81	89.05	63.46	160.7	92.41	323.3	154.8	112	72.19
Mexico	8.39	18.52	18.3	33.84	46.39	49.64	52.54	74.6	81.61	101.3	34.85	48.21
Morocco	2.78	15.98	6.23	22.7	9.835	24.38	14.67	37.65	28.36	59.24	10.59	33.03
Panama	31.11	41.95	24.79	73.64	35.06	82.69	46.08	92.66	65.63	201.9	39.06	88.28
Philippines	3.388	4.821	6.81	8.39	7.62	5.49	11.94	5.66	22.7	9.29	9.18	6.36
South Africa	155.9	62.48	355.2	95.4	397.1	75.01	588.1	140	771.7	183.3	392.9	101.9
South Korea	130.1	61.7	839.8	281.8	793.6	289.4	1188.8	479.2	1533.6	835.2	735.4	325.5
Thailand	7.902	6.976	30.08	31.6	31.13	19.93	65.73	33.64	150.8	65.62	48.3	26.77
Tunisia	1.295	18.54	2.25	30.84	2.909	32.36	5.293	50.74	10.86	64.78	3.948	35.28
Turkey	1.112	7.354	3.613	20.75	6.697	27.8	12.85	67.43	19.69	115.9	7.306	40.32
United Kingdom	630.8	358.8	1457.4	701	2999.3	814.3	4568.6	1283.7	3585.2	1109.9	2201.1	744.7
United States	573.3	919.7	1107	1362	1492.5	1581.8	1754.8	2098.3	1736.2	2186.5	1152.7	1479
Col. Average	162.2	140.8	398	247.7	494.8	254.4	686.9	369.7	778.1	458.4	432.1	263.3

Table 2. Trends in Insurance Penetration

Countries	Periods											
	1980-1992		1993-1997		1998-2002		2003-2007		2008-2013		Overall Average	
	LIP	NIP	LIP	NIP	LIP	NIP	LIP	NIP	LIP	NIP	LIP	NIP
Australia	0.026	0.032	0.032	0.033	0.056	0.033	0.04	0.024	0.032	0.021	0.034	0.029
Brazil	0.001	0.009	0.003	0.013	0.004	0.011	0.009	0.014	0.017	0.016	0.006	0.012
Canada	0.024	0.03	0.028	0.033	0.03	0.033	0.029	0.039	0.03	0.039	0.034	0.061
China	0.002	0.004	0.005	0.007	0.011	0.007	0.018	0.009	0.02	0.012	0.01	0.007
Colombia	0.003	0.011	0.003	0.013	0.005	0.014	0.006	0.014	0.008	0.016	0.004	0.013
Ecuador	0.001	0.008	0.001	0.009	0.001	0.011	0.002	0.012	0.003	0.013	0.001	0.01
Egypt	0.002	0.007	0.002	0.006	0.002	0.004	0.003	0.005	0.003	0.004	0.002	0.006
France	0.02	0.029	0.053	0.031	0.056	0.029	0.068	0.031	0.064	0.032	0.045	0.03
Guatemala	0.003	0.006	0.002	0.008	0.002	0.008	0.002	0.009	0.002	0.009	0.002	0.008
India	0.008	0.005	0.012	0.005	0.018	0.005	0.032	0.006	0.037	0.007	0.019	0.006
Indonesia	0.002	0.005	0.004	0.006	0.005	0.006	0.009	0.006	0.013	0.005	0.006	0.005
Italy	0.004	0.018	0.013	0.022	0.034	0.024	0.046	0.025	0.049	0.023	0.024	0.021
Japan	0.072	0.022	0.093	0.024	0.089	0.022	0.08	0.021	0.083	0.022	0.081	0.022
Malaysia	0.011	0.015	0.02	0.019	0.03	0.017	0.032	0.017	0.031	0.016	0.022	0.016
Mauritius	0.012	0.017	0.019	0.021	0.023	0.017	0.029	0.017	0.038	0.018	0.022	0.018
Mexico	0.003	0.006	0.004	0.007	0.007	0.008	0.007	0.01	0.009	0.011	0.005	0.008
Morocco	0.003	0.016	0.005	0.019	0.007	0.018	0.02	0.026	0.01	0.02	0.006	0.018
Panama	0.013	0.018	0.008	0.023	0.009	0.022	0.01	0.02	0.01	0.025	0.01	0.02
Philippines	0.005	0.007	0.007	0.013	0.008	0.005	0.009	0.005	0.01	0.004	0.007	0.006
South Africa	0.059	0.024	0.103	0.028	0.142	0.027	0.121	0.029	0.117	0.028	0.097	0.026
South Korea	0.018	0.013	0.078	0.026	0.075	0.027	0.066	0.026	0.072	0.039	0.052	0.024
Thailand	0.007	0.006	0.012	0.012	0.016	0.01	0.023	0.012	0.031	0.014	0.016	0.01
Tunisia	0.001	0.013	0.001	0.014	0.001	0.014	0.002	0.015	0.003	0.015	0.001	0.014
Turkey	0.001	0.003	0.001	0.005	0.002	0.007	0.002	0.01	0.002	0.011	0.001	0.006
United Kingdom	0.048	0.028	0.071	0.035	0.116	0.032	0.115	0.033	0.092	0.028	0.079	0.03
United States	0.03	0.047	0.035	0.047	0.041	0.044	0.04	0.048	0.035	0.044	0.034	0.046
Col. Average	0.014	0.015	0.024	0.018	0.03	0.018	0.032	0.019	0.032	0.019	0.023	0.018

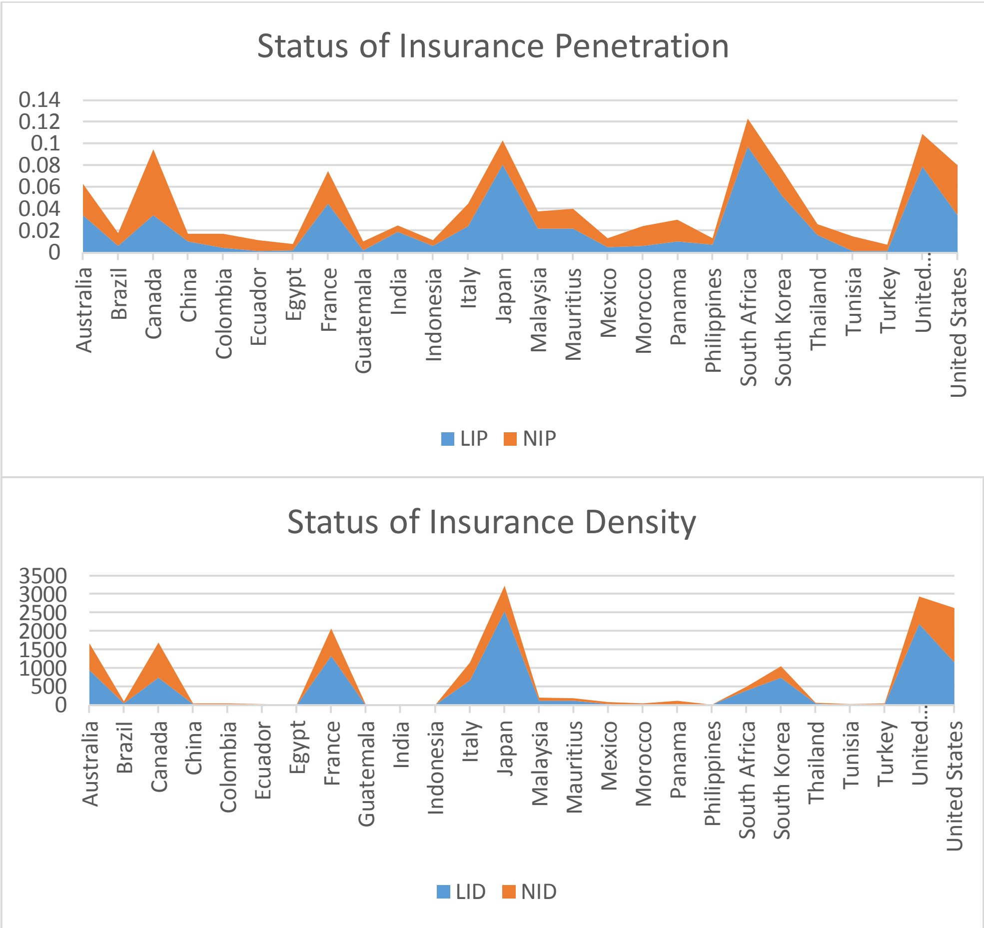

Figure 1. Insurance Market Development in 26 Selected Countries

Note: LID: Life insurance density; NID: Non-life insurance density; LIP: Life insurance penetration; and NIP: Non-life insurance penetration.

The amounts suggest that life insurance activities generate more premium income than non-life insurance activities. From 1980 to 1992, personal average life insurance density coverage was $162.2, compared to non-life insurance density coverage of $140.8. Between 2008 and 2013, the coverage of life insurance density increased to $778.1, compared to non-life insurance coverage of $458.4. This reveals the tremendous growth of both life insurance coverage and non-life insurance coverage in the selected countries. The overall average (between 1980 and 2013) was $432.1 in life insurance density, as opposed to $263.3 in non-life insurance density. The trend is slightly different with regard to insurance penetration for both life and non-life insurance. By the end of 2013, the average life insurance penetration is 0.057%, compared to non-life insurance penetration of 0.018%. Average life insurance penetration increased from 0.014% between 1980 and 1992 to 0.032% between 2008 and 2013. By contrast, the average non-life coverage increased only from 0.015% between 1980 and 1992 to 0.019% between 2008 and 2013.

In sum, the growth in life insurance coverage has consistently outgrown the non-life insurance coverage in the selected economies. This is mostly due to the focus of life policies, which range from policies to cover death to ones that include endowment, or funeral and other policies which serve as saving plans for policy holders (see, for instance, Alhassan and Fiador, 2014).

3. LITERATURE REVIEW

There are two approaches to analyse insurance market development and macroeconomic interactions, namely the production function approach and the Granger causality approach. In the present study, we focus on the latter, because we aim to identify the reverse causality (if any) between insurance market development and macroeconomic indicators. In this section, we present a brief overview of the empirical literature on the relationship between insurance market development and economic growth.[8]

There are four possible ways[9] in which we can summarize Granger causal relationships between insurance market development[10] and economic growth. These are the supply-leading hypothesis (SLH), the demand-following hypothesis (DFH), the feedback hypothesis (FBH), and the neutrality hypothesis (NLH). These hypotheses and support for them are discussed below.

The SLH posits that insurance market development Granger-causes economic growth. Proponents of this hypothesis maintain that the insurance market induces economic growth by facilitating savings in the form of financial assets, thereby promoting capital formation and hence economic growth. Studies supporting the SLH have been done by Adams et al. (2009), Alhassan and Fiador (2014), Boon (2005), Lee, Huang, and Yin (2013), Guochen and Wei (2012), Haiss and Sümegi (2008), Lee (2011), Nejad and Kermani (2000), and Vadlamannati (2008).

[8] The theoretical link between insurance market development and economic growth is explained in Grant (2012), and Haiss and Sümegi (2008).

[9] According to the classification of Blum et al. (2002) and Patrick (1966).

[10] Development is measured as any of these six activities: life insurance density, non-life insurance density, total insurance density, life insurance penetration, non-life insurance penetration, and total insurance penetration.

Table 3. Summary of Studies on the Link between Insurance Market Development and Economic Growth

Studies	Types of Insurance	Study Area	Year covered	Major finding(s)
Alhassan, & Fiador (2014)	4, 5, 6	Ghana	1990-2010	SLH
Boon (2005)	3	Singapore	1991-2002	SLH
Chang, Lee, & Chang (2014)	4, 5, 6	10 OECD countries	1979-2006	FBH
Catalan, Impavido, & Musalem (2000)	1, 2	14 OECD countries	1975-1997	DFH, NLH
Ching, Kogid, & Furuoka (2010)	1, 4	Malaysia	1997-2008	DFH
Guochen and Wei (2012)	4, 5	China	2006-2011	SLH, DFH, FBH, NLH
Han et al. (2010)	3	77 countries	1994-2005	SLH
Kugler, & Ofoghi (2005)	1, 2	United Kingdom	1966-2003	DFH, FBH
Nejad and Kermani (2012)	1	Iran	1960-2010	SLH
Lee, Huang, & Yin (2013)	1, 2, 3	6 Developed countries	1979-2007	SLH
Pradhan, Arvin, & Norman (2015)	1, 2, 3, 4, 5, 6	34 OECD countries	1988- 2012	FBH
Pradhan et al. (2017)	1, 2, 3	Eurozone Countries	1980-2014	SLH, DFH, FBH, NLH
Vadlamannati (2008)	4, 5	India	1980-2006	SLH
Ward, & Zurbruegg (2000)	6	9 OECD countries	1961-1996	SLH, NLH
Present Study	1, 2, 3, 4, 5, 6	26 countries	1988-2013	SLH, FBH, NLH

Notes: SLH (Supply-leading hypothesis): if unidirectional causality is present from insurance market activity to economic growth; DFH (Demand-following hypothesis): if unidirectional causality from economic growth to insurance market activity is present; FBH (Feedback hypothesis): if bidirectional causality between insurance market activity and economic growth is present; NLH (Neutrality hypothesis): if no causality between insurance market activity and economic growth is present. 1: relating to life insurance density and economic growth; 2: relating to non-life insurance density and economic growth; 3: relating to total insurance density and economic growth; 4: relating to life insurance penetration and economic growth; 5: relating to non-life insurance penetration and economic growth; and 6: relating to total insurance penetration and economic growth. OECD is organization of economic cooperation and development; and A relates to quarterly data.

The DFH suggests that economic growth Granger-causes insurance market development. The supporters of this hypothesis suggest that insurance activity plays only a minor role in economic growth, and that insurance market activity is merely an outcome of economic growth in the real side of the economy. The fact is that, as an economy grows, additional insurance activity may emerge in the market in reaction to a higher demand for financial services. Studies supporting the DFH have been published by Beck and Webb (2003), Beenstock et al. (1986), Catalan, Impavido, and Musalem (2000), Ching et al. (2010), Guochen and Wei (2012), Han et al. (2010), Hwang and

Gao (2003), Kugler and Ofoghi (2005), and Ward and Zurbruegg (2000).

The FBH suggests that economic growth and insurance market development Granger-cause each other. In other words, insurance market development and economic growth can complement and reinforce each other, making insurance market development and real economic growth mutually causal. The argument in favour of this bidirectional causality is that insurance market activity is indispensable to economic growth, as economic growth inevitably requires the flows of insurance market activities. Studies supporting the FBH have been done by Chang, Lee, and Chang (2014), Guochen and Wei (2012), Kugler and Ofoghi (2005), Nejad and Kermani (2012), Pradhan, Arvin, and Norman (2015), Vadlamannati (2008), and Ward and Zurbruegg (2000).

The NLH suggests that insurance market development and economic growth are independent from each other. The proponents of this hypothesis maintain that insurance activity has no influence on economic growth. This means they are completely independent from each other. Studies supporting the NLH have been conducted by Pradhan et al. (2017), Catalan et al. (2000), Guochen and Wei (2012), and Vadlamannati (2008).

Table 3 summarizes the findings of the studies on the causal relations between insurance market development and economic growth.

4. DATA AND MODEL

Annual data ranging from 1980 to 2013 for 26 countries were obtained from the *World Development Indicators* of the World Bank and Sigma Economic Research & Consulting, Switzerland. The countries included in our analysis are listed in footnote 7. Of these 26 countries, eight are high income countries, 12 are high middle-income countries, and six are lower middle-income countries. The sample consists of 15 member countries of the G-20, plus 11 member countries from other economic groups. The samples are selected on the basis of the data available for insurance market development, economic growth, and six other macroeconomic variables, covering all countries and time periods.

The variables used in our study were the growth rate of real per capita income expressed as a percentage of gross domestic product (GDP), life insurance[11] density[12] (LID, direct domestic life premiums divided by population), non-life insurance[13] density (NID, direct domestic non-life premiums divided by population), total insurance

[11] Life insurance, in its general form, is guaranteed to pay a specific amount of indemnification to a beneficiary after the insured's death or to the insured if he/she lives beyond a certain age.

[12] All measures of 'density' are defined as direct domestic premiums (in USD) divided by population.

[13] Non-life insurance, commonly called "general insurance" in many countries, includes all other types of insurance, such as homeowner's insurance, motor vehicle insurance, marine insurance, liability insurance, etc. (Chen et al., 2013).

density (TID, direct domestic life and non-life premiums divided by population), life insurance penetration[14] (LIP, direct domestic life premiums as a percentage of gross domestic product), non-life insurance penetration (NIP, direct domestic non-life premiums as a percentage of gross domestic product), total insurance penetration (TIP, direct domestic life and non-life premiums as a percentage of gross domestic product), broad money supply as a percentage of gross domestic product (BRM), inflation rate (INF), real interest rate (RIR), urban population growth (UPG), youth dependency ratios (YDR), and government consumption expenditures as a percentage of gross domestic product (GCE).[15] A more comprehensive definition of these variables is given in Table 2.

The previous section provided a discussion on the types of links that may exist between insurance and economic growth. Possible links between economic growth and other macroeconomic variables, namely money supply, inflation rate, interest rate, and government consumption expenditure are intuitive and have been examined in a litany of papers which are not reviewed here. However, a discussion of why there may be a link between economic growth, insurance and the other two variables is in order. The discourse appears below.

Urban population growth brings important benefits for economic growth and societal development. High rates of urban population growth can facilitate economies of scale and positive network effects. However, there is a downside to rapid urban population growth, namely increased risk to critical infrastructure, increased social unrest and widening inequalities, increased demand for housing and other scarce resources, increased incidence of crime, and higher risk of the spread of disease. The combination of these problematic issues, which are related to rapid urban population growth, mean that risks to infrastructure, property, and individuals are elevated. These risks require the development of insurance markets at a more rapid pace. Analogously, and for similar reasons, the age distribution of the population, captured by the youth dependency ratio, is likely to affect both economic growth and risk levels, including whether risks are exacerbated, again providing a link to how much insurance is required and ultimately to the development of insurance markets.

For estimation purposes, all these variables have been converted into their natural logarithms. The summary statistics and the correlation among the variables are presented in Table 5. The correlation matrix shows that the various indicators of insurance market development (LID, NID, TID, LIP, NIP, and TIP) are indeed highly correlated. Therefore, in order to avoid the problem of multicollinearity, we use one only of these

[14] All measures of 'penetration' are defined as direct domestic premiums (in USD) expressed as a percentage of the gross domestic product.

[15] As was suggested by an anonymous reviewer, another relevant variable would be the size of underwriting contract, which would be a realistic measure of the degree of activeness of insurance market. This could be measured by the ratio of underwriting volume to gross domestic product. However, since we already have several insurance variables, considering this additional variable is left open for future research.

indicators of insurance market development at a time. Therefore, we present six set of results, one for each IMD indicator.

Table 4. List of Variables

Variable/ Description	Variable Code
Life insurance density [Direct domestic life premiums per capita]	LID
Non-life insurance density [Direct domestic non-life premiums per capita]	NID
Total Insurance density [Direct domestic premiums (both life and non-life) per capita]	TID
Life insurance penetration [Direct domestic life premiums as a % of gross domestic product]	LIP
Non-life insurance penetration [Direct domestic non-life premiums as a % of gross domestic product]	NIP
Total insurance penetration [Direct domestic premiums (both life and non-life) as a % of gross domestic product]	TIP
Per capita economic growth [% change in per capita gross domestic product]	GDP
Broad money supply [Broad measure of the money supply as a % of gross domestic product]	BRM
Inflation rate [Annual change in consumer price index, expressed in %]	INF
Real interest rate [Lending interest rate adjusted for inflation using the gross domestic product deflator, expressed in %]	RIR
Urban population growth [% change in urban population]	UPG
Youth dependency ratio [Ratio of the population under the age of 15 to the population aged 15-65, expressed in %]	YDR
Government consumption expenditure [Ratio of government consumption expenditure to gross domestic product, expressed in %]	GCE

Notes: All monetary measures are in real US dollars. Variables above are defined in the World Development Indicators and published by the World Bank and in World Insurance published by Sigma Economic Research & Consulting, Switzerland. The coverage of these variables is 1980 to 2013. Insurance density means direct domestic premiums (for life/ non-life/ total) in USD divided by population; and insurance penetration means direct domestic premiums (for life/ non-life/ total) in USD expressed as a % of the gross domestic product. These various measures of density and penetration are used to capture the insurance market development (IMD).

Table 5. Summary Statistics for the Variables

Variable	LID	NID	TID	LIP	NIP	TIP	GDP	BRM	INF	RIR	UPG	YDR	GCE
Part 1: Summary Statistics													
Mean	1.71	1.76	2.08	-1.9	-1.85	-1.52	1.26	1.8	0.86	1.49	0.47	1.65	1.14
Median	1.63	1.75	2.03	-1.92	1.8	-1.54	1.27	1.81	0.84	1.48	0.48	1.67	1.15
Max	3.84	3.35	3.92	-0.83	-1.28	-0.75	1.47	2.38	1.99	2.02	0.82	1.95	1.39
Min	-0.41	-0.04	0.22	-3.37	-2.46	-2.25	-0.11	1.01	-0.23	-0.4	-0.01	1.32	0.7
Std.	1.06	0.86	0.93	0.58	0.3	0.39	0.11	0.26	0.31	0.13	0.18	0.16	0.13
Ske	0.11	0.06	0.14	-0.14	-0.14	0.12	-5.25	-0.16	0.24	-4.4	-0.39	-0.15	-0.52
Kur	1.8	1.92	1.81	2.15	1.89	1.81	5.56	2.9	3.98	7.19	2.65	1.98	2.88
Part 2: Correlation Matrix													
LID	1												
NID	0.92*	1											
	[0.00]												
TID	0.98*	0.98*	1										
	[0.00]	[0.00]											
LIP	0.90*	0.68*	0.81*	1									
	[0.00]	[0.00]	[0.00]										
NIP	0.82*	0.92*	0.89*	0.68*	1								
	[0.00]	[0.00]	[0.00]	[0.00]									
TIP	0.94*	0.83*	0.91*	0.94*	0.86*	1							
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]								
GDP	-0.02	-0.07	-0.04	0.02	-0.08	-0.03	1						
	[0.81]	[0.00]	[0.00]	[0.01]	[0.00]	[0.80]							
BRM	0.58*	0.44*	0.52*	0.60*	0.37*	0.54*	0.15	1					
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]						
INF	-0.53*	-0.44*	-0.49*	-0.51*	-0.38*	-0.47*	-0.12	-0.61*	1				
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.50]	[0.00]					
RIR	-0.11	-0.03	-0.07	-0.17**	-0.02	-0.11	0.17**	-0.21**	0.01	1			
	[0.63]	[0.80]	[0.00]	[0.05]	[0.00]	[0.50]	[0.05]	[0.05]	[0.00]				
UPG	-0.61*	-0.63*	-0.63*	-0.44*	-0.50*	-0.50*	-0.01	-0.39*	0.26*	-0.03	1		
	[000]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.50]	[0.00]	[0.00]	[0.50]			
YDR	-0.81*	0.77*	-0.80*	-0.67*	-0.63*	0.69*	-0.1	-0.65*	0.51*	0.07	0.71*	1	
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.50]	[0.00]	[0.00]	[0.50]	[0.00]		
GCE	0.57*	0.62*	0.61*	0.47*	0.66*	0.60*	-0.06	0.40*	-0.32*	0.14**	-0.48*	-0.54*	1
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.80]	[0.00]	[0.00]	[0.05]	[0.00]	[0.00]	

Notes: GDP: Per capita economic growth rate; BRM: Broad money supply; INF: Inflation rate; RIR: Real interest rate; UPG: Urban population growth; YDR: youth dependency ratio; GCE: Government consumption expenditure; LID: Life insurance density; NID: Non-life insurance density; TID: Total insurance density; LIP: Life insurance penetration; NIP: Non-life insurance penetration; TIP: Total insurance penetration. Values reported in square brackets are the probability levels of significance. * and ** indicate significance at the 1% and 5% levels of significance, respectively.

Note that since the period of our analysis is 1980 to 2013 and of short duration, we deploy panel data techniques. These techniques are better in detecting unit root, cointegration and Granger causality relationships, because a pooled level regression combines cross-sectional and time series information in the data when estimating the coefficients (Petkovski and Jordan, 2014).

We used the following model to detect the long-run and short-run causal relationship between economic growth, insurance market development, and other six macroeconomic variables.

$$GDP_{it} = \beta_{0GDP_{it}} + \beta_{1GDP_i} IMD_{it} + \beta_{2GDP_i} BRM_{it} + \beta_{3GDP_i} INF_{it} + \beta_{4GDP_i} RIR_{it} + \beta_{5GDP_i} UPG_{it} + \beta_{6GDP_i} YDR_{it} + \beta_{7GDP_i} GCE_{it} + \varepsilon_{it}, \quad (1)$$

where IMD denotes insurance market development. As we noted above, IMD is represented by six indicators or proxies. We label these LID, NID, TID, LIP, NIP, and TIP; for $i = 1, 2, \cdots, 26$ for each country in the panel; and $t = 1, 2, \cdots, T$ (1980-2013) for the time periods involved. ε_{it} refers to independently and normally distributed random variables for all i and t with zero means and finite heterogeneous variances (σ_{i2}).

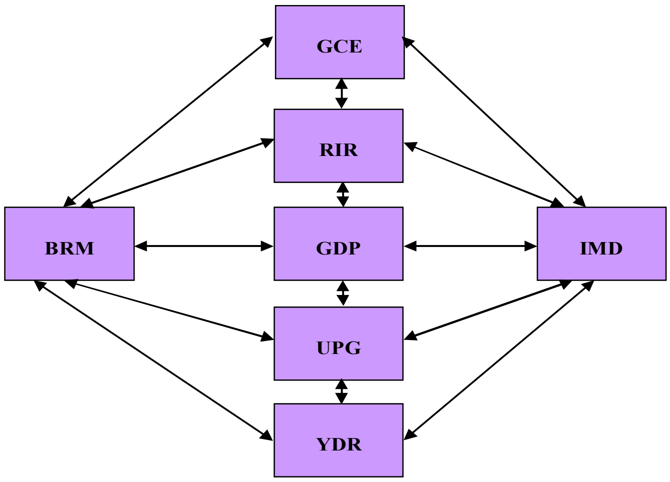

Figure 2. Possible Directions of Causality

Notes: GDP: Per capita economic growth rate; IMD: Insurance market development (measured by six separate indicators); BRM: Broad money supply; RIR: Real interest rate; UPG: Urban population growth; YDR: youth dependency ratio; GCE: Government consumption expenditure. IMD consists of the individual inclusion of LID, NID, TID, LIP, NIP, or TIP. LID: Life insurance density; NID: Non-life insurance density; TID: Total insurance density; LIP: Life insurance penetration; NIP: Non-life insurance penetration; TIP: Total insurance penetration.

The parameters β_{jGDP} (for $j = 1, 2, \cdots, 7$) represent the long-run elasticity estimates of GDP in respect of IMD, BRM, INF, RIR, UPG, YDR and GCE, respectively. Our task is to estimate the parameters in Equation (1) and to conduct panel tests on the causal nexus between these variables.

We need also to estimate the parameters in Equation (1) and to conduct some panel tests on the causal nexus between these variables. The literature cited on economic development and the role of the financial sector leads us to expect that $\beta_1 > 0$, implying that insurance market development will lead to an increase in economic growth. Similarly, we expect $\beta_2 > 0$, implying that an increase in broad money supply is likely to cause an increase in economic growth. Given that equations similar to (1) may be written with other variables besides GDP as the dependent variable, we expect the existence of bidirectional causality between most of these variables. Figure 2 depicts the possible causal relationships between the variables.

5. THE ESTIMATION STRATEGY AND EMPIRICAL RESULTS

Two types of tests were performed in the present study, namely panel cointegration tests and panel Granger causality tests. In conducting these tests, an essential first step was to identify the order of integration at which the variables attain stationarity. Three sets of panel unit root tests were used for this purpose, namely the Levin-Lin-Chu (LLC) test (Levin, Lin and Chu, 2012), the Augmented Dickey Fuller (ADF) test, and the Phillips Perron (PP) test (Choi, 2001).[16]

Table 6 reports the results of unit root tests for each variable. All the time series variables were non-stationary in their levels, except for inflation. However, they were all stationary in first differences at a 1% level of significance. That is, all the variables are integrated of order one (denoted by I (1)) at the individual country and panel levels. Being I (1) meets the requirements of the cointegration test. However, since inflation attains stationarity for the level data, for the sake of consistency we deleted it from our cointegration and Granger causality analyses. Thus, the primary objective of the present study became detecting whether there are long-run and dynamic causal relationships between economic growth, the insurance market development, and the five other remaining macroeconomic variables.

Subsequently, we deployed the Johansen-Fisher panel cointegration test (Maddala and Wu 1999), using both trace statistics and maximum eigenvalues, applied to the panel setting to check for any cointegration between GDP, IMD (measured by LID/ NID/ TID/ LIP/ NIP/ TIP), BRM, RIR, UPG, YDR, and GCE. The Johansen-Fisher panel cointegration test is the panel version of the individual Johansen cointegration test. The null hypothesis for these tests is that the variables are not cointegrated. If the null hypothesis is rejected, it implies that there is cointegration, indicating the presence of a long-run equilibrium relationship among the non-stationary variables.

[16] The LLC, ADF, and PP tests are described in several advanced econometric textbooks and are not described here due to space constraints.

Table 6. Results of Panel Unit Root Tests

	Test Statistics						
	LLC		ADF		PP		
Variables	Level	First Diff.	Level	First Diff.	Level	First Diff.	Inference
GDP	-0.64	-27.4*	24.1	605.8*	27	228.8*	I [1]
BRM	5.84	-11.9*	18.2	223.1*	11.6	395.1*	I [1]
INF	-4.43*	-22.9*	65.5*	500.5*	78.5*	1118.4*	I [0]
RIR	-1.06	-25.5*	40.5	538.7*	48.3	184.0*	I [1]
UPG	-1.07	-5.28*	44.4	189.9*	10.6	377.1*	I [1]
YDR	4.74	-11.6*	36.7	242.4*	49.7	61.9*	I [1]
GCE	0.85	-15.2*	27.1	282.9*	26	424.2*	I [1]
LID	5.59	-10.3*	16.7	185.4*	3.13	265.9*	I [1]
NID	4.65	-10.8*	4.09	193.8*	2.42	260.6*	I [1]
TID	6.06	-10.4*	2.96	183.8*	1.43	246.7*	I [1]
LIP	0.52	-9.02*	45.1	185.4*	44.9	275.2*	I [1]
NIP	-1.08	-8.22*	58.4	185.5*	66.2	265.2*	I [1]
TIP	-1.39	-8.24*	53.3	182.8*	62.2	247.1*	I [1]

Notes: GDP: Per capita economic growth rate; BRM: Broad money supply; INF: Inflation rate; RIR: Real interest rate; UPG: Urban population growth; YDR: youth dependency ratio; GCE: Government consumption expenditure; LID: Life insurance density; NID: Non-life insurance density; TID: Total insurance density; LIP: Life insurance penetration; NIP: Non-life insurance penetration; TIP: Total insurance penetration. * denotes rejection of the null hypothesis at a 1% level of significance.

Table 7. Results of the Panel Cointegration Tests

	With linear deterministic trend		With no deterministic trend	
Hypothesized No. of CE(s)	λTrace	λMax-eigen	λTrace	λMax-eigen
Case 1: GDP, BRM, RIR, UPG, YDR, GCE, LID				
None (k ≤ 0)	880.4*	857.4*	1014*	634.7*
At most 1 (k ≤ 1)	787.6*	400.4*	777.2*	409.0*
At most 2 (k ≤ 2)	556.0*	343.7*	500.5*	309.1*
At most 3 (k ≤ 3)	368.8*	250.6*	324.6*	212.8*
At most 4 (k ≤ 4)	233.0*	167.0*	200.0*	134.7*
At most 5 (k ≤ 5)	133.2*	104.5*	113.2*	102.8*
At most 6 (k ≤ 6)	97.64*	97.64*	54.25***	54.25***
Case 2: GDP, BRM, RIR, UPG, YDR, GCE, NID				
None (k ≤ 0)	891.4*	871.8*	951.9*	624.1*
At most 1 (k ≤ 1)	733.2*	381.1*	664.9*	350.2*
At most 2 (k ≤ 2)	484.6*	298.5*	429.9*	220.5*
At most 3 (k ≤ 3)	311.6*	197.4*	312.0*	200.4*
At most 4 (k ≤ 4)	219.9*	158.5*	189.5*	128.0*
At most 5 (k ≤ 5)	117.9*	94.47*	109.0*	96.41*
At most 6 (k ≤ 6)	86.32*	86.32*	58.93**	58.93**

Table 7. Results of the Panel Cointegration Tests (Con't)

	With linear deterministic trend		With no deterministic trend	
Hypothesized No. of CE(s)	λTrace	λMax-eigen	λTrace	λMax-eigen
Case 3: GDP, BRM, RIR, UPG, YDR, GCE, TID				
None (k ≤ 0)	903.5*	941.5*	1030*	668.8*
At most 1 (k ≤ 1)	773.7*	412.8*	721.4*	388.6*
At most 2 (k ≤ 2)	521.9*	336.8*	453.1*	258.3*
At most 3 (k ≤ 3)	337.4*	215.6*	319.1*	205.5*
At most 4 (k ≤ 4)	230.7*	170.6*	190.8*	133.0*
At most 5 (k ≤ 5)	117.5*	95.98*	105.0*	93.70*
At most 6 (k ≤ 6)	83.13*	83.13*	54.99***	54.99***
Case 4: GDP, BRM, RIR, UPG, YDR, GCE, LIP				
None (k ≤ 0)	902.2*	837.4*	976.5*	648.7*
At most 1 (k ≤ 1)	724.1*	387.5*	680.3*	375.3*
At most 2 (k ≤ 2)	486.6*	324.3*	441.5*	244.5*
At most 3 (k ≤ 3)	307.4*	200.1*	303.7*	187.3*
At most 4 (k ≤ 4)	213.9*	137.7*	211.2*	144.2**
At most 5 (k ≤ 5)	143.3*	108.8*	116.8*	106.8*
At most 6 (k ≤ 6)	105.1*	105.1*	55.22***	55.22***
Case 5: GDP, BRM, RIR, UPG, YDR, GCE, NIP				
None (k ≤ 0)	882.6*	993.3*	1020*	676.0*
At most 1 (k ≤ 1)	746.2*	435.5*	689.4*	363.7*
At most 2 (k ≤ 2)	461.8*	267.0*	485.3*	268.4*
At most 3 (k ≤ 3)	295.2*	182.1*	313.9*	179.8*
At most 4 (k ≤ 4)	202.9*	129.1*	207.2*	128.3*
At most 5 (k ≤ 5)	143.8*	118.6*	130.2*	117.0*
At most 6 (k ≤ 6)	89.66*	89.66*	58.27**	58.27**
Case 6: GDP, BRM, RIR, UPG, YDR, GCE, TIP				
None (k ≤ 0)	874.6*	918.3*	1002*	688.8*
At most 1 (k ≤ 1)	728.8*	420.5*	656.1*	384.9*
At most 2 (k ≤ 2)	459.1*	308.6*	423.6*	255.8*
At most 3 (k ≤ 3)	294.9*	194.8*	295.2*	185.6*
At most 4 (k ≤ 4)	203.8*	131.9*	191.0*	126.1*
At most 5 (k ≤ 5)	143.6*	107.7*	112.8*	106.1*
At most 6 (k ≤ 6)	104.4*	104.4*	51.40***	51.40***

Notes: GDP: Per capita economic growth rate; BRM: Broad money supply; RIR: Real interest rate; UPG: Urban population growth; YDR: youth dependency ratio; GCE: Government consumption expenditure; LID: Life insurance density; NID: Non-life insurance density; TID: Total insurance density; LIP: Life insurance penetration; NIP: Non-life insurance penetration; TIP: Total insurance penetration. λTrace is Trace statistics; and λMax-eigen is Max-eigen statistics. *, **, and *** denote rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively.

We investigate six different cases by using each insurance market development indicator (LID/ NID/ TID/ LIP/ NIP/ TIP) separately with the variables GDP, BRM, RIR, UPG, YDR, and GCE. The results of this test are reported in Table 7. The estimated results indicate that there are six significant cointegrating vectors in each case, in other words, economic growth is cointegrated with insurance market development indicators and the other five macroeconomic variables.

Having confirmed the existence of cointegration for our panel, the next step was to estimate the associated long-run cointegration parameters. Although ordinary least squares (OLS) estimators of the cointegrated vectors are super-convergent, their distribution is asymptotically biased and depends on nuisance parameters associated with the presence of serial correlation in the data (Pedroni, 2001). Since problems that exist in time series analysis also arise in panel data analysis, and since they tend to be more prevalent in the presence of heteroscedasticity, several estimators are proposed. The present study uses two panel cointegration estimators, namely the between-group, fully-modified OLS (FMOLS[17]) and the dynamic OLS (DOLS[18]). Both FMOLS and DOLS provide consistent estimates of standard errors that can be used for statistical inferences. These estimators are described in most advanced econometric texts and are therefore not described here. The coefficients using FMOLS and DOLS estimators are shown in Table 8.

Table 8. Panel FMOLS and DOLS Results

		Panels			
		FMOLS		DOLS	
Dependent Variable	Independent Variables	Coefficients	t-Statistic	Coefficients	t-Statistic
Case 1: GDP, BRM, RIR, UPG, YDR, GCE, LID					
GDP	LID	0.01	0.51	-0.02	-0.88*
	BRM	0.1	1.94**	0.2	3.39*
	RIR	0.27	6.82*	0.37	6.13*
	UPG	-0.04	-0.58	0.01	0.23
	YDR	0.07	0.45	0.1	0.61
	GCE	-0.3	-3.89*	-0.2	-2.75
Case 2: GDP, BRM, RIR, UPG, YDR, GCE, NID					
GDP	NID	0.04	1.25	-0.03	-0.84
	BRM	0.09	1.68**	0.15	2.24**
	RIR	0.26	6.91*	0.32	4.15*
	UPG	-0.05	-0.76	-0.01	-0.05
	YDR	0.16	1.15	0.12	0.89
	GCE	-0.29	-3.88*	-0.19	-2.21

[17] FMOLS is a non-parametric approach, and it takes into account the possible correlation between the error term and the first differences of the regressors, as well as the presence of a constant term, to deal with corrections for serial correlation (Maeso-Fernandez, Osbat and Schnatz, 2006; Pedroni, 2000, 2001).

[18] DOLS is a parametric approach which adjusts the errors by augmenting the static regression with leads, lags, and contemporaneous values of the regressor in first differences (Kao and Chiang, 2000).

Table 8. Panel FMOLS and DOLS Results (Con't)

		Panels			
		FMOLS		DOLS	
Dependent Variable	Independent Variables	Coefficients	t-Statistic	Coefficients	t-Statistic
Case 3: GDP, BRM, RIR, UPG, YDR, GCE, TID					
GDP	TID	0.04	1.34	-0.01	-0.06
	BRM	0.09	1.79***	0.2	2.41**
	RIR	0.26	6.82*	0.34	3.82*
	UPG	-0.04	-0.54	0.05	0.56
	YDR	0.18	1.17	0.21	0.98
	GCE	-0.29	-3.89*	-0.24	-2.28**
Case 4: GDP, BRM, RIR, UPG, YDR, GCE, LIP					
GDP	LIP	-0.01	-0.31	-0.03	-0.7
	BRM	0.09	1.60***	0.1	1.52***
	RIR	0.28	6.44*	0.2	2.84*
	UPG	-0.07	-0.93	-0.03	-0.45
	YDR	-0.05	-0.33	0.14	0.96
	GCE	-0.31	-3.59*	-0.32	-3.74*
Case 5: GDP, BRM, RIR, UPG, YDR, GCE, NIP					
GDP	NIP	0.02	0.32	0.06	0.72
	BRM	0.1	1.70***	0.06	0.68
	RIR	0.28	6.58*	0.24	2.59*
	UPG	-0.07	-0.94	-0.08	-0.74
	YDR	-0.01	-0.05	-0.01	-0.12
	GCE	-0.31	-3.62*	-0.33	-2.84*
Case 6: GDP, BRM, RIR, UPG, YDR, GCE, TIP					
GDP	TIP	0.04	0.74	-0.03	-0.48
	BRM	0.1	1.74***	0.17	1.9
	RIR	0.28	6.56*	0.29	3.19*
	UPG	-0.06	-0.82	-0.01	-0.02
	YDR	0.04	0.3	0.11	0.78
	GCE	-0.31	-3.64*	-0.39	-3.68*

Notes: GDP: Per capita economic growth rate; BRM: Broad money supply; RIR: Real interest rate; UPG: Urban population growth; YDR: youth dependency ratio; GCE: Government consumption expenditure; LID: Life insurance density; NID: Non-life insurance density; TID: Total insurance density; LIP: Life insurance penetration; NIP: Non-life insurance penetration; TIP: Total insurance penetration. *, **, and *** denote rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively.

We are interested in the nature of the relationships (positive or negative) between the variables. It seems that insurance market development has no significant impact on economic growth. However, the results suggest that economic growth is significantly influenced by broad money supply, real interest rates, and government consumption expenditure. While the impact of broad money supply and real interest rates are both positive, the impact of government consumption expenditure is negative. This is true in all six cases.

Engle and Granger (1987) have demonstrated that when variables are cointegrated, an error-correction model necessarily describes the data-generating process. Thus, on the basis of the unit root and cointegration test results above, the vector error-correction models, VECMs, were used to determine the causal relationships between the variables. In other words, we sought to determine which variable caused the other, in the presence of all the other variables. We were able to determine this causal link for both the short run and the long run. Following the Arellano and Bond (1991) and Holtz-Eakin, Newey, and Rosen (1988) estimation procedures, we deployed the VECMs as presented below to trace the causal links between economic growth, insurance market development, and the other five macroeconomic variables.

$$\begin{bmatrix} \Delta GDP_{it} \\ \Delta IMD_{it} \\ \Delta BRM_{it} \\ \Delta RIR_{it} \\ \Delta UPG_{it} \\ \Delta YDP_{it} \\ \Delta GCE_{it} \end{bmatrix} = \begin{bmatrix} \lambda_{1j} \\ \lambda_{2j} \\ \lambda_{3j} \\ \lambda_{4j} \\ \lambda_{5j} \\ \lambda_{6j} \\ \lambda_{7j} \end{bmatrix} + \sum_{k=1}^{p} \begin{bmatrix} d_{11ik}(L) d_{12ik}(L) d_{13ik}(L) d_{14ik}(L) d_{15ik}(L) d_{16ik}(L) d_{17ik}(L) \\ d_{21ik}(L) d_{22ik}(L) d_{23ik}(L) d_{24ik}(L) d_{25ik}(L) d_{26ik}(L) d_{27ik}(L) \\ d_{31ik}(L) d_{32ik}(L) d_{33ik}(L) d_{34ik}(L) d_{35ik}(L) d_{36ik}(L) d_{37ik}(L) \\ d_{41ik}(L) d_{42ik}(L) d_{43ik}(L) d_{44ik}(L) d_{45ik}(L) d_{46ik}(L) d_{47ik}(L) \\ d_{51ik}(L) d_{52ik}(L) d_{53ik}(L) d_{54ik}(L) d_{55ik}(L) d_{56ik}(L) d_{57ik}(L) \\ d_{61ik}(L) d_{62ik}(L) d_{63ik}(L) d_{64ik}(L) d_{65ik}(L) d_{66ik}(L) d_{67ik}(L) \\ d_{71ik}(L) d_{72ik}(L) d_{73ik}(L) d_{74ik}(L) d_{75ik}(L) d_{76ik}(L) d_{77ik}(L) \end{bmatrix} \begin{bmatrix} \Delta GDP_{it-k} \\ \Delta IMD_{it-k} \\ \Delta BRM_{it-k} \\ \Delta RIR_{it-k} \\ \Delta UPG_{it-k} \\ \Delta YDP_{it-k} \\ \Delta GCE_{it-k} \end{bmatrix}$$

$$+ \begin{bmatrix} \delta_{1i} ECT_{it-1} \\ \delta_{2i} ECT_{it-1} \\ \delta_{3i} ECT_{it-1} \\ \delta_{4i} ECT_{it-1} \\ \delta_{5i} ECT_{it-1} \\ \delta_{6i} ECT_{it-1} \\ \delta_{7i} ECT_{it-1} \end{bmatrix} + \begin{bmatrix} \xi_{1it} \\ \xi_{2it} \\ \xi_{3it} \\ \xi_{4it} \\ \xi_{5it} \\ \xi_{6it} \\ \xi_{7it} \end{bmatrix}, \tag{2}$$

where Δ is the first difference operator; i represents a country in the panel ($i = 1, 2 \cdots, N$); t denotes a year in the panel ($t = 1, 2, \ldots, T$); p is the lag lengths for the differenced variables of the respective equations; and ε_{it} is a normally-distributed random error term for all i and t with a zero mean and a finite variance.

The ECTs are error-correction terms, derived from the cointegrating equations. The ECTs represent long-run dynamics, while the differenced variables represent short-run dynamics between the variables. Put differently, the ECTs indicate the extent of the deviations from the long-run equilibrium present in the previous periods. The coefficients of the ECTs fulfil the role of adjustment parameters, which show the proportion of the disequilibria recovered during the subsequent period. By contrast, the coefficients of the lagged first differences provide an indication of the short-run relationships between the variables (Enders, 2004; Harris and Sollis, 2006).

In the present study, we test for both short-run and long-run causal relationships. The short-run causal relationship is based on Wald statistics and is measured by using F-statistics and the significance of the lagged changes in independent variables, while the long-run causal relationship is assessed by t-tests applied to the lagged ECT coefficients. Table 9 presents the restrictions to test the short-run and long-run dynamics between insurance market development, economic growth, and the other macroeconomic variables in our sample of countries.

It can be noted that preceding to VECM estimation, we need to specify the lag lengths in the estimation process. This is a key step, as the causality test results may depend judgmentally on the description of a suitable lag structure. Both too few and too many lags may cause problems. On the one hand, too few lags mean that some important variables are omitted from the model, and such a specification error usually causes bias in the regression coefficients that are retained, leading to misleading conclusions. On the other hand, too many lags waste observations and will usually increase the standard error of the estimated coefficients, making the results less reliable.

Table 9. Restrictions to Test the Dynamics Between the Variables

Cases	Causal Flows	Restrictions
1	IMD => GDP; GDP => IMD	$d12ik \neq 0; \delta 1i \neq 0; d21ik \neq 0; \delta 2i \neq 0$
2	BRM => GDP; GDP => BRM	$d13ik \neq 0; \delta 1i \neq 0; d31ik \neq 0; \delta 3i \neq 0$
3	RIR => GDP; GDP => RIR	$d14ik \neq 0; \delta 1i \neq 0; d41ik \neq 0; \delta 4i \neq 0$
4	UPG => GDP; GDP => UPG	$d15ik \neq 0; \delta 1i \neq 0; d51ik \neq 0; \delta 5i \neq 0$
5	YDR => GDP; GDP => YDR	$d16ik \neq 0; \delta 1i \neq 0; d61ik \neq 0; \delta 6i \neq 0$
6	GCE => GDP; GDP => GCE	$d17ik \neq 0; \delta 1i \neq 0; d71ik \neq 0; \delta 7i \neq 0$
7	BRM => IMD; IMD => BRM	$d23ik \neq 0; \delta 2i \neq 0; d32ik \neq 0; \delta 3i \neq 0$
8	RIR => IMD; IMD => RIR	$d24ik \neq 0; \delta 2i \neq 0; d42ik \neq 0; \delta 4i \neq 0$
9	UPG => IMD; IMD => UPG	$d25ik \neq 0; \delta 2i \neq 0; d52ik \neq 0; \delta 5i \neq 0$
10	YDR => IMD; IMD => YDR	$d26ik \neq 0; \delta 2i \neq 0; d62ik \neq 0; \delta 6i \neq 0$
11	GCE => IMD; IMD => GCE	$d27ik \neq 0; \delta 2i \neq 0; d72ik \neq 0; \delta 7i \neq 0$
11	RIR => BRM; BRM => RIR	$d34ik \neq 0; \delta 3i \neq 0; d43ik \neq 0; \delta 4i \neq 0$
12	UPG => BRM; BRM => UPG	$d35ik \neq 0; \delta 3i \neq 0; d53ik \neq 0; \delta 5i \neq 0$
13	YDR => BRM; BRM =>YDR	$d36ik \neq 0; \delta 3i \neq 0; d63ik \neq 0; \delta 6i \neq 0$
14	GCE => BRM; BRM => GCE	$d37ik \neq 0; \delta 3i \neq 0; d73ik \neq 0; \delta 7i \neq 0$
15	UPG => RIR; RIR => UPG	$d45ik \neq 0; \delta 4i \neq 0; d54ik \neq 0; \delta 5i \neq 0$
16	YDR => RIR; RIR => YDR	$d46ik \neq 0; \delta 4i \neq 0; d64ik \neq 0; \delta 6i \neq 0$
17	GCE => RIR; RIR => GCE	$d47ik \neq 0; \delta 4i \neq 0; d74ik \neq 0; \delta 7i \neq 0$
18	YDR => UPG; UPG => YDR	$d56ik \neq 0; \delta 5i \neq 0; d65ik \neq 0; \delta 6i \neq 0$
19	GCE => UPG; UPG => GCE	$d57ik \neq 0; \delta 6i \neq 0; d75ik \neq 0; \delta 7i \neq 0$
20	GCE => YDR; YDR => GCE	$d67ik \neq 0; \delta 6i \neq 0; d76ik \neq 0; \delta 7i \neq 0$

Notes: GDP: Per capita economic growth; IMD: Insurance market development; BRM: Broad money supply; INF: Inflation rate; RIR: Real interest rate; UPG: Urban population growth; YDR: youth dependency ratio; GCE: Government consumption expenditure; LID: Life insurance density; NID: Non-life insurance density; TID: Total insurance density; LIP: Life insurance penetration; NIP: Non-life insurance penetration; TIP: Total insurance penetration. IMD is represented by LID, NID, TID, LIP, NLP, or TIP.

Moreover, there is no universal rule for determining the maximum lag lengths, though fairly reliable formal model specification criteria are available (see for instance Hendry, 1995). Preferably, the lag structure is allowed to vary across countries, variables, and equation systems. Nevertheless, for a relatively large panel such as ours, this would increase the computational burden substantially. For this intention, under each system, we allow different maximum lag lengths for the variables, but do not allow them to vary across countries. We estimate each equation accordingly and choose the combination of lags which minimizes the Akaike Information Criterion (AIC) and the Schwartz-Bayes Information Criterion (SBIC). The lag specification results in our VECM estimation are not reported here due to space constraints. The results are available from the authors upon request.

The results of the panel Granger causality tests are shown in Table 10, which reports both the short-run and long-run causality results. The long-run results are fairly uniform in one respect. When ΔGDP acts as the dependent variable, the lagged error-correction terms are uniformly statistically significant, no matter which indicator of insurance market development we use. Thus, in each case, economic growth tends to converge to its long-run equilibrium path in response to changes in its regressors, which are comprised of other macroeconomic variables, as well as an indicator of insurance market development. Based on these results, we can confirm that insurance sector development and the other macroeconomic variables that we consider are significant drivers of economic growth in the long run. Our results indicate that the change in the level of per capita economic growth rapidly responds to any deviation in the long-run equilibrium (or short-run disequilibrium) for the $t-1$ period. In other words, the effect of an instantaneous shock from insurance market development and other macroeconomic variables on the per capita economic growth will be completely adjusted in the long run. The return to equilibrium, however, occurs at different rates, namely 73% in Case 1, 82% in Case 2, 79% in Case 3, 71% in Case 4, 75% in Case 5, and 74% in Case 6.

Table 10. Results of Panel Granger Causality Tests

Dependent Variable	Independent Variables							ECT_{-1} Coefficient
Case 1: GDP, BRM, RIR, UPG, YDR, GCE, LID								
	ΔGDP	ΔLID	ΔBRM	ΔRIR	ΔUPG	ΔYDR	ΔGCE	ECT_{-1}
ΔGDP	------	8.51*	6.40*	0.74	2.9	23.4*	2.08	-0.73 (-13.3)*
	[---]	[0.00]	[0.00]	[0.69]	[0.23]	[0.00]	[0.35]	
ΔLID	3.50***	------	1.69	27.0*	0.46	9.06*	4.09**	0.13 (2.90)
	[0.10]	[---]	[0.44]	[0.00]	[0.79]	[0.01]	[0.05]	
ΔBRM	0.94	1.05	------	1.73	0.96	3.64**	1.1	0.06 (2.61)
	[0.62]	[0.59]	[---]	[0.42]	[0.61]	[0.10]	[0.58]	
ΔRIR	4.34**	1.62	17.2*	------	3.17**	0.42	4.37**	-0.25 (-3.37)**
	[0.05]	[0.44]	[0.00]	[---]	[0.10]	[0.80]	[0.05]	
ΔUPG	5.38*	0.94	0.3	4.87**	------	1.79	0.36	-0.01 (-0.36)
	[0.01]	[0.62]	[0.85]	[0.05]	[---]	[0.40]	[0.83]	
ΔYDR	1.77	1.2	0.76	0.09	0.55	------	3.75***	-0.01 (-0.99)
	[0.41]	[0.55]	[0.68]	[0.96]	[0.76]	[---]	[0.10]	
ΔGCE	1.63	7.13*	1.61	5.09**	3.17**	0.4	------	-0.02 (-1.37)
	[0.44]	[0.02]	[0.44]	[0.05]	[0.10]	[0.82]	[---]	

Table 10. Results of Panel Granger Causality Tests (Con't)

Dependent Variable	Independent Variables							ECT_{-1} Coefficient
Case 2: GDP, BRM, RIR, UPG, YDR, GCE, NID								
	ΔGDP	ΔNID	ΔBRM	ΔRIR	ΔUPG	ΔYDR	ΔGCE	ECT_{-1}
ΔGDP	------	17.9*	4.85**	1.98	2.36	15.7*	1.89	-0.82 (-14.2)*
	[---]	[0.00]	[0.05]	[0.37]	[0.30]	[0.00]	[0.39]	
ΔNID	0.9	------	1.78	14.6*	2.3	11.8*	4.62**	0.03 (0.79)
	[0.64]	[---]	[0.41]	[0.00]	[0.32]	[0.00]	[0.05]	
ΔBRM	0.68	1.1	------	1.54	0.88	3.81**	1.22	0.06 (2.34)
	[0.71]	[0.57]	[---]	[0.46]	[0.64]	[0.05]	[0.59]	
ΔRIR	2.43	0.83	17.8*	------	3.84	0.24	4.61**	-0.22 (-2.74)
	[0.29]	[0.66]	[0.00]	[---]	[0.10]	[0.89]	[0.05]	
ΔUPG	6.94*	0.04	0.34	5.28**	------	2.16	0.35	-0.02 (-0.95)
	[0.01]	[0.98]	[0.84]	[0.05]	[---]	[0.34]	[0.84]	
ΔYDR	2.17	0.34	0.67	0.17	0.52	------	3.36***	-0.01 (-1.34)
	[0.34]	[0.84]	[0.72]	[0.92]	[0.77]	[---]	[0.10]	
ΔGCE	0.54	6.74*	1.01	5.37**	3.05**	0.3	------	-0.01 (-0.66)
	[0.76]	[0.01]	[0.60]	[0.05]	[0.10]	[0.86]	[---]	
Case 3: GDP, BRM, RIR, UPG, YDR, GCE, TID								
	ΔGDP	ΔTID	ΔBRM	ΔRIR	ΔUPG	ΔYDR	ΔGCE	ECT_{-1}
ΔGDP	------	17.0*	6.06*	1.25	2.72	19.3*	1.94	-0.79 (-13.9)*
	[---]	[0.00]	[0.01]	[0.53]	[0.26]	[0.00]	[0.38]	
ΔTID	2.14	------	1.94	23.1*	0.55	9.84*	4.33**	0.07 (1.86)
	[0.34]	[---]	[0.23]	[0.00]	[0.76]	[0.01]	[0.05]	
ΔBRM	0.86	1.01	------	1.77	0.95	3.71**	1.15	0.06 (2.46)
	[0.65]	[0.60]	[---]	[0.41]	[0.62]	[0.05]	[0.56]	
ΔRIR	3.76**	1.73	17.5*	------	3.08***	0.36	4.40**	-0.24 (-3.10)
	[0.05]	[0.42]	[0.00]	[---]	[0.10]	[0.83]	[0.05]	
ΔUPG	6.17*	0.91	0.29	4.90**	------	2.13	0.34	-0.01 (-0.78)
	[0.01]	[0.82]	[0.86]	[0.05]	[---]	[0.34]	[0.84]	
ΔYDR	1.84	0.76	0.72	0.13	0.55	------	3.68**	-0.01 (-1.01)
	[0.391]	[0.68]	[0.69]	[0.94]	[0.76]	[---]	[0.10]	
ΔGCE	0.84	5.47*	1.22	5.11**	3.23***	0.31	------	-0.02 (-1.05)
	[0.66]	[0.01]	[0.54]	[0.05]	[0.10]	[0.85]	[---]	
Case 4: GDP, BRM, RIR, UPG, YDR, GCE, LIP								
	ΔGDP	ΔLIP	ΔBRM	ΔRIR	ΔUPG	ΔYDR	ΔGCE	ECT_{-1}
ΔGDP	------	0.63	5.13**	1.18	2.11	25.2*	1.78	-0.71 (-13.8)*
	[---]	[0.73]	[0.05]	[0.55]	[0.20]	[0.00]	[0.41]	
ΔLIP	2.73	------	0.33	9.48*	0.63	4.45**	1.38	0.09 (2.78)
	[0.76]	[---]	[0.85]	[0.00]	[0.73]	[0.05]	[0.50]	
ΔBRM	784	0.64	------	1.41	0.93	3.73***	1.1	0.05 (2.25)
	[0.67]	[0.73]	[---]	[0.49]	[0.63]	[0.10]	[0.58]	
ΔRIR	2.2	0.93	18.3*	------	3.03***	0.51	5.04**	-0.18 (-2.66)
	[0.33]	[0.63]	[0.00]	[---]	[0.10]	[0.77]	[0.05]	
ΔUPG	5.18**	1.02	0.33	5.28*	------	1.82	0.42	-0.01 (-0.57)
	[0.05]	[0.59]	[0.85]	[0.05]	[---]	[0.40]	[0.81]	
ΔYDR	2.53	0.83	0.73	0.12	0.51	------	3.58***	-0.01 (-1.47)
	[0.28]	[0.66]	[0.69]	[0.94*]	[0.76]	[---]	[0.10]	
ΔGCE	1.18	2.63	1.34	5.44**	3.13***	0.36	------	-0.01 (-0.40)
	[0.56]	[0.27]	[0.51]	[0.05]	[0.10]	[0.84]	[---]	

Table 10. Results of Panel Granger Causality Tests (Con't)

Dependent Variable	Independent Variables							ECT_{-1} Coefficient
Case 5: GDP, BRM, RIR, UPG, YDR, GCE, NIP								
	ΔGDP	ΔNIP	ΔBRM	ΔRIR	ΔUPG	ΔYDR	ΔGCE	ECT_{-1}
ΔGDP	------	7.97*	4.87**	2.22	2.38	19.5*	1.71	-0.75 (-14.4)*
	[---]	[0.00]	[0.05]	[0.33]	[0.30]	[0.00]	[0.43]	
ΔNIP	3.36***	------	0.88	1.73	2.29	6.64*	0.71	0.01 (0.53)
	[0.10]	[---]	[0.65]	[0.42]	[0.15]	[0.01]	[0.70]	
ΔBRM	0.87	1.65	------	1.3	0.87	3.67***	1.41	0.05 (2.17)
	[0.65]	[0.44]	[---]	[0.52]	[0.65]	[0.10]	[0.49]	
ΔRIR	1.14	0.01	18.1*	------	2.94***	0.38	5.07**	-0.15 (-2.10)
	[0.57]	[0.99]	[0.00]	[---]	[0.10]	[0.83]	[0.05]	
ΔUPG	6.89*	0.23	0.3	5.40**	------	2.16	0.32	-0.02 (-0.92)
	[0.01]	[0.89]	[0.86]	[0.05]	[---]	[0.34]	[0.85]	
ΔYDR	2.71	1.79	0.54	0.09	0.51	------	3.58***	-0.02 (-1.84)
	[0.15]	[0.41]	[0.76]	[0.95]	[0.78]	[---]	[0.10]	
ΔGCE	0.22	5.05**	1.19	5.38**	3.46***	0.31	------	0.01(0.34)
	[0.89]	[0.05]	[0.55]	[0.05]	[0.10]	[0.86]	[---]	
Case 6: GDP, BRM, RIR, UPG, YDR, GCE, TIP								
	ΔGDP	ΔTIP	ΔBRM	ΔRIR	ΔUPG	ΔYDR	ΔGCE	ECT_{-1}
ΔGDP	------	4.84**	5.03**	1.14	2.10***	23.0*	1.58	-0.74 (-14.2)*
	[---]	[0.05]	[0.05]	[0.56]	[0.20]	[0.00]	[0.45]	
ΔTIP	2.48	------	0.24	3.76***	0.28	4.41**	1.08	0.04 (1.91)
	[0.20]	[---]	[0.89]	[0.10]	[0.87]	[0.05]	[0.58]	
ΔBRM	1.04	1.12	------	1.59	0.96	3.64***	1.24	0.05 (2.33)
	[0.59]	[0.57]	[---]	[0.45]	[0.62]	[0.10]	[0.54]	
ΔRIR	1.97	1.32	18.1*	------	2.98***	0.48	5.30*	-0.17 (-2.50)
	[0.37]	[0.52]	[0.00]	[---]	[0.10]	[0.79]	[0.01]	
ΔUPG	6.07*	0.18	0.33	5.34**	------	1.98	0.39	-0.02 (-0.80)
	[0.01]	[0.91]	[0.85]	[0.05]	[---]	[0.37]	[0.82]	
ΔYDR	2.76	0.53	0.66	0.15	0.5	------	3.40***	-0.01 (-1.56)
	[0.20]	[0.77]	[0.72]	[0.92]	[0.78]	[---]	[0.10]	
ΔGCE	0.64	1.04	1.06	5.27**	3.02***	0.29	------	-0.01 (-0.03)
	[0.72]	[0.59]	[0.59]	[0.05]	[0.10]	[0.86]	[---]	

Notes: GDP: Per capita economic growth rate; BRM: Broad money supply; RIR: Real interest rate; UPG: Urban population growth; YDR: young dependency ratio; GCE: Government consumption expenditure; LID: Life insurance density; NID: Non-life insurance density; TID: Total insurance density; LIP: Life insurance penetration; NIP: Non-life insurance penetration; TIP: Total insurance penetration. *, **, and *** denote rejection of the null hypothesis at the 1%, 5%, and 10% levels, respectively. ECT_{-1}: lagged error-correction term. Values in square brackets represent probabilities for F-statistics. Values in parentheses represent t-statistics. Basis for the determination of long-run causality lies in the significance of the lagged ECT coefficient.

In contrast to the results for the long-run Granger causality analysis, our study revealed a wide spectrum of short-run causality patterns between the three variables. These results are summarized in Table 9 and are presented below.

In Case 1, we find bidirectional causality between insurance market development and economic growth [LID ↔ GDP], real interest rates and insurance market development [RIR ↔ LID], government consumption expenditure and insurance market development [GCE ↔ LID], urban population growth and real interest rates [UPG ↔ RIR], and also between government consumption expenditure and real interest rates [GCE ↔ RIR]. This provides evidence of two-way Granger causality (feedback) between LID and GDP, LID and RIR, GCE and LID, UPG and RIR, and RIR and GCE. Our results thus support both the supply-leading hypothesis and the demand-following hypothesis. The inference, particularly for the LID-GDP nexus, is that insurance market development and economic growth are endogenous, so they mutually cause each other and their reinforcement may have important implications for the conduct of financial or economic policies. Moreover, the study finds unidirectional causality from broad money supply to economic growth [BRM → GDP], economic growth to real interest rates [GDP → RIR], economic growth to urban population growth [GDP → UPG], and the youth dependency ratio to economic growth [YDR → GDP]. Furthermore, the study also finds unidirectional causality from the youth dependency ratio to insurance market development [LID ← YDR], broad money supply to real interest rates [RIR ← BRM], the youth dependency ratio to broad money supply [BRM ← YDR], urban population growth to government consumption expenditure [GCE ← UPG], and government consumption expenditure to the youth dependency ratio [YDR ← GCE].

In Case 2, we find bidirectional causality between government consumption expenditure and insurance market development [GCE ↔ NID], urban population growth and real interest rates [UPG ↔ RIR], and government consumption expenditure and real interest rates [GCE ↔ RIR]. This provides evidence of two-way Granger causality (feedback) between GCE and NID, UPG and RIR, and RIR and GCE. Furthermore, our study finds unidirectional causality from insurance market development to economic growth [NID → GDP], broad money supply to economic growth [BRM → GDP], economic growth to urban population growth [GDP → UPG], real interest rates to insurance market development [RIR → NID], and the youth dependency ratio to economic growth [YDR → GDP]. Furthermore, the study finds unidirectional causality from the youth dependency ratio to insurance market development [NID ← YDR], broad money supply to real interest rates [RIR ← BRM], the youth dependency ratio to broad money supply [BRM ← YDR], urban population growth to government consumption expenditure [GCE ← UPG], and government consumption expenditure to the youth dependency ratio [YDR ← GCE].

In Case 3, we find evidence of the existence of bidirectional causality between government consumption expenditure and insurance market development [GCE ↔ TID], urban population growth and real interest rates [UPG ↔ RIR] and government consumption expenditure and real interest rates [GCE ↔ RIR]. This is indicative of two-way Granger causality (feedback) between GCE and TID, UPG and RIR, and RIR and GCE. Furthermore, the study finds unidirectional causality from insurance market development to economic growth [TID → GDP], broad money supply to economic growth [BRM → GDP], economic growth to real interest rates [GDP → RIR], economic growth to urban population growth [GDP → UPG], and from the youth dependency ratio to economic growth [YDR → GDP]. Furthermore, the study finds unidirectional causality from real interest rates to insurance market development [TID ← RIR], from the youth dependency ratio to insurance market development [TID ← YDR], broad money supply to insurance market development [BRM → TID], broad money supply to real interest rates [RIR ← BRM], the youth dependency ratio to broad money supply [BRM ← YDR], urban population growth to government consumption expenditure [GCE ← UPG], and government consumption expenditure to the youth dependency ratio [YDR ← GCE].

In Case 4, we find the existence of bidirectional causality between urban population growth and real interest rates [UPG ↔ RIR] and government consumption expenditure and real interest rates [GCE ↔ RIR]. This provides evidence of two-way Granger causality (feedback) between, UPG and RIR, and RIR and GCE. Moreover, the study finds unidirectional causality from broad money supply to economic growth [BRM → GDP], economic growth to urban population growth [GDP → UPG], and the youth dependency ratio to economic growth [YDR → GDP]. Furthermore, the study also finds unidirectional causality from real interest rates to insurance market development [LIP ← RIR], the youth dependency ratio to insurance market development [LIP ← YDR], broad money supply to real interest rates [RIR ← BRM], the youth dependency ratio to broad money supply [BRM ← YDR], urban population growth to government consumption expenditure [GCE ← UPG], and government consumption expenditure to the youth dependency ratio [YDR ← GCE].

In Case 5, we find bidirectional causality between insurance market development and economic growth [NIP ↔ GDP], urban population growth and real interest rates [UPG ↔ RIR] and government consumption expenditure and real interest rates [GCE↔ RIR]. This is evidence of two-way Granger causality (feedback) between NIP and GDP, UPG and RIR, and RIR and GCE. In addition, the study finds unidirectional causality from broad money supply to economic growth [BRM → GDP], economic growth to urban population growth [GDP → UPG], and the youth dependency ratio to economic growth [YDR → GDP]. Furthermore, the study demonstrates the existence of unidirectional causality from urban population growth to insurance market development [NIP ← UPG], the youth dependency ratio to insurance market development [NIP ← YDR], insurance market development to government consumption expenditure [GCE ← NIP], broad money supply to real interest rates [RIR ← BRM], the youth dependency ratio to broad money supply [BRM ← YDR], urban population growth to government consumption expenditure [GCE ← UPG], and government consumption expenditure to the youth dependency ratio [YDR ← GCE].

In Case 6, we find evidence of bidirectional causality between urban population growth and real interest rates [UPG ↔ RIR] and government consumption expenditure and real interest rates [GCE ↔ RIR]. This supplies evidence of two-way Granger causality between UPG and RIR, and across RIR and GCE. That lends support for both the supply-leading hypothesis and the demand-following hypothesis. In addition, the study finds unidirectional causality from insurance market development to economic growth [TIP → GDP], broad money supply to economic growth [BRM → GDP], economic growth to urban population growth [GDP → UPG], and the youth dependency ratio to economic growth [YDR → GDP]. The study also finds unidirectional causality from real interest rates to insurance market development [TIP ← RIR], the youth dependency ratio to insurance market development [TIP ← YDR], broad money supply to real interest rates [RIR ← BRM], the youth dependency ratio to broad money supply [BRM ← YDR], urban population growth to government consumption expenditure [GCE ← UPG], and government consumption expenditure to the youth dependency ratio [YDR ← GCE].

Table 11. Summary of Short-run Granger Causality Test Results

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
GDP Vs. ISD	LID ↔ GDP	NID → GDP	TID → GDP	LIP ≠ GDP	NIP↔ GDP	TIP→ GDP
GDP Vs. BRM	BRM → GDP	BRM → GDP	BRM → GDP	BRM → GDP	BRM → GDP	BRM → GDP
GDP Vs. RIR	RIR ← GDP	RIR ≠ GDP	RIR ← GDP	RIR ≠ GDP	RIR ≠ GDP	RIR ≠ GDP
GDP Vs. UPG	UPG ← GDP	UPG ← GDP	UPG ← GDP	UPG ← GDP	UPG ← GDP	UPG ← GDP
GDP Vs. YDR	YDR → GDP	YDR → GDP	YDR → GDP	YDR → GDP	YDR → GDP	YDR → GDP
GDP Vs. GCE	GCE ≠ GDP	GCE ≠ GDP	GCE ≠ GDP	GCE ≠ GDP	GCE ≠ GDP	GCE ≠ GDP
ISD Vs. BRM	BRM ≠ LID	BRM ≠ NID	BRM ≠ TID	BRM ≠ LIP	BRM ≠ NIP	BRM ≠ TIP
ISD vs. RIR	RIR ↔ LID	RIR → NID	RIR → TID	RIR → LIP	RIR ≠ NIP	RIR → TIP
ISD Vs. UPG	UPG ≠ LID	UPG ≠ NID	UPG ≠ NID	UPG ≠ LIP	UPG → NIP	UPG ≠ NIP
ISD Vs. YDR	YDR →LID	YDR →NID	YDR →TID	YDR →LIP	YDR →NIP	YDR →TIP
ISD VS. GCE	GCE ↔ LID	GCE ↔ NID	GCE ↔ TID	GCE ≠LIP	GCE ←NIP	GCE ≠TIP
BRM Vs. RIR	RIR ←BRM	RIR ←BRM	RIR ←BRM	RIR ←BRM	RIR ←BRM	RIR ←BRM
BRM Vs. UPG	BRM ≠ UPG	BRM ≠ UPG	BRM ≠ UPG	BRM ≠ UPG	BRM ≠ UPG	BRM ≠ UPG
BRM Vs. YDR	YDR → BRM	YDR → BRM	YDR → BRM	YDR → BRM	YDR → BRM	YDR → BRM
BRM Vs. GCE	BRM ≠GCE	BRM ≠ GCE	BRM ≠ GCE	BRM ≠ GCE	BRM ≠ GCE	BRM ≠ GCE
RIR Vs. UPG	UPG ↔ RIR	UPG ↔ RIR	UPG ↔ RIR	UPG ↔ RIR	UPG ↔ RIR	UPG ↔ RIR
RIR Vs. YDR	RIR ≠ YDR	RIR ≠ YDR	RIR ≠ YDR	RIR ≠ YDR	RIR ≠ YDR	RIR ≠ YDR
RIR Vs. GCE	GCE ↔ RIR	GCE ↔ RIR	GCE ↔ RIR	GCE ↔ RIR	GCE ↔ RIR	GCE ↔ RIR
UPG Vs. YDR	UPG ≠ YDR	UPG ≠ YDR	UPG ≠ YDR	UPG ≠ YDR	UPG ≠ YDR	UPG ≠ YDR
UPG Vs. GCE	GCE ← UPG	GCE ← UPG	GCE ← UPG	GCE ← UPG	GCE ← UPG	GCE ←UPG
YDR Vs. GCE	GCE → YDR	GCE → YDR	GCE → YDR	GCE → YDR	GCE → YDR	GCE → YDR

Notes: GDP: Per capita economic growth rate; BRM: Broad money supply; RIR: Real interest rate; UPG: Urban population growth; YDR: youth dependency ratio; GCE: Government consumption expenditure; LID: Life insurance density; NID: Non-life insurance density; TID: Total insurance density; LIP: Life insurance penetration; NIP: Non-life insurance penetration; TIP: Total insurance penetration. X → Y means variable X Granger-causes Variable Y; X ← Y means variable Y Granger-causes X; X ↔ Y means both variables Granger-cause each other; and X ≠ Y means no causality between the two variables.

It should be evident that, unlike much of the previous literature, the present study distinguishes between short-run and long-run causality results. As already indicated above, these short-run results demonstrate the short-run adjustment dynamics between the variables. Our more interesting results pertain to the long run: these results are remarkably uniform and robust across the six cases addressed above.

Our results point to the fact that insurance market development, broad money supply, real interest rate, urban population growth, youth dependency ratio, and government consumption expenditure generally Granger-cause per capita economic growth in the long run. However, we do not find any evidence of reverse causality in the long run. In other words, there is unidirectional causality from insurance market development and other macroeconomic variables to per capita economic growth in the long run.[19]

The use of Arellano and Bond's (1991) and Holtz-Eakin et al.'s (1988) estimation procedures as discussed above, is one way of checking the direction of Granger causality between economic growth, insurance market development, and other macroeconomic variables. Nonetheless, this estimation procedure does not provide direct information on how each variable responds to innovations in the other variables, or whether the shocks are permanent or not. To address this shortcoming, we also employed generalized impulse response functions (GIRFs), developed by Koop, Pesaran, and Potter (1996), to trace the effect of a one-off shock to one of the innovations on the current and future values of the endogenous variables. The GIRFs offer additional insights into how shocks to economic growth can affect and be affected by each of the other variables. These results, which support our earlier findings, are not reported due to space constraints. They can be obtained from the authors upon request.

Even though some of the results of this study are similar to those of previous studies, there are some fundamental differences (see Table 3 for a summary). The differences may be due to our conjoint consideration of several important macroeconomic variables in the examination of the nexus between economic growth and insurance market development – an aspect that was missing from earlier studies. Another remarkable difference between our study and earlier work is that we clearly distinguish between short-run and long-run results. With regard to short-run causality, we find unidirectional causality from insurance market development to economic growth for some indicators – a result that contradicts the findings of Horng et al. (2012) and Vadlamannati (2008), who both report unidirectional causality in the opposite direction. At the same time, our short-run bidirectional Granger causality results with respect to some other indicators of insurance market development are consistent with those reported by Chang, Lee, and Chang (2014), Vadlamannati (2008), and Ward and Zurbruegg (2000). Finally, our robust long-run result, contrary to the findings of other studies, suggests that there is unidirectional causality from insurance market development to economic growth – no matter which indicator is used for insurance market development.

6. CONCLUSION

The financial system has become demonstrably more complex in the last 20 years, especially as the separation between hedge funds, mutual funds, insurance companies,

[19] The only exception where there is evidence of feedback is with respect to real interest rate in Case 1. However, this does not hold in other cases.

banks, and brokers/dealers has become blurred, thanks to global financial diffusion and deregulation. Such complexity is an unavoidable consequence of intense competition and continued economic growth, but it is accompanied by certain phenomena, including much greater interdependence between these variables (Billio, Getmansky, Lo and Pelizzon, 2012). In the present paper, we formally investigate the interdependence between insurance market development and economic growth in the presence of several other pertinent macroeconomic variables for 26 countries using time-series data from 1980 to 2013.

The main recommendations from the present study for policy-makers are that inferences drawn from research on the subject of economic growth that exclude the dynamic interrelation between insurance market development and economic growth, may be unreliable. In other words, future studies on economic growth must include the development of the insurance market as a key variable in the analysis in the light of our long-run results.

Finally, policy-makers in government need to institute changes to their financial systems in order to strengthen relationships between the insurance market and other markets to achieve interactive and compounding effects on their rates of economic growth. In particular, policy-makers should encourage the innovation of financial products in the insurance market by promoting collaborative developments for both the insurance and banking sectors. Furthermore, in order to achieve sustainable economic growth, it would be advantageous to encourage reform in the insurance market, which in turn will improve information flows, enhance service delivery and stimulate competition. However, it should be noted that in order to allow the insurance market to fulfil its role in economic activity, an optimal regulatory environment is required. A well-developed insurance market can provide broader insurance coverage directly to firms, thereby reducing risk and improving the financial soundness of the firms. Insurance firms, as institutional investors, will contribute to the development and modernization of stock markets, facilitate in firms' access to capital, and mobilize savings - thereby stimulating economic growth and development.

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