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Financial Developments and Economic Growth

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Abstract

This paper investigates whether there is a causal relationship between financial market development and economic growth using cross-country dynamic panel data. Using life and non-life insurance penetration as a proxy for financial market activity the study estimates the relationship between insurance activity and economic growth for G-20 countries. We use several macroeconomic variables as conditioning factors. The empirical study uses Arellano-Bond-Bover (1991) dynamic generalized method of moments model (GMM) and finds insurance development activity positively affect economic growth. The study finds remaining all other things constant, the magnitude of the impact of life insurance penetration for G-20 countries is twice the effect of nonlife penetration in the economic growth process. We find trade and openness, capital accumulation, and life expectancy amplify the positive effect of life and nonlife insurance activity on economic growth. When the countries are grouped into developed, developing, and BRICS within the G-20 countries, we find positive and significant correlation of life insurance activity and economic growth for developed and developing countries. However, the impact of non-life insurance activity, is insignificant for all three groups. We also find that life insurance activity plays much more important role in economic growth for developing economies than developed economies. The policy implications for this study is that the G-20 countries should recognize the positive causal effect of insurance market activities while crafting policies to achieve sustainable economic growth.

Keywords: G-20, Insurance, GMM, Dynamic, Pane data, Economic Growth

JEL Codes: C23, E44, G22, O16

1. Introduction

It is theoretically and empirically established in the literature that the economic growth requires a strong financial infrastructure for resource mobilization and efficient deployment of these resources. A considerable number of studies found a strong and positive relationship between banking sector, stock market development, and other financial intermediaries and economic growth (Beck and Levine, 2004; Levin and Zervos, 1998; King and Levin, 1993). Studies examining the impact of insurance market development and economic growth are relative less. The major sources through which insurance affect economic growth are: (a) risk transfer and indemnification activities, which aid households and businesses to lessen their loss in adverse times; and (b) financial intermediation services enabling investors to access diversified investment

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portfolios. In general, the insurance activities may promote economic growth through multitude of avenues. Such as: (i) promoting financial stability; (ii) mobilizing domestic savings; (iii) managing different risks more efficiently; (iv) encouraging the accumulation of new capital; (v) facilitating trade and commerce; (vi) supporting to reduce or mitigate losses; and (vii) fostering a more efficient allocation of domestic capital (Skipper, 1997; Ward and Zurbruegg, 2000). These activities promote productivity growth, innovation, and long-term investment (Ward and Zurbruegg, 2000; Kugler and Ofoghi, 2005; Beck and Webb, 2003: and Haiss and Sumegi 2008). As a result, the effect of insurance market development on economic growth expected to be positive.

Studies by Ward and Zurbruegg (2000), Webb et al. (2002) and Hans et al. (2010) have documented the positive effect of insurance market development on economic growth. However, empirical and theoretical evidences also suggest that the role of insurance may be different across countries. Beenstock et al. (1986) and Browne and Kim (1993) found the demand for life insurance depends on the level of education, age dependency, and other socio-economic factors, which differ across nations. Hence, the relationship between insurance market development and economic growth may differ across countries. Lee (2011a) and Arestis et al. (2001) argue the difference of the impact of insurance on economic growth may be due to a potential complementarity effect between insurance sector and stock market instead of substitution effect between insurance and banking sector.

Over the last two decades, the GDP in developing countries has increased significantly but the share of total insurance premium generated in developing countries remained low. Figure 1 depicts life insurance penetration (percent) and GDP growth and Figure 2 depicts nonlife insurance penetrations (percent) and GDP growth for G-20 countries. The diagrams show the relationship between insurance penetration (density) and economic growth is inconclusive.

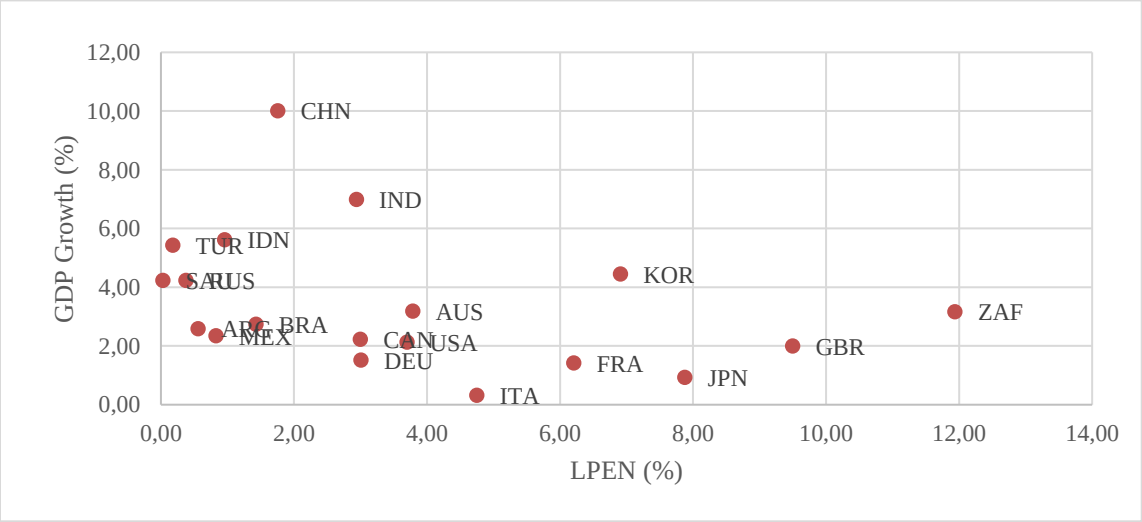

Figure 1: Scatter Plot of Life Insurance Penetration and Economic Growth, 2000-2015

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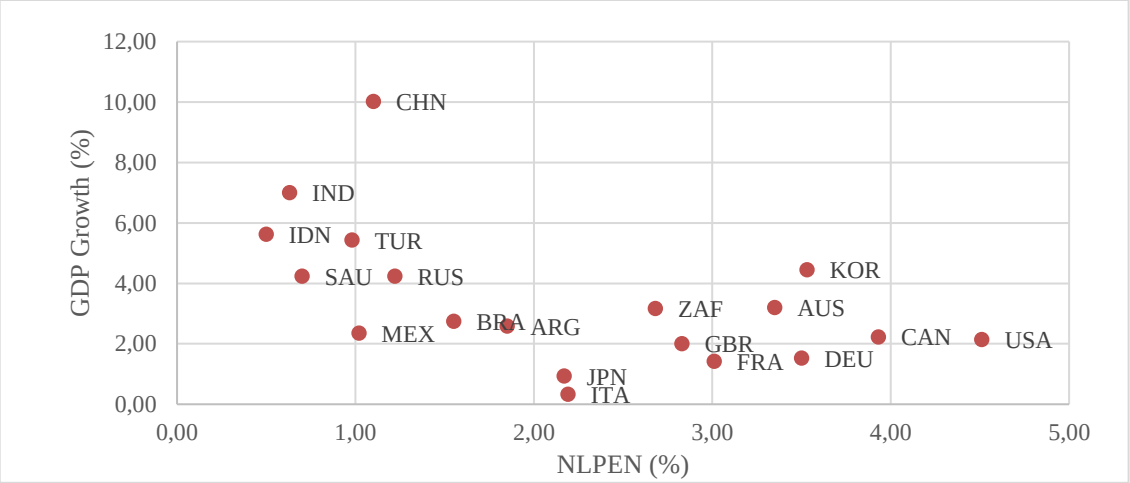

Figure 2: Scatter Plot of Nonlife Insurance Penetration and Economic Growth, 2000-2015

Most of the studies investigating the causal relationship between insurance market development and economic growth use linear panel data model (cross-section or time-series) assuming different insurance activities have uniform effect on economic growth. However, in reality "S-curve" phenomena explain during higher levels of economic growth (for mature economy) the impact of insurance market activities is low, implying the relationship between insurance activity and economic growth is non-linear. In other words, insurance consumption is slow in the early stages of economic development, then grows more than proportionately as income increases and at the end slows down again toward the maturity (Reeve, 1993, and Enz, 2000).

The objective of this study is to provide a systematic assessment of the effect of insurance market activity on economic growth. In doing so, this study considers the effects of both life and non-life insurance activity on economic growth. Because life and nonlife insurance provide different set of benefits to households and corporations. In our study insurance penetration (measured as a proportion of insurance premium to GDP) used as a proxy for insurance activity and annual growth of per capita GDP is used as a measure of economic growth. Several macroeconomic condition variables used to analyze whether these conditions amplify or mitigate the effects of insurance market on economic growth. To accomplish our objectives the study uses data from G-20 countries for the period 2000-2015 and employs a two-step generalized method of moments (GMM) approach for dynamic panel data developed by Arellano, Bond and Bond (1991). This model is best use for panel data analysis with endogeneity in the explanatory variables i.e., when lagged dependent variable is used as an instrument. The study found robust evidence of a causal relationship between insurance market activity and economic growth suggesting both life and nonlife insurance penetration have significant positive impact on economic growth. When we group the countries into developed, developing, and BRICS countries (within G-20), we find the impact of life insurance on economic growth remained significant and positive for developed and developing counties, but the effect of nonlife insurance though mostly positive and insignificant. The novelty of this study is that no other study used exclusive G-20 data to estimate the causal relationship between insurance development and economic growth corrected for endogeneity problem.

The remainder of the study organized as follows. Section 2 reviews the background and literature for this study. Section 3 provides the empirical model and the methodology. The

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discussion on the description and sources of dataset is in Section 4. Section 5 reports analyzes the empirical results. The final section draws the conclusion.

2. Background and Literature Review

Compared with the studies that examine the relationship between financial intermediaries and economic growth, studies investigating relationship between insurance market and economic growth are limited. For example, Levine and Zervos (1998) used cross-country regression, Levine (1999), Levine et al. (2002), used cross-country instrumental variable regressions, Beck et al. (2000), Levine et al. (2000) and Beck and Levine (2004) used dynamic panel GMM estimation and Rousseau and Wachtel (2000) used panel GMM for VAR model. These studies found robust relationship between financial development and economic growth. The study by Outreville (1990, 1996) identifying the link between financial activity and economic growth probably one of the earliest studies that discussed the importance of property-liability insurance and life insurance in economic growth for developing countries. One of the most significant findings in the growth literature is the robust empirical relationship between insurance market development and economic growth (Lee and Chiu 2012; Geovannini et al. 2013; Horng et al. 2012; Chen et al. 2011; Adams et al. 2009; Arena 2008; Haiss and Sumegi 2008).

Ward and Zurbruegg (2000) contend that the key economic benefits for life insurance is financial intermediation and for nonlife and health insurance is risk transfer and indemnification. These benefits transformed into productivity improvement and innovation for nonlife insurers and enhanced production efficiency, increased investment opportunity, and reduction in the waste of early monetary realization for life insurers. Each type of insurances protects households and corporations in diverse ways - life insurance companies for long-term investments and nonlife insurance companies for short-term investments. Han et al. (2010) find life insurers can shift resources from unproductive to productive uses, reducing the demand for liquidity while increasing productivity and the property-liability insurers can reduce the probability of firm financial distress from bankruptcy costs, by providing an extra risk financing choice (p. 184). As a result, insurance market activity may promote economic growth because it allows different risks be managed more efficiently. Using cross-country data from 55 developing countries for the period 1980-96, Webb et al. (2002) find exogenous components of the banking and life insurance penetration are strong and significant predictor of higher economic growth. The study found complementarity among bank, life and nonlife insurance activities, influencing economic growth. Webb et al. (2002), Haiss and Sumegi (2008), and Arena (2008) find a positive relationship between the financial sector and insurance market activity and economic growth. However, there is no consensus among researchers on the causal relationship.

The studies on insurance market development and economic growth generally follow one of the two hypothesis – the demand following hypothesis (DFH) and supply leading hypothesis (SLH). The DFH view as the trade and industry expands higher demand for financial services promote additional insurance activity hence; insurance market activity is the outcome of economic growth. Studies supporting demand following hypothesis are Beck and Webb (2003), Beenstock et al. (1986), Ching et al. (2010), Guichen and Wei (2012), Han et al. (2010), Hwang and Gao (2003), Kugler and Ofoghi (2005) and Ward and Zurbruegg (2000). The supply leading hypothesis view is insurance market induces economic growth by enhancing savings in the form of financial assets, promoting capital formation and economic growth. Studies supporting SLH are Adams et

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al. (2009), Alhassan and Fiador (2014), Boon (2005), Lee et al. (2013), Haiss and Sumegi (2008), Lee (2011b), and Vadlamannati (2008). The current study follows the SLH. We use economic growth as the dependent variable and insurance market activity as independent variable.

A few studies in the literature use dynamic panel data (cross-section and time-series) and econometric models such as, generalized method of moments (GMM). For instance, Arena (2008) examined the causal relationship between insurance market activity and economic growth and applied generalized method of moments model (GMM) for dynamic panel data. The author uses 55 countries for the period 1976-2004 and finds both life and nonlife insurance activities have positive and significant effect on economic growth. His study finds impact of life insurance is more significant for countries with low-level of economic development and nonlife activity is highly significant for middle and low-level of economic development. Han et al. (2010) use GMM model on a dynamic panel data for 77 countries for the period 1994-2005 and find insurance development positively correlated with economic growth. However, when the countries are divided into developing and developed, based on per capita income, the study finds life and non-life insurance activity play a more significant role for developing countries than developed countries affecting economic growth.

Chen et al. (2011) examined the relationship between life insurance development and economic growth conditioned on various macroeconomic variables and applied GMM model on a dynamic panel data from 60 countries between 1976 and 2005. The study also found the overall impact of life insurance activity on economic growth is positive but vary across countries. The impact is lower for middle-income countries and higher for low-income countries. The study finds the stock market and life insurance market development acts as a substitute in the economic growth process. The study by Chang and Lee (2012) investigates whether the relationship between economic development and life and nonlife insurance activity is non-linear. Which is also an empirical test for the conventional 'S-curve' relationship between insurance spending and income. The fundamental premise for his study is whether an increase in national income increases the demand for insurance at various stages of economic development (or maturity). Using threshold model with instrumental variable approach the study finds that national income positively correlate with life insurance activity and the effect is higher for high-income countries than it is for low-income countries.

The current study supports the supply-leading hypothesis (SLH) and adds to the existing literature in several ways. To our knowledge except the study by Pradhan et al. (2014), no other study uses data exclusively from G-20 countries for estimating the relationship between economic growth and insurance market development. The study by Pradhan et al. (2014) is limited in depth and breadth, because it uses univariate vector auto-regression (VAR) model testing Granger causality and examines the relationship between insurance market and economic growth. In contrast, we examine the relationship between insurance market activity and economic growth using dynamic panel data GMM model for G-20 countries. We assume the marginal effect of various macroeconomic conditions specific to each country influence the relationship between economic growth and insurance activity. Studies find diverse macroeconomic conditions in a country influence the relationship between insurance activity and economic growth even under similar income and insurance market developments. The proxy for life and nonlife insurance activity in this study uses insurance penetration (premium volume as percentage of GDP). Macroeconomic conditions that we use as control variables are - government consumption expenditure, inflation, capital accumulation, life expectancy, and young dependency ratio. Further,

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we use annual panel data instead of 5-year or 3-year averaged data to avoid small-sample problems due to dynamic panel (Windmeijer, 2005). The results show the development of life and nonlife insurance market have strong positive impact on economic growth. When we grouped the countries as developed, developing, and BRICS countries the effect of life insurance on economic growth remains strong and positive for developed and developing countries but the effect of nonlife insurance activity although positive becomes weak.

3. The Model and Methodology

Following Beck and Levine (2004), Han et al. (2010) and Chen et al. (2012), the empirical model in this study uses dynamic equation with a lagged dependent variable to test the relationship between insurance market development and economic growth. The equation written as,

$$y_{it} - y_{i,t-1} = a y_{i,t-1} + \beta' X_{it} + \eta_i + \epsilon_{it} \quad (1)$$

Where y is the logarithm of real GDP per capita, X represents the set of control variables including insurance market development variables other than lagged dependent variable, □ and ε are unobserved country specific effect and error term. The subscript i = 1, 2 ... N represents country and t = 1, 2 …, T represents time-period. The dependent variable measures economic growth (GROW). In generalized method of moments (GMM) the unobserved time effects modeled through the inclusion of period-specific intercepts (not included in the equation). We use the Arellano, Bond and Bover model (1991) dynamic GMM model. The GMM model works best with small time-period (T) and large number of units (N). The model is efficient in correcting bias induced by omitted variables in cross-section estimates and inconsistency arising from endogeneity. The technique also controls for the endogeneity bias caused by reverse causality running from economic growth to insurance market development and other explanatory variables (Chen et al. 2011). For insurance market development proxies, we use: (i) life insurance penetration (LPEN) defined as ratio of annual insurance premium volume to GDP, and (ii) nonlife insurance penetration (NLPEN) defined as ratio of annual insurance premium volume to GDP. Unlike studies that consider total insurance activity or only life insurance market development, this study considers the impact of life and nonlife insurance activity on economic growth separately.

Consistent with the growth economics literature, following Shen and Lee (2006) and Chen et al. (2011) we include several macroeconomic variables. Such as, initial GDP per capita (INGDPPC), annual rate of inflation (INFLA), the ratio of government consumption to GDP (GEXP), rate of fixed capital formation to GDP (FCAP), the ratio of total exports and imports to GDP (OPEN) measures degree of openness, initial GDP per capita (INIGDPPC), young dependency ratio (YDEP), and life expectancy (LEXP). The empirical model estimation based on the following equation.

$$Growth = f(INGDPPC, INS, GEXP, FCAP, INFLA, OPEN, YDEP, LEXP) \quad (2)$$

4. Description and Sources of Data

We estimate the economic growth regression (equation 2) using data from G-20 countries for time-period 2000-2015. The G-20 consists of 19 member nations and the European Union, represented by the President of the European Council and by the European Central Bank. In our analysis we consider only 19 member countries since inclusion of European Union would double count France, Germany, Italy, and United Kingdom. For an extended analysis within the G-20 countries, we

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grouped the countries as developing (10 countries), developed (nine countries), and BRICS countries (5 counties). Table A1 in the Appendix reports the list of countries used in this study. Figure 1 reports the scatter plots for life insurance penetration (LPEN) and economic growth and Figure 2 reports scatter plots for nonlife penetration (NLPEN) and economic growth. In both diagrams, China has the highest average rate of economic growth (10.02 percent) but it has only 1.76 percent of GDP as life penetration and 1.10 percent of GDP as nonlife penetration. On the contrary, South Africa with highest life insurance penetration (11.94 percent) has average economic growth of 3.17 percent and the USA with highest nonlife penetration has low average economic growth of 2.14 percent. Guided by the literature in growth economics and the limitation of the econometric model used, we select the variables based on the data availability for the time-period adopted for this study

In this study the dependent variable economic growth (GROWTH) is measured as the difference between Log (GDPPC)t and Log (GDPPC)t-1 adjusted to real PPP. The major variables of interest are life and nonlife insurance penetration (LPEN, NLPEN). Nonlife insurance includes accident, health, and property-liability insurance. In theory, insurance penetration as a proxy for insurance market activity captures the role of life and nonlife insurance as a provider of risk transfer and indemnification and not as a provider of institutional investors (Arena, 2008). The list of variables used, definitions, sources, expected signs, and descriptive statistics provided is Table 1.

The data on life and nonlife insurance penetration (LPEN, NLPEN) collected directly from Swiss Reinsurance Company. Information on macroeconomic variables such as, GDP, INIGDPPC, GEXP, INFLA, FCAP, OPEN, YDEP, and LEXP taken from World Development Indicator (WDI, 2016). Table 2 presents the correlation matrix of the variables used in the model. The highest correlation coefficient between initial GDP per capita (INIGDPPC) and life expectancy (LEXP) is 0.708. The lowest correlation coefficient is -0.034, between life insurance penetration (LPEN) and life expectance (LEXP). The rest of the correlation coefficients are within the acceptable range for avoiding the problem of multicollinearity.

It is hypothesized the sign on the initial GDP per capita variable (INIGDPPC) should be negative since it is accounting for the diversity of the income level among the countries and represents the conditional convergence in growth literature. The variable inflation (INLFA) is expected to negatively correlate with economic growth, because low level of inflation is associated with better economic performance. Capital accumulation (FCAP) expected to be positively correlate with economic growth. Government expenditure variable (GEXP) represents the role of government in economic growth but the relationship found in the literature is mostly negative. Insurance variables used as life and nonlife penetration (LPEN, NLPEN), expected to be positively correlated with economic growth. The relationship between young dependency ration (YDEP) and life expectancy (LEXP) and economic growth is uncertain. Beck and Webb (2003) find young dependency ratio has no significant relationship with life insurance activity. Chang and Lee (2012) find life expectancy and young dependency ratio negatively correlated with insurance penetration.

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Table 1: Descriptive statistics of the variables, definitions, and sources (2000-2015) Country =19, Observation = 304

Variables Used in Model (Expected Sign)	Definition	Source	Mean	SD	Min	Max
Dependent Variable	Annual growth of GDP per capita percent PPP	WDI	1.984	1.799	-4.830	10.080
Independent Variables						
Life Insurance penetration (LPEN) (+)	Annual life insurance premium volume as percent of GDP	WDI, Sigma	3.677	3.413	0.020	14.480
Nonlife insurance penetration (NLPEN) (+)	Annual non-life insurance premium volume as percent of GDP	WDI, Sigma	2.158	1.239	0.310	5.060
Initial GDP per capita (INIGDPC) (-)	GDP per capita beginning of year, PPP, ($) constant	WDI	4.291	0.328	3.333	4.754
Government consumption (GEXP) (-)	Government consumption expenditure as percent of GDP	WDI	1.984	1.799	-4.830	10.080
Rate of inflation (INFLA) (-)	Annual percent change of CPI	WDI	4.835	6.220	-1.353	54.915
Openness of the economy (OPEN) (+)	Ratio of volume of exports and imports as % of GDP (1995$)	WDI, Author's calculation	1.070	0.253	0.645	2.291
Fixed Capital (FCAP) (+)	Gross fixed capital as % of GDP	WDI	23.388	6.275	11.961	45.515
Young dependency ratio (DEPY) (-)	Ratio of the population under the age of 15 to the population aged 15-65	WDI	33.990	11.345	19.200	62.357
Life expectancy (LEXP) (-)	Life expectancy at birth, total years	WDI	74.863	7.076	51.557	83.844

WDI: World Development Indicators Database (2018), published by the World Bank. Swiss Re: Swiss Reinsurance Company. WB: World Bank Atlas.

Table 2: Correlation Matrix for the Variables used in the Study

	GROW	INGDPPC	INFLA	GEXP	FCAP	OPEN	YDEP	LEXP	LPEN	NLPEN
GROW	1.000									
INGDPPC	-0.357	1.000								
INFLA	0.083	-0.375	1.000							
GEXP	-0.315	0.626	-0.324	1.000						
FCAP	0.360	-0.314	-0.108	-0.393	1.000					
OPEN	0.142	-0.008	0.117	0.154	-0.136	1.000				
YDEP	0.020	-0.566	0.308	-0.329	-0.094	0.079	1.000			
LEXP	-0.237	0.708	-0.370	0.276	0.011	-0.144	-0.665	1.000		
LPEN	-0.176	0.205	-0.302	0.319	-0.132	-0.300	-0.217	-0.034	1.000	
NLPEN	-0.273	0.657	-0.360	0.389	-0.213	-0.360	-0.568	0.455	0.496	1.000

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5. Empirical Results and Discussion

The parameter estimates from Arellano-Bond (1991) two-step GMM model produced in Table 3. Column 2 and 3 report the results for life and nonlife insurance activity on economic growth, respectively. The coefficient on life insurance penetration (LPEN) is positive and highly significant implying a one percent increase in LPEN increases economic growth by 0.26 percent. The coefficient on nonlife insurance penetration is also positive and highly significant implying one percent increase in NLPEN increases economic growth by 0.13 percent. The magnitude of impact for nonlife penetration on economic growth is half the size of the impact life insurance activity. As hypothesized, the effect of control variables such as, openness (OPEN) and capital accumulation (FCAP) are significant and have positive relationship with economic growth for both life and nonlife insurance. Consistent with growth theory, annual inflation (INFLA), government consumption expenditure (GEXP), and initial GDP per capita (INIGDPPC) have negative relationship with economic growth and they are highly significant for both life and nonlife insurance market activity (Chang and Lee, 2012, Chen et al. 2011, and Concha and Tabata 2014). The justification of a negative correlation between government expenditure (GEXP) and economic growth is that if larger retirement savings disbursed through government agency such as, social security or substantial benefits provided by the country's public sector to the wage earners for premature death, then it will lead to less demand for life insurance products and services.

The coefficient on young dependency ratio (YDEP) is highly significant and negatively correlated with economic growth for life insurance activity but positive and significant for nonlife (column 2 and 3). One of the main purposes of life insurance is to protect dependents against financial hardship in the event of exigencies such as, premature death of the wage earner. Although Beenstock et al. (1986), Truett and Truett (1990), and Browne and Kim (1993) find positive correlation between life insurance penetration and young dependency ratio. Beck and Webb (2003) find young dependency ratio has no robust relationship with life insurance activities. Because dependency ratio can have different impact across different business lines. Further, Chen et al. (2011) find young dependency ratio is significant and negatively correlated with economic growth for life and nonlife insurance activity.

The coefficient of life expectancy (LEXP) on economic growth for life and nonlife insurance activity is highly significant and positive (column 2 and 3) (see Beck and Webb, 2003). However, studies find the impact of LEXP on economic growth for life insurance market activity can be ambiguous. The demand for life insurance decreases with the increase in average life expectancy and increases with the rise in dependency ratio (Li et al. 2007). Tabata (2005) provides an empirical evidence for positive effect of life expectancy on economic growth for countries where life expectancy is relatively low (i.e., developing countries) and negative for countries where life expectancy is relatively high (i.e., developed countries). For overall model specification, the Sargan/Bhargava test statistics is highly significant implying we fail to reject the null hypothesis that the GMM dynamic model specification is appropriate for this data.

To examine the robustness of the model selected for this study we compare the results from GMM model and two-way linear Fixed and Random effect model. We report the parameter estimates from the random-effect model (column 4 and 5, of Table 3). High value of LM test statistic and low value of Hausman test statistic suggest random effect model better fits the data (Limdep, 2016). The major inconsistency of the random effect model appears from the weak explanatory power of life and nonlife insurance penetration (LPEN and NLPEN) on economic growth. Rest of the control variables in the random-effect model have appropriate signs and are

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highly significant. We argue that the dynamic GMM model results, corrected for endogeneity are consistent with economic theory and superior compared to the random effect model.

Table 3: Estimated Results from Arellano-Bond-Bover Dynamic Panel Model and Random Effect Model Dependent variable = Log (Annual per capita GDP growth) (2000-2015)

Description of Variables	**ABB-2nd Step GMM Model**		**Random Effect Model**	
	Life Coefficient	*Nonlife Coefficient*	*Life Coefficient*	*Nonlife Coefficient*
[a]Initial GDP per capita	-2.519***	-4.131***	-0.698	-0.751
INIGDPPC	(0.000)	(0.000)	(0.600)	(0.573)
[a]Openness	3.476***	2.144***	1.606**	1.712**
OPEN	(0.000)	(0.000)	(0.046)	(0.037)
Fixed capital	0.060***	0.138***	0.076**	0.804**
FCAP	(0.000)	(0.000)	(0.052)	(0.043)
Government consumption	-0.046***	0.158***	-0.144**	-0.150**
GEXP	(0.000)	(0.000)	(0.031)	(0.027)
Life Penetration	0.263***	---	-0.012	---
LPEN	(0.000)		(0.892)	
Nonlife Penetration	---	0.129***	---	0.162
NLPEN		(0.000)		(0.564)
Inflation	-0.013***	-0.025***	-0.067***	-0.068***
INFLA	(0.000)	(0.000)	(0.000)	(0.000)
Dependency ratio	-0.029***	0.059***	-0.066**	-0.057
DEPY	(0.000)	(0.000)	(0.052)	(0.119)
Life expectancy	0.174***	0.183***	-0.202**	-0.204**
LEXP	(0.000)	(0.000)	(0.012)	(0.011)
Constant	---	---	23.268***	22.991***
			(0.000)	(0.000)
[b]Sargan/Bhargava Test	0.000	0.000	---	---
LM Statistics	---	---	271.38	260.56
Hausman Statistic	---	---	5.35	5.60
Country	19	19	19	19
Observations	304	304	304	304

a-used as log(variable); p-values are in parenthesis
b-shows instruments used in the model are not correlated with the residuals
*** Significant at 1%; **-significant at 5%; and *-significant at 10%

To investigate if variation in income levels among countries influence the relationship between insurance market development and economic growth, we group the countries into three. For example, developed (nine), developing (ten), and the BRICS countries (five) (Appendix Table-A1). Table 4 reports the parameter estimates from two-step GMM model for the developed countries and one-step GMM model for the developing and BRICS countries. Column 2 and 3 report results for developed countries, column 4 and 5 for developing countries, and column 6 and 7 for BRICS countries.

Life insurance penetration (LPEN) for developed (Column 2) and developing countries (column 4) are highly significant and have positive effect on economic growth. Moreover, the coefficient for LPEN is much larger for developing countries compared with developed countries. In contrast, Arena (2008) find life insurance activity significantly correlate with economic growth for high-income countries while nonlife insurance activity is significant for high, low and middle-

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income countries. For BRICS countries, LPEN is positive but not significant. Nonlife insurance penetration (NLPEN) is has no significant relationship with economic growth for all three groups.

Table 4: Estimated Results from Arellano-Bond-Bover Dynamic Panel Model - Developed, Developing, and BRICS Countries Dependent variable = Log (Per capita GDP growth) (2000-2015)

	Two Step GMM Developed Countries (9)		**One Step GMM Developing Countries(10)**		**One Step GMM BRICS Countries (5)**	
Description of Variables	*Life Coefficient*	*Non-life Coefficient*	*Life Coefficient*	*Non-life Coefficient*	*Life Coefficient*	*Non-life Coefficient*
[a]Initial GDP pc	2.210***	0.739	-0.120	0.950	0.350	-1.979
INIGDPPC	(0.000)	(0.619)	(0.878)	(0.230)	(0.731)	(0.424)
[a]Openness	0.507***	2.597***	0.387	-0.384	2.737*	9.405***
OPEN	(0.000)	(0.001)	(0.621)	(0.637)	(0.075)	(0.004)
Govt. Cons	0.046***	-0.116***	-0.085*	-0.083	-0.305***	-0.323*
GEXP	(0.000)	(0.000)	(0.082)	(0.106)	(0.007)	(0.052)
Life Penetration	0.037***	---	0.237***	---	0.244	---
LPEN	(0.000)		(0.000)		(0.303)	
Nonlife Penetration	---	-0.097	---	0.223	---	1.511
NLPEN		(0.491)		(0.489)		(0.240)
Dependency ratio	0.064***	0.073***	-0.097***	-0.078***	0.098	0.098*
DEPY	(0.000)	(0.007)	(0.000)	(0.000)	(0.192)	(0.060)
Life expectancy	-0.128***	-0.022	0.100***	0.029	-0.046	0.116
LEXP	(0.000)	(0.721)	(0.008)	(0.395)	(0.349)	(0.199)
Sargan/Bhargava Test	0.000	0.893	0.000	0.000	0.000	0.000
Country	9	9	10	10	5	5
Observations	144	144	160	160	80	80

a-used as log(variable); p-values are in parenthesis

b-shows instruments used in the model are not correlated with the residuals

*** Significant at 1%; **-significant at 5%; and *-significant at 10%

The relationship between dependency ratio (DEPY) and economic growth for developed countries (column 2 and 3) is positive and significant and for developing countries, (column 4 and 5) negative and both are significant. The reverse is the scenario for life expectancy (LEXP) - negative and significant for developed countries (column 2 and 3) and positive for developing countries (column 4 and 5). The control variables such as, initial GDP per capita (INIGDPPC), openness (OPEN), government consumption (GEXP) generally have appropriate signs but have mixed level of significance. We argue that lack of robustness for the overall results in Table 4 is mainly due to a very small sample size for each group. Gujarati (2003) mentions that for a small sample GMM tends to reject the true hypothesis. The GMM model depends on the law of large numbers. With data for small number of countries in each group, we do not have enough observations to run the model efficiently. As a result, the estimates are prone to small sample bias, especially, when the autoregressive (yt-1 on yt) is near 1.0 (Blundell and Bond, 1998; and Kiviet at al. 2014). However, we believe the effort is worth making because the Sargan/Bhargava test statistic is mostly significant (except nonlife in developed countries) implying the dynamic GMM model specification is appropriate for each group.

Lastly, we run an ordinary least square regression (OLS) corrected for serial correlation for BRICS and one for each country in BRICS, viz., Brazil, China, India, Russia, and South Africa. The results reported in Table A2 in the Appendix. Unlike GMM regression (Table 3 and 4), in OLS we include both life and nonlife penetrations (LPEN, NLPEN) for each equation. For BRICS (column 2), the relationship between economic growth and life (LPEN) and nonlife penetration

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(NLPEN), are negative and positive, respectively and both are significant. For the OLS regressions, the relationship between economic growth and insurance market activity for all five countries are generally negative with mixed significance, which is contrary to our hypothesis. We argue that simple OLS regressions do not represent the dynamic nature of the relationship between insurance market activity and economic growth as a result, parameter estimates from OLS are inefficient and inconsistent with the economic theory.

6. Conclusions

This paper finds robust evidence of a causal relationship between insurance market development and economic growth. The relationship examined using GMM model on dynamic panel data from G-20 countries for the period 2000-2015. The study finds that life and nonlife insurance market activity have different impact on economic growth for different levels of economic development measured in terms of GDP per capita. The study also investigates the effect of insurance market development on economic growth among counties using several macroeconomic condition variables. We find development of life and nonlife insurance penetration has positive and significant relationship with economic growth. The study finds remaining all other things constant, the magnitude of the impact of life insurance penetration for G-20 countries is twice the effect of nonlife penetration in the economic growth process. We find trade and openness, capital accumulation, and life expectancy amplify the positive effect of life and nonlife insurance activity on economic growth. When countries are grouped by income levels, we find life insurance development has strong and positive effect on economic growth for developed and developing countries but has no effect on BRICS countries. The probable cause for insignificant relationship between insurance activity and economic growth for BRICS is very small sample size. The study finds nonlife insurance development has no effect on economic growth for all three groups. It is also evident from the results that the impact of life insurance development on economic growth is much stronger for developing countries compared to developed countries. The results are consistent with Han et al. (2012), who used large sample of cross-county data and applied dynamic GMM model

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Appendix A1

Table A1. List of Countries Used in the Study

G-20 Country = 19	Developing Country = 10	Developed County = 9	BRICS Country = 5
Argentina	Argentina	Australia	Brazil
Brazil	Brazil	Canada	China
China	China	France	India
India	India	Germany	Russia
Indonesia	Indonesia	Italy	South Africa
Mexico	Mexico	Japan	
Russian Federation	Russian Federation	Korean Republic	
Saudi Arabia	Saudi Arabia	UK	
South Africa	South Africa	USA	
Turkey	Turkey		
Australia			
Canada			
France			
Germany			
Italy			
Japan			
Korean Republic			

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Table A1. List of Countries Used in the Study (cont)

G-20 Country = 19	Developing Country = 10	Developed County = 9	BRICS Country = 5
UK			
USA			
European Union			

Table A2. Estimated Results from OLS Regression (AR1) - BRICS - Country Level Life and Non-life Insurances Dependent variable = Log (Annual per capita GDP growth) (2000-2015)

Description of Variables	BRICS	Brazil	China	India	Russia	South Africa
	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
[a]Initial GDP per capita INIGDPC	-1.726 (0.205)	-16.855 (0.516)	-8.328*** (0.005)	74.483 (0.119)	71.355*** (0.000)	-9.559 (0.246)
[a]Openness OPEN	6.198*** (0.000)	0.930 (0.623)	6.079*** (0.000)	5.420 (0.306)	-1.336 (0.889)	-11.186** (0.029)
Government consumption GEXP	-0.516*** (0.000)	-1.342*** (0.000)	1.031*** (0.004)	0.097 (0.884)	-1.917*** (0.000)	-0.915*** (0.007)
Inflation INFLA	-0.087 (0.118)	-0.120 (0.155)	0.213*** (0.000)	0.071 (0.668)	-0.323** (0.012)	-0.110 (0.438)
Life Penetration LPEN	-0.346** (0.035)	-8.102*** (0.004)	-0.132 (0.723)	-0.079 (0.898)	6.372** (0.015)	-0.413 (0.217)
Nonlife Penetration NLPEN	2.530** (0.020)	-5.053* (0.068)	-3.357*** (0.000)	13.001 (0.266)	-11.731*** (0.000)	-2.782 (0.536)
Life expectancy LEXP	-0.041 (0.526)	3.078 (0.175)	2.639*** (0.000)	-6.243 (0.123)	-6.705*** (0.000)	0.098 (0.664)
Constant	18.676*** (0.000)	-107.19* (0.051)	171.43*** (0.000)	138.32 (0.119)	209.84*** (0.000)	65.611*** (0.000)
Adjusted R^2	0.4326	0.8337	0.8709	0.0756	0.7016	0.5857
p-value for Rho	0.340	0.021	0.000	0.475	0.002	0.238
Observations	80	16	16	16	16	16

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