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An Empirical Cross-Country Assessment of the Nexuses Between Insurance, Economic Growth, Human Development, and Institutional Quality

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AN EMPIRICAL CROSS-COUNTRY ASSESSMENT OF THE NEXUSES BETWEEN INSURANCE, ECONOMIC GROWTH, HUMAN DEVELOPMENT, AND INSTITUTIONAL QUALITY

ABSTRACT

We contribute to the empirical literature exploring jointly the three nexuses between insurance development with economic growth, institutional, and human development, which in the past were analyzed separately. We built one database for 59 countries and selected evidence from 254 variables using principal component analysis. We hypothesize that "better institutions bring more opportunities for the development of the insurance sector through its impulse to economic growth and human development, which in turn generate an insurance demand increase to protect the enhanced amount and value of human and physical capital." We estimate a cross-country recursive econometric model to corroborate the hypothesis.

Keywords: Insurance, Growth, Institutions, Human Development

JEL Codes: G22, O16

RESUMEN

Contribuimos a la literatura empírica explorando conjuntamente los tres nexos entre el desarrollo de seguros con el crecimiento económico, institucional y humano, que en el pasado se analizaban por separado. Construimos una base de datos para 59 países y seleccionamos evidencia de 254 variables utilizando el análisis de componentes principales. Nuestra hipótesis es que "mejores instituciones brindan más oportunidades para el desarrollo del sector de seguros a través de su impulso al crecimiento económico y el desarrollo humano, lo que a su vez genera un aumento en la demanda de seguros para proteger la mayor cantidad y valor del capital humano y físico". Estimamos un modelo econométrico recursivo entre países para corroborar la hipótesis.

Palabras clave: Seguros, Crecimiento, Instituciones, Desarrollo Humano

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1. INTRODUCTION

The insurance industry is an important engine for economic growth. Life insurance covers biological random events affecting persons, and non-life insurance does the same concerning real assets. The former offers coverage to human capital and the latter supplies coverage to tangible capital. Since reserves to face liabilities of the insurance companies are saved as financial securities, the insurance industry requires efficient management of a financial long-run, low-risk financial portfolio.

Empirical economic literature developed in the last thirty years, try to establish the conceptual and empirical links between the development (measured by penetration -Prizes on GDP- and density -Prizes per capita-) of the insurance market and economic growth, between insurance and institutional development, and between insurance and human development, respectively. Since there are subtle complementarities in the three issues, we aim to study them jointly. Institutional quality yields adequate incentives to increase investment and productivity, and at the same time reduces transaction costs and uncertainty. We hypothesize that "better institutions bring more opportunities for the development of the insurance sector through its impulse to economic growth and human development, generating, in turn, an increase in the demand for insurance coverage to protect the enhanced amount and value of human and physical capital."

Our contribution is encompassing the three nexuses simultaneously and globally, in terms of variables considered (economic, institutional, and those characterizing human development together, after a selection from an extensive list) and in terms of countries included (Developed and Emerging). We also innovate in the method followed. Since variables that can be included in the analysis are numerous, we select them through a Principal Component Analysis, and with those selected we develop a recursive econometric model.

In Section 2 we present a brief synthesis of the empirical literature on the three nexuses we try to address jointly in this study. In the past, the contributions had explored one or two of the three nexuses at the same time. In Section 3, devoted to the sample, we characterize the countries (our unit of analysis) in terms of the main variables to consider and find similarities within three differentiated groups. In Section 4, a multi-equational model is presented to establish the links between insurance development with economic, institutional, and human development variables. The model is estimated for the whole sample, and three groups of countries are detected in the former section. In Section 5, of the results,

we discuss the four empirical models, which address respectively the aggregate and group effect of the variables Expectancy of Life, Human Development Adjusted by Inequality, Corruption Control, Insurance Penetration, GDP per capita, and National Income per capita, to exhaust all channels of influence. Those variables were previously selected after a Principal Component Analysis from a database including 254 quantitative variables for 59 countries (Developed and Emerging). In Section 6, we present our conclusions.

2. LITERATURE REVIEW

The economic literature of the last three decades comprehends numerous and profound studies to unravel the conceptual and empirical nexuses between 1) the development of insurance markets and economic growth, 2) the development of insurance markets and institutional development, and 3) the development of insurance markets and human development, the latter measured by health and educational variables mainly.

2.1 Insurance and Economic Growth

Economic growth recognizes correlational and causal links with financial development. The literature es extensive in dealing with links between banking development and growth, and less extensive in the study of the relationship between insurance development and growth, nevertheless, the qualitative results are similar for banking and insurance. Studies recognize slight differences, related to the complexities of each market (such as the existence of universal banking versus specialized), if countries included are more developed or less developed, if life insurance is more important than non-life insurance in certain markets, etc. As a shared result, countries with more developed financial systems (including under the latter label banking, insurance, and capital markets) register greater economic growth rates than countries with less developed financial intermediaries.

The first set of contributions refers to insurance links with economic growth. King and Levine (1993) (for 80 countries) and Rajan and Zingales (1998) (for the USA) deal with the links between all types of financial markets and insurance development. Webb et al. (2002) (for 55 countries) study the nexus between growth and banking and life-insurance penetration. Ward and Zurbruegg (2000) (for 9 OECD countries), Kugler and Ofoghi (2005) (for the UK), Esho et al. (2004) (for 44 countries), Haiss and Sümegi (2008) (for 29 European countries), Tong (2008) (for the USA, Sweden, Germany, and South Korea), Han et al. (2010) (for 77 countries), Kjosevski (2011) (for North Macedonia),

Cristea et al. (2013) (for Romania), Peleckienė et al. (2019) (for 27 Eurozone countries), Ul Din et al. (2017 a) (for 20 countries), Beenstock et al. (1988) (for 12 OCED countries), Ćurak et al. (2009) (for 11 European countries), Ege and Bahadır (2011) (for 29 OECD countries), and Arena (2008) (for 55 countries), address the relationship between economic growth and life and non-life insurance penetration and density, using different time windows and techniques. Ul Din et al. (2017 b) (for the USA, UK, China, India, Malaysia, and Pakistan), study the links between Life and Non-Life Insurance, Banking, Capital Markets, and growth; Hou and Cheng (2017) (for 31 countries), Ouédraogo et al. (2016) (for 86 developing countries) analyze links between Life Insurance plus Macro and Institutional variables; and Olayungbo and Akinlo (2016) (for 8 African countries), examine the nexus between Non-Life Insurance (Penetration and Density) and economic growth.

2.2 Insurance and Institutional Development

A better institutional quality implies higher transparency, lower uncertainty, and more possibilities for the development of the insurance sector. Institutional quality improves conditions for capital accumulation, feeds economic growth, and the latter increases possibilities to finance improvements in human development. Institutional quality reduces uncertainty, turning it into risk (random results with an attributable likelihood of occurrence), amplify planning horizons, increases the growth perspectives, and the demand for insurance to protect the increased human and physical capital. Political instability, corruption, and a fragile democracy destroy incentives for long-run investments. A lower institutional quality would generate uncertainty, disincentivizing coverage supply. Deficient legal norms and enforcement, a poor judiciary to settle conflicts, instability, and lack of integrity in the legislative process, all the former, imply lasting and costly negotiations, with unpredictable results, generating "transaction costs" and underdevelopment of the insurance industry.

In the second set of contributions, the concern is about insurance links with institutions. North and Weingast (1989) (for England) and North (1991) (for European countries) analyze historical data on Fiscal, Monetary, Foreign Trade, Debt and Public Expenditure, inter alia, and institutional development. Hogarth and Kunreuther (1992) (for the USA) examine Life and Non-Life Insurance plus institutional variables to address ambiguity; Outreville (1996) (for 48 Emerging economies) relates Life Insurance (Penetration and Density) Plus Macro variables with institutions; Knack and Keefer (2002) for (OECD countries) study insurance against Per Capita GDP and GNI, Macro-financial, International Country Risk, Gini Index, Ethnic and Demographic variables; Erbas and Sayers (2006) (for 70 countries) analyze Non-Life Insurance (Penetration), Macro-financial, World Bank Governance Index WBGI;

Ward and Zurbruegg (2002) (for 22 OECD and 22 Asian countries) regress Life Insurance (Penetration) with Macro-financial, Civic and Political Rights; Chui and Kwok (2009) (for 38 countries) relate Life Insurance (Penetration, and Density) with Macro, Banking, Education, Religious and Institutional variables; Dragos and Dragos (2013) (for 31 European countries) address the relationship between Life and Non-Life Insurance (Density), with Macro-financial, Political and Institutional variables; Giné et al. (2019) (for 180 countries) relate the nexus between Life and Non-Life Insurance with Macro-financial, Political and Institutional Variables from the WBGI; Feyen et al. (2011) (for 90 Emerging and Developed countries), regress Life and Non-Life Insurance (Penetration and Density) against Macro-financial, Demographic, Political and Institutional, Labor and Education variables; Enz (2000) (for two samples of 90 and 88 countries) relate Life and Non-Life Insurance (Penetration-Density) and GDP; Beck and Webb (2003) (for 68 countries) and Brown and Kin (1993) (for 45 countries) analyze Life Insurance (Penetration, Density) relationships with Macro, Banking, Education, Religious and Institutional variables; Sepehrdoust and Ebrahimnasab (2015) (for 11 Emerging economies) explore nexuses between Life-Insurance (Penetration) with Macro-financial, Labor Market and the WBGI. Finally, within the papers, we analyzed Nesterova's (2008) (for 14 European countries) studies of Life Insurance (Penetration) relationship with Macro-Financial, Demographic, Political, Institutional and Educational variables.

2.3 Insurance and Human Development

Human development adds to economic growth the attainment of higher achievements in education and health, and lower inequality, which complete a more ample notion of welfare than the mere consideration of the GDP per capita. With human development, the demand for insurance grows, because the human capital is more valuable and productive and there is more tangible capital to protect with coverage.

The third set of contributions refers to the nexuses between insurance and human development, which is proxied through health (mortality, longevity), education (literacy, years of schooling), and economical variables (GDP per capita, etc.). Accumulated literature in these respects is less extensive than in the former two categories. Li et al. (2007) (for OECD countries) relate Life and Non-Life Insurance (Density) with Macro-financial, Education, and Demographic Variables. Codruta et al. (2019) (for Romania) studies Life Insurance (Density) against the Human Development Index (from United Nations Development Program, UNDP), Macro-financial, and political and institutional variables from the WBGI. Other studies are those from Auerback and Kotlikoff (1989) (for the USA), processing a consumption survey of American citizens, and Millon and Carmeci (2015) (for Italy) who relate Life Insurance (Density), with

Macro-financial, Educational, Labor and Urbanization indicators. Similarly, however with cross-country reach, are the contributions from Beenstock et al. (1986) (for 29 European and South-Eastern Asian countries) and Outreville (1999) (for 55 Emerging countries), both relate to Life Insurance (Density) with Education, Labor, and Socio-Demographic variables. Truett and Truett (1990) (for Mexico and the USA), as well as Lenten and Rulli (2006) (for Australia), analyze Life Insurance (Penetration and Density) with Macro-financial, Education, and Demographic Variables. Hwang and Gao (2003) for China, studied Life and Non-Life Insurance (Penetration and Density), and its relationship with Macro-financial, Education, and Labor, while Lee et al. (2018) (for 10 Asia countries) relate Life Insurance (Density) with Education, Labor, and Urbanization. Dragos (2014) (for 17 European and Asian countries) study the nexuses between Life and Non-Life Insurance (Density) with Macro-financial, Education, Labor, and Urbanization. Finally, Emamgholipour et al. (2017) (for 23 MENA countries) addresses the link between Life Insurance (Penetration, Density), Macro-financial, and the HDI Index.

3. THE EXAMPLE

Our sample provides 2018 cross-sectional data for 59 countries (36 of them from the OECD, 23 are Emerging Economies) for 254 quantitative variables, which can be grouped into four categories:

a) *Insurance market* (24 variables from Global Insurance Market Trends, GIMT-OECD),
b) *Human and Economic Development* (159 variables from Human Development Index, HDI-UNDP),
c) *Institutional Quality* (36 variables from World Bank Governance Index, WBGI), and
d) *Competitiveness* (35 variables, from Global Competitiveness Survey GCS-World Economic Forum, Economist Intelligence Unit EIU, Bertelsmann Transformation Unit BTI-Bertelsmann Stiftung).

The process starts by exploring the database to find common aspects of countries and the association between the categories observed in the variables to identify common features. On data, we apply a Principal Component Analysis which allows us to classify the observations and group them according to the differences between the variables. The method reduces the dimension of the analysis by detecting characteristics that discriminate the observations. The technique turns a set of observations from variables possibly correlated into a smaller set of variables without serial correlation called Principal Components. These describe most of the data variance (the greater when more correlated are

the original variables), and some variables can be ignored since are highly correlated to Principal Components.

We can classify the sample into three groups:

1) Group 1 (25 countries or 42 percent of the sample). The four categories of variables result relevant to describe them.
2) Group 2 (13 countries or 22 percent of the sample). There, only categories of Human and Economic Development and Competitiveness are enough to classify them.
3) Group 3 (21 countries or 36 percent of the sample). Only Human and Economic Development is sufficient to characterize them.

Table 1 puts together the most significant variables for each group. Human and Economic Development are present in the three groups, although the variables characterizing each group are disparate. Only in Group 1 are present Insurance and Institutional Quality variables. Competitiveness variables are present in Groups 1 and 2, nevertheless, the variables which characterize the groups are different.

Table 1: Most Significant Variables for Each Group of Countries

Variables	Group 1	Group 2	Group 3
Insurance	Penetration Total Assets of Insurance Companies (Million US$) Labor Productivity of Insurance Sector (Prizes U$S / Employees) Density		
Human and Economic Development	Gross National Income Per Capita (GNIPC 2018; PPP U$S) Life Expectancy at Birth (Years) Human Development Index (Males) Gross Domestic Product Per Capita (GDPPC 2018; PPP U$S) Employment in Services (Percentage of Total Employment) Healthy Life Expectancy at Birth (Years)	Male Suicide Rate (Every 100,000 persons) Adult Literacy Rate (15 years and beyond) Male Mortality Rate for Non-Transmissible Diseases (Every 100,000 persons)	Human Development Index Adjust to Inequality in Life Expectancy (In percentage) Mortality Rate Under 5 Years Old (Every 1000 Live Births) Mortality Rate on Female Adults (Every 1000 Females) Gender Inequality Index (Value) Diphtheria, Pertussis, and Tetanus Not Immunized Babies (% <1-Year-Old)
Institutional Quality	Corruption Control (WBGI) Effectiveness of Government (WBGI) Rule of Law (WBGI) Quality of Regulation (WBGI) Voice and Responsibility (WBGI)		
Competitiveness	Rule of Law (EIU) Corruption Control (GCS). Rule of Law (GCS). Effectiveness of Government (EIU) Voice and Responsibility (EIU) Effectiveness of Government (GCS).	Rule of Law Efficiency of Resources Social and Political Integration Market Organization Management Capacity	

Source: Authors' elaboration from WBGI, GCS, GCS, EIU, and BTI.

Table 2 shows how countries compose each group, being the order of similitude of each observation and the distance with the center of gravity of each group (the average value of all the variables of the group). The similitude is measured through the distance between the values for each country and the average country. The distances in Group 1 are less disperse than in Groups 2 and 3. The countries reunited in Group 1 combine the best levels of economic and human development, institutional quality, and competitiveness, and have the most developed insurance market- Group 3 is intermediate and Group 3 is relatively lagged.

Table 2: Countries Integrating Each Group

	Group 1			Group 2			Group 3	
	Distance*	Country		Distance*	Country		Distance*	Country
1	2,08	Austria	1	8,06	Latvia	1	12,79	Morocco
2	2,64	United Kingdom	2	12,29	Slovakia	2	13,42	Dominican Republic
3	4,08	Belgium	3	15,91	Czech Republic	3	16,43	Ecuador
4	4,40	Canada	4	18,83	Slovenia	4	17,67	Mexico
5	5,27	Netherlands	5	21,30	Lithuania	5	22,35	Paraguay
6	8,80	Iceland	6	28,09	Costa Rica	6	23,71	Panama
7	9,46	Sweden	7	30,00	Uruguay	7	26,34	Bolivia
8	10,53	New Zealand	8	32,13	Estonia	8	31,00	Guatemala
9	10,71	Switzerland	9	34,85	Poland	9	37,36	Colombia
10	11,46	Australia	10	38,85	Hungary	10	40,65	Honduras
11	11,81	Norway	11	39,30	Chile	11	40,69	Tunisia
12	12,82	Denmark	12	40,20	Argentina	12	44,06	Nicaragua
13	15,10	Portugal	13	51,82	South Korea	13	47,67	Thailand
14	15,31	Finland				14	47,84	Brazil
15	15,65	Ireland				15	48,72	Turkey
16	16,64	Japan				16	53,22	Indonesia
17	17,71	Greece				17	55,96	Malaysia
18	19,25	Israel				18	71,26	Egypt
19	20,50	Spain				19	82,26	El Salvador
20	21,55	Hong Kong (China)				20	82,58	India
21	26,03	Germany				21	87,61	Cuba
22	30,29	France						
23	32,90	United States						
24	34,50	Italy						
25	129,33	Luxembourg						

*To the center of gravity of the Group.

Source: Authors' elaboration from WBGI, GCS, GCS, EIU, and BTI.

Analyzing each subset of countries, Group 1 is made of developed countries. The Assets of the insurance sector in this group double, on average, the world mean. Productivity and Density exceed 66 percent of the world average, and Penetration is 34 percent superior to the world mean. In these countries, National Income and GDP per capita are on

average US$ 45,587 and US$ 47,020 respectively (52 percent over the world average); Life Expectancy at Birth is 4 years more extended than in the world average, and the Healthy Expectancy of Life is 2 years above than in the world mean. The HDI for males is 9.4 percent superior to the average of the whole sample. Institutional quality for the group, as measured by the WBGI, doubles the whole sample, and in the case of Corruption Control and Rule of Law, the performance is 142 and 127 percent above the average of the sample. Finally, concerning the Competitiveness indexes, these exceed 3 percent of the world average.

Group 2 is composed of the more developed countries from Eastern Europe and Latin America, with lower GDP per capita than Group 1. In Economic and Human Development, it is remarkable that the Male Suicide Rate is 50 percent of the world average. The mortality rate for Non-Transmissible Diseases in males is 17 percent above the sample average, and Literacy Rate in Adults is on average 7 percent superior to the whole sample. In Competitiveness, Rule of Law, Efficiency of Resources, Political and Social Integration, Market Organization, and Management Capacity they are between 42 and 28% above the world average. However, there are no distinctive characteristics of Insurance or Institutional Quality which distinguish this group.

Group 3 is integrated into the middle- and low-income countries. In the Economic and Human Development variables, the registers are deficient concerning the whole sample. Mortality Rate Under 5-year-old children doubles the world average. The Diphtheria, Pertussis, and Tetanus Not Immunized Babies is 112 percent above the world average. Inequality in Life Expectancy and Genre Inequality is 86 percent above the world average. The female Mortality Rate is 49 percent larger than the world average. These countries have Tuberculosis incidence above 143 percent of the world average, Refugees per Country of Origen which are 223 percent above the world average, and Financial Remittances which are 283 percent above the world average. Nevertheless, in the characteristics of Insurance, Institutional Quality, and Competitiveness there are no distinctive features of this group. Table 3 synthesizes quantitative information which characterizes each group and the sample.

Table 3: Predominant Characteristics of Each Group

		Variables	Whole Sample		Values In Group				Group / Total
			Mean	Std. Dev.	Mean	Std. Dev.	T-Value	P-Value	
Group 1	Insurance Market	Penetration	5.86	5.63	7.86	6.47	2.44	0.007	1.3413
		Total Assets of Insurance Companies (Million US$)	217,264	481,483	469,206	637,152	2.39	0.009	2.1596
		Labor Productivity of Insurance Sector: Prizes (U$S) / Employees	892,573	899,211	1,485,021	1,176,885	2.34	0.010	1.6638
		Density	3,023	6,015	5,069	7,777	2.33	0.010	1.6767
	Human and Economic Development	Gross National Income Per Capita (GNIPC 2018; PPP U$S)	29,507	16,991	45,577	10,702	6.18	0.000	1.5446
		Life Expectancy at Birth (Years)	78.83	3.77	82.30	1.18	6.01	0.000	1.0440
		Human Development Index (Males)	0.85	0.09	0.93	0.02	5.86	0.000	1.0941
		Gross Domestic Product Per Capita (GDPPC 2018; PPP U$S)	30.854	18.336	47.020	14.135	5.79	0.000	1.5240
		Employment in Services (Percentage of Total Employment)	66.96	12.11	77.30	4.74	5.58	0.000	1.1544
		Healthy Life Expectancy at Birth (Years)	68.01	2.97	70.40	1.28	5.12	0.000	1.0351
	Institutional Quality	Corruption Control (WBGI)	0.65	1.01	1.57	0.62	5.94	0.000	2.4154
		Effectiveness of Government (WBGI)	0.75	0.84	1.50	0.43	5.82	0.000	2.0000
		Rule of Law (WBGI)	0.67	0.96	1.52	0.48	5.78	0.000	2.2687
		Quality of Regulation (WBGI)	0.76	0.88	1.50	0.44	5.48	0.000	1.9737
		Voice and Responsibility (WBGI)	0.66	0.81	1.31	0.32	5.24	0.000	1.9848
	Competitiveness	Rule of Law (EIU)	0.67	0.23	0.88	0.11	5.77	0.000	1.3134
		Corruption Control (GCS).	0.59	0.19	0.75	0.12	5.55	0.000	1.2712
		Rule of Law (GCS).	0.61	0.16	0.74	0.09	5.45	0.000	1.2131
		Effectiveness of Government (EIU)	0.61	0.24	0.81	0.15	5.42	0.000	1.3279
		Voice and Responsibility (EIU)	0.67	0.20	0.83	0.08	5.35	0.000	1.2388
		Effectiveness of Government (GCS).	0.59	0.16	0.72	0.08	5.29	0.000	1.2203
Group 2	Human and Economic Development	Male Suicide Rate (Every 100,000 persons)	15.86	7.69	23.72	8.75	4.15	0.000	1.4956
		Adult Literacy Rate (15 years and beyond)	92.78	8.54	98.92	1.00	2.66	0.004	1.0662
		Male Mortality Rate for Non-Transmissible Diseases (Every 100,000 persons)	504.11	141.40	589.78	137.00	2.46	0.007	1.1699
	Competitiveness	Rule of Law	6.33	2.37	9.00	0.80	4.58	0.000	1.4218
		Efficiency of Resources	5.92	1.61	7.73	0.69	4.55	0.000	1.3057
		Social and Political Integration	6.26	1.64	8.02	0.76	4.37	0.000	1.2812
		Market Organization	6.58	2.00	8.73	1.14	4.37	0.000	1.3267
		Management Capacity	6.33	1.65	8.09	0.67	4.34	0.000	1.2780
Group 3	Human and Economic Development	Human Development Index Adjust to Inequality in Life Expectancy (In percentage)	6.99	4.73	13.08	4.26	5.21	0.000	1.8712
		Mortality Rate Under 5 Years Old (Every 1000 Live Births)	9.56	8.78	19.85	9.27	4.76	0.000	2.0764
		Mortality Rate on Female Adults (Every 1000 Females)	68.88	29.25	102.60	25.79	4.69	0.000	1.4895
		Gender Inequality Index (Value)	0.22	0.16	0.41	0.07	4.62	0.000	1.8636
		Diphtheria, Pertussis, and Tetanus Not Immunized Babies (% <1-Year-Oldd)	4.10	4.04	8.69	5.41	4.61	0.000	2.1195

Source: Authors' elaboration from WBGI, GCS, GCS, EIU, and BTI.

4. THE MODEL

The identification of predominant characteristics of the analyzed set of countries and the observation of similitudes which allows grouping them under common features permit specifying a recursive econometric model (or causal chain model), where Institutional Quality influences Insurance variables through the positive impact on the Economic and Human Development and Competitiveness. Analytically, the model is:

$$
\begin{aligned}
&(1)\quad Y_{1i} = \alpha_0 + \alpha_1 Y_{2i} + \alpha_2 X_{3i} + \varepsilon_{1i} \\
&(2)\quad Y_{2i} = \beta_0 + \beta_1 Y_{3i} + \beta_2 X_{2i} + \varepsilon_{2i} \qquad \forall i = 1, \ldots\ldots 59 \\
&(3)\quad Y_{3i} = \gamma_0 + \gamma_1 X_{1i} + \gamma_2 X_{2i} + \gamma_3 X_{3i} + \varepsilon_{3i}
\end{aligned}
$$

Where:

Y_{1i} is Insurance Penetration (Prizes/GDP).

Y_{2i} is the logarithm of per capita GDP (PBIPC) as measured in purchasing power parity dollars. The expected sign is positive.

Y_{3i} is the per capita National Income (INBPC) as measured in purchasing power parity dollars. The expected sign is positive.

X_{1i} is Corruption Control (CICOR) as measured in a normalized scale between -2.5 (worst) and 2.5 (best). The expected sign is positive.

X_{2i} is the Expectancy of Life at Birth (EV) in years (determined in turn by greater and better educational levels, security levels, nutrition, and health among others); the expected sign is positive.

X_{3i} is the HDI adjusted by inequality (IDHAD), measured between 0 (worst) and 1 (best). It is a measure of the average human development of a country, accounting for deficiencies in the distribution of levels of health, education, and income. Its value is lower than HDI without inequality corrections. Under "equality" both indexes are equal, and greater differences among them are due to observed inequality. IDHAD is thus the "real" human development index, while HDI is the "potential" human development index under conditions of equality in the three respects. IDHAD acts as a complement of EV. The expected sign is positive.

ε_{1i}, ε_{2i} and ε_{3i} represent the stochastic term of each equation, respectively.

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The model is solved starting with the third equation, then the second, and lastly the first. The Insurance Market at the whole sample level is explained by the variations of three exogenous variables: Expectancy of Life (EV), Human Development Index Adjusted by Inequality (IDHAD), and Corruption Control (CICOR), and by two endogenous variables: PBIPC and INBPC.

The causal chain starts when the exogenous variables EV, IDHAD, and CICOR, explain the variation of the endogenous variable INBPC in the third equation. In the second equation, this last variable together with EV explains the PBIPC of the countries of the sample. Finally, the Insurance Market, represented by the variable Penetration, is explained by the log of PBIPC and IDHAD. The latter implies that Penetration is explained by the variables and causality chain presented.

The binary variables which recall for differential effects in some countries or sets of countries are PAIS (for Luxembourg and Indonesia), FICI (for Luxembourg), LUXE (for Luxembourg), FIC49 (for Hong Kong, China), FIC15 (for Ireland), F3R (for Luxembourg, Norway, and the USA), F25 (for New Zealand), FIC19 (for Argentina and Costa Rica), F032 (for South Korea), FECU2 (for Norway, Honduras, and Nicaragua), FIC44 (for Ecuador), and FI (for Turkey, Bolivia, Egypt, Nicaragua, and Tunisia).

5. RESULTS

THe model, estimated by Ordinary Least Squares for the cross-section of the 59 countries of the sample and the three groups separately, yields the results shown in Table 4.

Table 4: Estimates for the General Recursive Model and Each Group

Equation	Model	Whole Sample	Group 1	Group 2	Group 3
1	Dependent: Penetration				
	α0 constant	-22.70653	-47.52614*	531.3177***	12.1109***
	α1 LOG(PIBPC)	2.708851***	5.099256*	-57.78984***	-1.063292**
	α2 IDHAD PAIS	30.1055***			27.40969***
	α3 IDHAD*FIC1		28.78716***		
	α4 INBPC			0.002326***	
	α5 FIC49		-7.163592*		
	α6 FIC19			-4.064654***	
	Observations	46	25	11	11
	R-Squared	0.739	0.803	0.858	0.982
	Jarque Bera	3.9318**	0.3689	1.2645	2.3451
	Breusch-Pagan-Godfrey	1.4684**	0.5283	0.0648	2.7758
2	Dependent: LOG(PBIPC)				
	β0 constant	7.092617	0.530708***	9.905095***	7.415493***
	β1 INBPC	0.0000346***		0.0000403***	0.0000677***
	β2 LOG(INBPC)		0.949874***		
	β3 EV	0.025757***		-0.010005**	0.014965
	β4 EV FIC13		0.003062***		
	β5 FECU2	-0.632518***			-0.377523***
	β6 LUXE		0.38297***		
	Observations	58	25	13	20
	R-Squared	0.945	0.995	0.984	0.969
	Jarque Bera	3.7072**	1.1632	1.1323	1.8988
	Breusch-Pagan-Godfrey	2.3979**	0.4617	4.3313**	2.4787*
3	Dependent: INBPC				
	γ0 constant	-75888.8	-167737.8*	-29486.74***	-35399.95***
	γ1 CICOR	6008.906***	10579.57**		-3977.609**
	γ2 CICOR F032			16084.45***	
	γ3 CICOR FI				5682.732***
	γ4 EV	799.4714***	2369.568**		
	γ5 EV FIC19			-2100.993**	
	γ6 EV FIC44				-83.3003***
	γ7 IDHAD	52886.7*		72778.19***	81891.2***
	γ8 IDHA F25		-17716.68**		
	γ9 PAIS	10193.3*			
	γ10 F3R		19474.24***		
	γ11 FIC19			165614.6**	
	Observations	56	25	13	18
	R-Squared	0.843	0.781	0.959	0.916
	Jarque Bera	6.8167***	1.1733	2.4647	0.6151
	Breusch-Pagan-Godfrey	20.639**	0.6236	0.5304	2.0497

(*) significance 0.10; (**) 0.05; and (***) 0.01

Source: Authors' elaboration.

5.1 Discussion of Results at the Whole Sample Level

For the Whole Sample (third column of Table 4), the explanatory variables of the system of equations are individually and jointly significant in each equation, and the signs are as expected. The R squared is 0.74, 0.94, and 0.84 respectively in equations 1, 2, and 3. Disturbances are normal and homoscedastic, according to the Jarque-Bera and Breusch-Pagan-Godfrey tests.

Equation 1 implies that Penetration will amplify 2.71 percent if the per capita GDP increases by one percent. Equation 2 indicates that per capita GDP will increase 3.46 percent if the per capita National Income increases by one percent, and 2.58 percent for each year of Expectancy of Life enhancement. Equation 3 points that before increases in one unit in the level of Corruption Control, per capita National Income increases by US$ 6,009; adding one year to Life Expectancy increases by US$ 799 the per capita National Income; and enhancing by one percent the IDHAD, increases in US$ 528.87 the per capita National Income (the effect is larger for Luxembourg and Indonesia).

Given that in a system there are direct and indirect channels of influence of the exogenous on the endogenous variables, altering the conditions of the equilibria, it is worth analyzing the variations in each endogenous variable when some exogenous shock happens. Table 5 puts together all the effects on the endogenous variables of the system, before alterations on the exogenous variables. It can be observed that the IDHAD is the external effect with more impact in each considered dimension of the analysis. Empirical evidence analyzed at this stage verifies for the whole sample the hypothesis: better levels of institutional quality bring better opportunities for the development of the Insurance Market, the latter contributing to income and human development of the countries of the sample.

Table 5: Total Effects of Changes in the Exogenous Variables on the Whole Sample Model

Variables	CICOR	EV	IDHAD
Penetration	0.56	0.14	4.96 (*)
LOG(PBIPC)	20.79	5.34	182.99
INBPC	6,008.91	799.47	52,886.70

(*) For Luxembourg and Indonesia, this multiplier is much higher.

Source: Authors' elaboration.

5.2 Discussion of Results at Group Level

The whole sample model requires some re-specifications to capture distinctive effects to put together a set of characteristics capable of explaining the behavior of the endogenous forces of the system. As well as in the whole sample model, hypotheses are consistent and independent, and each model has a unique solution. To re-specify the model, some auxiliary variables are added to isolate effects for some countries. These binary variables were explained above.

Table 4, in columns fourth to sixth, shows the estimates of the recursive model for each Group. The explanatory power of the dependent variables explains at least 0.78 of the variances of the independent variable in the

three models. Residuals are normal for each model as the Jarque-Bera test testifies. In every case, homoscedasticity is guaranteed as the Breusch-Pagan-Godfrey test states.

Variables are significant and signs are those expected, with a few exceptions: LOGPBIPC has a negative sign in Equation 1 for Groups 2 and 3, EV is not significant in Equation 2, for Group 3, and significant but with the opposite sign in Equation 2 for Group 2. Besides analyzing each influence, it is interesting to address the whole chain of causality.

5.3 Discussion of Results of External Shocks

Table 6 summarizes the total impact of exogenous variables on the endogenous ones, for the whole sample and each Group.

Table 6: Total Effects of External Shocks at Whole Sample and Individual Group Levels

Effect	Result	Whole Sample	Group 1	Group 2	Group 3
$\frac{\partial\, Penetration}{\partial\, CICOR}$	$\alpha_1\beta_1\gamma_1$	0.563			0.286
	$\alpha_1\beta_2\gamma_1$		5.124		
	$\alpha_1\beta_1\gamma_2 + \alpha_4\gamma_2$			-0.047††	
	$\alpha_1(\beta_3 + \beta_1\gamma_4)$	0.145			
$\frac{\partial\, Penetration}{\partial\, EV}$	$\alpha_1\beta_4 + \alpha_1\beta_2\gamma_4$		1.163††		
	$\alpha_1\beta_3 + (\alpha_1\beta_1 + \alpha_4)\gamma_5$			0.584†	
	$\alpha_1(\beta_3 + \beta_1\gamma_6)$				-0.009†
$\frac{\partial\, Penetration}{\partial\, IDHAD}$	$\alpha_2 + \alpha_1\beta_1\gamma_7$	35.062†			
	$\alpha_3 + \alpha_1\beta_2\gamma_8$		20.206††		
	$\alpha_1\beta_1\gamma_7 + \alpha_4\gamma_7$			-0.213	
	$\alpha_1(\alpha_2 + \beta_1\gamma_7)$				-6.186†
$\frac{\partial \log(PBIPC)}{\partial\, CICOR}$	$\beta_1\gamma_1$	20.791			-26.924
	$\beta_2\gamma_1$		100.493		
	$\beta_1\gamma_2$			64.820††	
$\frac{\partial \log(PIBPC)}{\partial\, EV}$	$\beta_3 + \beta_1\gamma_4$	5.342			
	$\beta_2\gamma_4$		22.508		
	$\beta_3 + \beta_1\gamma_5$			-9.467†	
	$\beta_1\gamma_6$				-0.564††
$\frac{\partial \log(PIBPC)}{\partial\, IDHDA}$	$\beta_1\gamma_7$	182.988		293.296	554.403
	$\beta_2\gamma_8$		-168.286††		
$\frac{\partial\, INBPC}{\partial\, CICOR}$	γ_1	6,008	10,579		-3,977
	γ_2			16,084††	
$\frac{\partial\, INBPC}{\partial\, EV}$	γ_4	799	2,369		
	γ_5			-2,101††	
	γ_6				-83††
$\frac{\partial\, INBPC}{\partial\, IDHDA}$	γ_7	52,886		72,778	81,891
	γ_8		-17,716††		

†There are disparate effects for different countries within each Group; ††Valid only for some countries.

Monetary units (for effects on INBPC) had been rounded to the next integer.

Source: Authors' Elaboration.

What happens if each exogenous variables (CICOR, EV, and IDHAD) register a relative improvement of 5 percent, for example? In the whole sample, Penetration grows 14.8 percent, more importantly, in Groups 1 and 2 (22,5 and 30.6 percent respectively), and the opposite happens in Group 3, where Penetration decreases (see Table 7).

Table 7: Changes in Penetration Before a 5 percent increase in selected variables

	Mean				Mean with 5 percent growth in exogenous variables				Difference between observed and simulated means			
Endogenous variables	Whole Sample	G1	G2	G3	Whole Sample	G1	G2	G3	Whole Sample	G1	G2	G3
Penetration	5.44	7.29	4.90	3.56	6.24	8.91	6.41	2.71	14.80	22.25	30.62	-23.73
GDPPC (U$S)	30,005	45,896	27,305	12,758	40,504	57,184	29,887	16,612	34.99	24.60	9.46	30.20
GNIPC (U$S)	29,888	49,977	31,224	12,258	35,160	56,126	29,436	15,273	17.64	12.30	-5.72	24.60

Source: Authors' elaboration.

6. CONCLUSIONS

The examination of the relationship between insurance and economic, institutional, and human development variables jointly, illustrates a possible complementarity and complex nexuses, which we address empirically. We hypothesize that "better institutions bring more opportunities for the development of the insurance sector through its impulse to economic growth and human development, generating, in turn, an increase in the demand for insurance coverage to protect the enhanced amount and value of human and physical capital".

In doing that, we first characterize the countries under study in terms of the main variables to consider. Secondly, we draw a multi-equational

model containing the nexuses between institutional quality, human and economic development, and their impact on insurance globally. Thirdly, we examine the aggregate effects of the variables selected by the principal component analysis, Expectancy of Life, Human Development Index Adjusted by Inequality, and Control of Corruption on Insurance Penetration, Gross Domestic Product Per Capita, and National Income Per Capita to address all channels of influence. Groups of countries were clustered according to their common features.

The complete database offers information for 59 countries (36 OECD and 23 Emerging) of 254 quantitative variables in four dimensions of analysis (insurance, economic and human development, institutional quality, and competitiveness) for a cross-section of 2018. The principal component analysis allows us to differentiate among three groups; the first is made of developed countries from Western Europe, North America, East Asia, and Oceania; the second is composed of developing countries of intermediate economic, human, and institutional levels from Eastern Europe and Latin America; the third comprehends middle- and low-income countries from Latin America, Africa, and Asia.

Group 1 has good performance in all the categories of variables; Group 2 has reasonable numbers for human development and some competitiveness indicators, while is relatively lagged in economic development, institutional quality, and insurance penetration; Group 2 is well behind in insurance, human development, and equality. Group 1 is also more homogeneous than the other two, with less dispersion of indicators, while in Groups 2 and 3 differences among countries are larger.

We develop a recursive or causal chain model where institutional quality influences insurance through the positive levels of insurance markets of economic development and competitiveness. The insurance market at the whole sample level is explained by three exogenous variables (Expectancy of Life, Human Development Index Adjusted by Inequality, and Control of Corruption), and two endogenous variables (Gross Domestic Product Per Capita, and National Gross Income Per Capita).

The causal chain starts when the three exogenous variables explain National Gross Income Per Capita and this jointly with Expectancy of Life explains Gross Domestic Product Per Capita. This, in turn, together with Human Development Index Adjusted by Inequality, explain Insurance Penetration. The model and our database reconcile all the precedent evidence, which was revised in the literature review. The variables are, in general, statistically significant, with the expected signs, and pass the tests of the quality of estimates common in this type of analysis. Some interaction channels are direct and predictable, while others function in a more indirect and complex way. Besides the group effects, we detected

specific effects for some countries or subgroups of countries, weak or strong, depending on the variables and the cases.

Results are sensitized simulating changes in some institutional quality and human development variables, to address their impact on Insurance Penetration. A 5 percent increase in the three exogenous variables, implies an expected growth of 15 percent in Insurance Penetration at the global level. These effects are even stronger in Groups 1 and 2, however, they are not present in Group 3 when considered separately.

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