**The Relationship between Insurance Industry Indexes and Socio-Economic Factors**

**at Iran’s Provincial Level**

**Abstract**

The purpose of this paper is to study the relationship between insurance industry development indexes including penetration rate, insurance density and written premium and the socio-economic factors such as population, GDP, number of branches and agencies and unemployment rate at Iran provincial level over the period 2007-2015, using a static panel data model. The panel data for 9 years starting from 2007 to 2015 on annual basis and 30 provinces are collected from different sources. Based on our best knowledge, it is for the very first that the study concentrates on provincial level. Hausman (1978) provides a formal framework for choosing between fixed effect and random effect estimations. The key findings emerged from the empirical analysis show positive and negative impact of socio-economic factors on insurance industry indexes, as measured by the written premium, penetration rate and insurance density. We conclude that as our expectation unemployment rate has a negative impact on insurance growth and other variables such as GDP, population, number of branches have positive impact on insurance growth.

**Key words:** insurance, socio-economic growth, panel data, provincial level, fixed effect model, random effect model, Hausman test.

1. **Introduction**

Insurance such as a large umbrella covers and supports people’s life and spread peace of mind. So they can live and work with ease and transfer the main risks to insurance companies. In this study, we try to assess the relationship between some socio-economic variables and insurance industry development indexes, in Iran’s provincial level for the period of 2007 to 2015. The contribution of this research is that for the very first time, the relationship between insurance industry development and economic growth will be examined at the provincial level. Hence, the findings of this work shed light on the above-mentioned relationship. We consider the insurance industry’s development indexes as our dependent variable (insurance density and penetration rate and written premium) and to check the relationship between these three items and independent variables such as gross domestic product (GDP) of each provinces, population, unemployment rate, the number of branches and agencies, dummy variable and so on.

The penetration rate is the percentage of the relevant population that has purchased a given brand or category at least once in the period under study. Penetration rate indicates the level of development of insurance sector in a country. Penetration rate is measured as the ratio of premium underwritten in a particular year to the GDP. Insurance density is used as an indicator for the development of insurance within a country and is calculated as ratio of total insurance premiums to whole population of a given country. Written premiums are the amount of premium charged for a policy that has already became effective.

In [statistics](https://en.wikipedia.org/wiki/Statistics) and [econometrics](https://en.wikipedia.org/wiki/Econometrics), particularly in [regression analysis](https://en.wikipedia.org/wiki/Regression_analysis), a dummy variable is one that takes the value 0 or 1 to indicate the absence or presence of some categorical effect that may be expected to shift the outcome. We assumed that from the 1388 the detarriffing insurance rate started and the value 1 is intended to the year 1388 and after. The panel data for 9 years starting from 2007 to 2015 and 30 provinces are collected from different sources such as Statistical Yearbook of Iran’s Insurance Industry, Central bank of Iran, Insurance Research Centre, Central Insurance of Iran and Statistical Centre of Iran.

The main issue to start with would be to examine the variables which can present the relationship between insurance industry and socio-economic factors. The main question of this study is which factors effect on insurance development at provincial level. In order to answer this question, we consider below questions:

What is the relationship between insurance industry indexes and the GDP of each province?

What is the relationship between insurance industry indexes and the number of branches and agencies?

What is the relationship between insurance indexes and unemployment rate?

1. **literature review**

Beenstock et al (1988) examined the relationship between insurance and economic growth using time series data for ten industrialized countries for the period 1970-1981. They found that life insurance is directly dependent on income, as measured by GDP per capita.

Outreville (1990) analysed the long and short-term causal relationships between economic growth and development of the insurance market. This is done on a country by country basis to allow the worn different causal relationships in size and direction of each country. Nine major OECD countries are examined with real GDP used as a measure of economic activity and total real premiums as a measure of the insurance business. Outreville noted the importance of insurance in the process of economic development.

De Gregorio’s (1992) panel data set was used for 12 Latin American countries for 1950 – 1985. They found a positive effect of financial development on long-run growth of real per capita GDP, which was particularly strong in middle-income and low-income countries (negative in Latin American countries). The results also showed that the effect of financial intermediation on growth is due mainly to its impact on the efficiently of investment, rather than to its volume. In addition De Gregorio and Guidotti (1995) focused on the effects of investment as an additional potential channel of transmission from financial development into growth.

Webb et al (2002) tried to examine whether banks, life and non-life insurance individually and collectively contribute to economic growth, to do this they used data from 55 countries for the period 1980-1996. The result of this research is that the penetration of life insurance is significantly positively correlated with economic growth and the relationship is reciprocal. In addition, they stated that there is no link between economic development and non-life insurance.

Esho et al (2004) studied the role of legal factors in determining insurance density across countries using GMM on panel data for the period 1984-1998. The results show that there is a strong positive relationship between the protection of property rights, income and consumption insurance.

Kugler and Ofoghi (2005) examined the relationship between the size of the insurance market and economic growth in the UK over the period 1966 to 2003 for long-term insurance, and over the period 1971-2003 for general insurance. As a measure of growth , they used the growth rate of real GDP per capita and premiums ( car insurance, liability insurance , property insurance, transport insurance ) general insurance, insurance premiums in the long term ( life insurance , annuities , pensions individuals) as a measure of the activity of insurance. Their study showed that there is a causal link between long-term growth of the insurance market and economic growth for eight of the nine classes of insurance.

Adams et al. (2006) conduct an analysis similar to Kugler and Ofoghi (2005) but focus on Sweden for the period of 1830-1998 and include additional variables like bank lending. Bank lending seems superior to insurance service and cause growth in the nineteenth century. In the twentieth century causality is reversed. Insurance seem to be more driven by the economic growth.

Haiss and Sumegi (2008) studied the impact of insurance on economic growth, on a sample of 29 European countries. They conducted an analysis of panel data over the period 1992-2005 , the total sample and then they split into two groups, one consisting of 15 EU countries and the other includes the new member states the EU (such as Turkey and Croatia). They found a positive impact of life insurance on the growth of GDP for the first group of countries, for the second group, they found a greater impact of the non-life insurance (liability insurance). In addition, their results highlight the impact of the real interest rate for the bond insurance growth.

Ofoghi (2008) in his study investigate the relationship between insurance market development and economic growth within the UK. Some previous studies have shown that there is no long-run relationship between insurance development and economic growth for some OECD countries including UK. As it is possible to observe no cointegration at the aggregate level and cointegration at the disaggregated one and vice versa, this study reassessed the conclusions using disaggregate data for insurance markets, and find a long-run relationship between insurance market development and economic growth. On the basis of the causality test, conclude that the structure of the UK’s insurance industry tends to display a demand-following pattern rather than a supply-leading one (i.e. growth promotes insurance market development, but not vice versa).

Safari and Soltani (2010) studied on the relationship between insurance sector and economic development in Iran and some developing countries such as India, Turkey, Pakistan, Indonesia, Malaysia, Philippines and Algeria from 1976 to 2009 by panel data model. With an increase of 1 % on penetration rate, 0.003 % on economic growth would increase in the concerned countries. They found that all of their variables have positive and meaningful effect on the economy of mentioned countries.

Han et al (2010) studied the relationship between insurance development and economic growth using a dynamic panel data model on 77 countries for the period 1994-2005. The insurance density is used to measure the development of the insurance; they concluded that the development of insurance is positively correlated with economic growth. The estimated sample is then divided into developed and developing countries. For developing economies, the development of insurance is more important than that played in the case of developed economies assurance role.

In another panel study, İlhan and Taha ([2011](http://cogentoa.tandfonline.com/doi/abs/10.1080/23322039.2016.1150390#CIT0022)) examined the role of insurance in economic growth using 29 countries between 1999 and 2008. The countries are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Turkey, South Korea, Luxemburg, Mexico, Holland, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, England, and United States. The result shows that there is a positive relationship between insurance and economic growth in the sample countries.

Michael Ojo (2012) examined the relationship in the short and long -term relationship between economic growth and the development of the insurance sector in the Nigerian economy over the period 1985-2009. The results showed that the development of the insurance sector positively and significantly affects economic growth.

Omoke ([2012](http://cogentoa.tandfonline.com/doi/abs/10.1080/23322039.2016.1150390#CIT0035)) makes use of insurance density (premium per capita) as a measure for insurance market activity and real GDP for economic growth in Nigeria between 1970 and 2008. The study also employs control variables such as inflation and savings rates as other determinants of growth. The result shows low-insurance market activity and development in Nigeria.

Safarzade and Jafari (2012)have been investigated non-linear relationship between penetration and per capita income. Using pooled data from 70 countries with different income during the period from 2000 to 2011 is estimated by maximum likelihood method.

In addition, Akinlo ([2012](http://cogentoa.tandfonline.com/doi/abs/10.1080/23322039.2016.1150390#CIT0002)) examines the effects of insurance on economic growth in Nigeria during the period of 1986 to 2010. The structure, growth of insurance subsectors, and the direction of causality between insurance and economic growth in Nigeria were addressed in the study. An error-correction model analysis and cointegration technique was adopted in the analysis. The cointegration technique shows that all the variables apart from premium are highly significant. The coefficient of premium was significant at 10%. The findings of the study indicate insurance measured as premium, has a positive significant influence on economic growth, and that there is a long-run relationship between insurance and economic growth in Nigeria.

A panel study by Akinlo and Apanisile ([2014](http://cogentoa.tandfonline.com/doi/abs/10.1080/23322039.2016.1150390#CIT0003)) examined the relationship between insurance and economic growth in sub-Saharan Africa over the period 1986–2011. Pooled OLS, Fixed Effect Model, and Generalized Method of Moment Panel Model were employed in the estimation. The estimations of the dynamic panel data results show that insurance has positive and significance impact on economic growth in sub-Saharan Africa. This shows that premium contributes to economic growth in sub-Saharan Africa which means that a well-developed insurance sector is necessary for the economic development, as it provides long-term investments for economic growth and simultaneously strengthening risk-taking abilities.

Recently, Olayungbo ([2015](http://cogentoa.tandfonline.com/doi/abs/10.1080/23322039.2016.1150390#CIT0034)) investigated the asymmetric non-linear relationship between insurance and economic growth in Nigeria from 1976 to 2010. The conclusion is that asymmetric effect is present in Nigeria’s insurance market. Also, unidirectional causality runs from positive GDP growth to negative insurance premium growth. In addition, the robustness results, using variance decomposition and impulse response with control variables, show that low insurance promotes high growth in Nigeria. The impulse responses also show the presence of an asymmetric relationship between low insurance and high growth in Nigeria.

1. **Methodology**

The situation often arises in financial modeling where we have data comprising both time series and cross-sectional elements, and such a dataset would be known as a panel of data or longitudinal data. A panel of data will embody information across both time and space. Importantly, a panel keeps the same individuals or objects and measures some quantity about them over time.

In statistics and econometrics, the term panel data refers to multi-dimensional data frequently involving measurements over time. Panel data contain observations of multiple phenomena obtained over multiple time periods for the same firms or individuals.

Panel data is essentially cross-sectional data that is pooled together for a certain period of time with equal intervals. A simple model for such a set of data would be:

$$y\_{it}= α+ βx\_{it}+u\_{it}$$

Where $y\_{it} $is the dependent variable, *α* is the intercept term, *β* is a *k*×1 vector of parameters to be estimated on the explanatory variables, and $x\_{it} $is a 1 × *k* vector of observations on the explanatory variables, *t* = 1, *. . .* , *T* ; *i* = 1*,. . ., N*.

The simplest way to deal with such data would be to estimate a pooled regression, which would involve estimating a single equation on all the data together, so that the dataset for *y* is stacked up into a single column containing all the cross-sectional and time-series observations, and similarly all of the observations on each explanatory variable would be stacked up into single columns in the *x* matrix. Then this equation would be estimated in the usual fashion using OLS.

Panel data analysis uses a wide range of models and estimators. $\_{}$X i t , i = 1 , … , N t = 1 , … , T , {\displaystyle X\_{it},\;i=1,\dots ,N\;t=1,\dots ,T,} $\_{}$Three important models are the fixed effects model and the random effects model and pooled OLS estimator.

Fixed and Random Effects Regression model is:

$$Y\_{it}= β\_{0}+ X\_{it}β+ Z\_{i}γ+ α\_{i}+ u\_{it}$$

Where the

|  |
| --- |
| $Y\_{it}$ is the dependent variable observed for individual i in time t. $X\_{it}$ is the time-variant regressor $Z\_{i}$ is the time-invariant regressor; observed and cannot be estimated directly by the fixed effect model but can be estimated by the random effect model $α\_{i}$ is the unobserved individual effect $u\_{it}$ is the error term  |

**Fixed Effects Model**

It makes sense to use the fixed-effect model if two conditions are met. First, we believe that all the studies included in the analysis are functionally identical. Second, our goal is to compute the common effect size for the identified population, and not to generalize to other populations.

Use fixed-effects whenever you are only interested in analyzing the impact of variables that vary over time. FE explores the relationship between predictor and outcome variables within an entity. Each entity has its own individual characteristics that may or may not influence the predictor variables. We use fixed effects model for Controlling for unobserved heterogeneity when heterogeneity is constant over time and correlated with independent variables. When there are certain non-random characteristics you don’t want ending up in your error term.

**Random Effects Model**

The rationale behind random effects model is that, unlike the fixed effects model, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model.

Instead of thinking of each unit as having its own systematic baseline, we think of each intercept as the result of a random deviation from some mean intercept. The intercept is a draw from some distribution for each unit, and it is independent of the error for a particular observation. Instead of trying to estimate N parameters as in fixed effects, we just need to estimate parameters describing the distribution from which each unit’s intercept is drawn.

**The Hausman Test**

The correlation between independent variables and α represent the differences between fixed effects and random effects approach. Hausman (1978) provides a formal framework for choosing between fixed effect and random effect estimations. The Huasman test, tests the null hypothesis that the coefficient estimated by the efficient fixed effects estimator ($β\_{FE})$ are the same as the ones estimated by the consistent random effects estimator ($β\_{RE})$.

$$H\_{0}: β\_{FE}- β\_{RE}=0 $$

The significant P-value is smaller than 0.5, it is is interpreted as an indicator for the rejection of null hypothesis and using of fixed effect estimator as the more efficient method but getting an insignificant P-value is an indicator in favour of choosing random effect estimation.

It is worthy of mention that the Huasman test checks a more efficient model against a less efficient but consistent model to make sure that the more efficient model also gives consistent results.

1. **Empirical Result**

The correlation between insurance and economic growth has been analysed by many authors at the international level, thus there are a lot of studies seeking to assess the causal relation between economic performance and the size of the insurance sector.

Now the main question is that, which factors affect economic growth? And then check that which one of them has influenced on insurance sector.

The models that are expressed in the previous chapter are going to be estimated in order to examine the relationship between insurance industry indexes as dependent variables and socio-economy factors as independent variables. Before launching with the analysis, the statistical specification of variables and their graphical trend will be demonstrated and then estimation will be determined and the hypothesis will be tested.

### Written Premium and Socio-Economic Factors

Our model incorporates several measures used to control variables. The variables used in this study for first model are:

|  |  |
| --- | --- |
| Y | Logarithm of written premium |
| X1 | Logarithm of lagged dependent variable of written premium |
| X2 | Logarithm of GDP |
| X3 | unemployment rate |
| X4 | Logarithm of branches |
| X5 | Logarithm of population |
| X6 | Dummy variable |

In order to select between fixed and random effects model, we run Hausman test.

|  |
| --- |
| The Hausman test |
| Test summary | Chi-Sq statistic | Chi-sq df | Prob |
| Cross section random | 0.000 | 6 | 1.000 |

Based on the results, we can confirm the null hypothesis. The *p*-value for the test is more than 0.05, indicating that the random effects model is appropriate and that it is specification is to be preferred. According to random effect model,

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| variable | Coefficient | Std. Error | t-Statistic | prob |
| C | 0.458040 | 0.138411 | 3.309268 | 0.0011 |
| Log of lagged dependent variable of written premium | 0.837149 | 0.024370 | 34.35118 | 0.0000 |
| Log of GDP | 0.031701 | 0.017528 | 1.808642 | 0.0718 |
| unemployment rate | -0.002551 | 0.001110 | -2.297648 | 0.0225 |
| Log of branches | 0.056356 | 0.027379 | 2.058386 | 0.0407 |
| Log of population | 0.095971 | 0.021219 | 4.522983 | 0.0000 |
| Dummy variable | 0.083607 | 0.009905 | 8.440724 | 0.0000 |
| R-squared | 0.991838 |

It shows that, unemployment rate has negative effect on written premium. The economic policies of government could help to improve this subject. About population, the coefficient is positively affected and the p-value is meaningful. The lagged dependent variable of written premium is meaningful and positive. The [gross domestic product](http://www.investopedia.com/terms/g/gdp.asp) (GDP) is one of the primary [indicators](http://www.investopedia.com/terms/i/indicator.asp) used to gauge the health of a country's [economy](http://www.investopedia.com/terms/e/economy.asp). This estimation shows the positive effect of GDP and it’s logical because the written premium is affected by increasing the GDP. About the next variable, it’s obvious that the number of branches and agents is directly related the insurance indexes growth. The total panel observation is 240 and generally 1860 data is contributed to all estimation.

### Insurance Density and Socio-Economic Factors

|  |  |
| --- | --- |
| Y | Logarithm of insurance density |
| X1 | Logarithm of GDP |
| X2 | unemployment rate |
| X3 | Logarithm of branches |
| X4 | Logarithm of population |
| X5 | Dummy variable |

The last model variables are as above. Now to check that which model is better we study the Hausman test.

|  |
| --- |
| The Hausman test  |
|  Test summary | Chi-Sq statistic | Chi-sq df | Prob |
|  Cross section random | 57.447179 | 5 | 0.000 |

As it is clear from the results, the probability is less than 0.05 and it means that fixed effect model is preferred and null hypothesis is not accepted.

To consider the fixed effect model:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| variable | Coefficient | Std. Error | t-Statistic | prob |
| C | -7.918733 | 3.528719 | -2.244082 | 0.0258 |
| Log of GDP | 0.726005 | 0.056706 | 12.80292 | 0.0000 |
| unemployment rate | -0.006933 | 0.002646 | -2.619741 | 0.0094 |
| Log of branches | 0.434596 | 0.052265 | 8.315287 | 0.0000 |
| Log of population | 0.261814 | 0.607790 | 0.430765 | 0.6670 |
| Dummy variable | 0.045691 | 0.019488 | 2.344572 | 0.0199 |
| R-squared | 0.964991 |

In this estimation, unemployment rate has negative effect on the insurance density. It is obvious that unemployment rate has negative relationship with insurance indexes. When the unemployment rate is increases the willing to incorporate in insurance contracts decreases. Other variables are directly related to insurance indexes growth.

### Penetration Rate and Socio-Economic Factors

The dependent and independent variables are considered as:

|  |  |
| --- | --- |
| Y | Penetration rate |
| X1 | Logarithm of GDP |
| X2 | unemployment rate |
| X3 | Logarithm of branches |
| X4 | Logarithm of population |
| X5 | Dummy variable |

|  |
| --- |
| The Hausman test |
| Test summary | Chi-Sq statistic | Chi-sq df | Prob |
| Cross section random | 36.583883 | 5 | 0.000 |

As it stands, fixed effect model is preferred (probability is less than 0.05) and the output of fixed effect model is as below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| variable | Coefficient | Std. Error | t-Statistic | prob |
| C | -16.69538 | 11.59223 | -1.440222 | 0.1511 |
| Log of GDP | 0.614919 | 0.186286 | 3.300942 | 0.0011 |
| unemployment rate | 0.009381 | 0.008694 | 1.079043 | 0.2817 |
| Log of branches | 0.403179 | 0.171695 | 2.348221 | 0.0197 |
| Log of population | 1.625409 | 1.996656 | 0.814066 | 0.4164 |
| Dummy variable | 0.044171 | 0.064021 | 0.689950 | 0.4909 |
| R-squared | 0.870586 |

In this estimation, it seems that all of independent variables have positive effect on penetration rate but about the unemployment rate although it’s positive, the p-value is not meaningful and these options together destroy its effect. As it is predicted, other independent variables are directly related to penetration growth.

1. **Conclusion**

Using either the fixed or random effects model on panel data indicates the relationship between insurance industry indexes and socio-economic factors.

As the previous chapter estimated, the Gross Domestic Product is positively related to insurance industry growth. When the economy is healthy, there is usually low unemployment and wage increases, as businesses demand labor to meet the growing economy. The GDP report is also a way to look at which sectors of the economy are growing and which are declining. The percentage in GDP of provinces is the measure of the development of that respective state. From the estimation, it found that by increasing the GDP for each provincial each year, the insurance industry is directly improvement.

In the debate on economy policy, unemployment rate is often related to the rise in wage dependent social security contribution. The rate of unemployment is another key macroeconomic variable because it shows how well an economy is using its resources. Unemployment cannot be zero even if the economy it’s operating at full capacity because of the frictional and structural unemployment. Frictional unemployment is determined by the time spent to match workers and jobs. This period can vary quite a lot because of imperfect information regarding job vacancies, relative geographic immobility of the workers and wage rigidity. On these estimations, unemployment rate has negative effect on insurance industry growth.

About the number of branches and agencies, it’s obvious that the more branches, the more growth at insurance industry indexes.

The population is one of the most important factors which include the population covered at insurance industry. In the other words, the more population on each provinces, make the higher chance for buying insurance policies and take part in and therefore this variable is significant.

The last variable is dummy variable which represents the tariffing and ditariffing the insurance rate at insurance companies. Before 1388 all insurance rates were the same (tariff rate) but after that each company allow to have its own rate and the ditariffing rate started from 1388.

Economic policies that lead to balanced economic growth, could contribute to insurance industry development at all provinces. The economic policies of government could help to reduce the unemployment rate.

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