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## ROLE OF ECONOMIC FACTORS IN PROPERTY LIABILITY INSURANCE CONSUMPTION: EMPIRICALLY EXAMINING THE INDIAN MARKET

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### **Abstract:**

*The association of property liability insurance (PLI) consumption with economic growth in the post liberalized era has already been established justifying the need to analyze the economic factors which lead to PLI development. The empirical examination reveals that income and trade development have a positive relation with PLI consumption whereas negative relationship is obtained for interest rate movement and financial development. However, inconclusive relation is derived for infrastructure development and price of insurance. The findings will assist the policymakers, insurance regulator and insurance statutory body in stimulating PLI consumption by focusing on the identified economic factors and devise policies to support the growth in PLI sector.*

**Key words:** *Property Liability Insurance, Economic factors, Time series, Economic growth, India*

### **1. Introduction**

Transfer of risks, financial intermediation and employment generation (Esho et al., 2004; Hussels et al., 2005; Ward & Zurbruegg, 2000; Arena, 2008) are the major roles played by the insurance sector. Property Liability Insurance protects property, health and against any claims that may arise due to lawsuits mainly by way of Motor, Marine, Fire, Aviation, Health, Engineering, Crop, Personal accident and Liability insurance. Coverage of business and personal risks facilitate business house and entrepreneurs to take more risk with capital deployment in productive activities leading to economic growth of the nation.

Relationship of economic growth with financial development has widely been studied by Rousseau and Wachtel (1998), Levine and Zervos (1998), King and Levine (1993), Ahmed (2016). Later research shifted on deriving the factors affecting the demand of financial products and contribution of financial intermediaries towards

economic growth. Contribution of banks and stock markets in economic growth has been widely studied (Levine & Zervos, 1998; Naceur & Ghazouani, 2007; Yartey, 2008), however, studies on causal relationship of insurance with economic growth are less extensive (Ward & Zurbruegg, 2000; Haiss & Sumegi, 2008). Relationship of insurance sector and economic growth was derived (Ghosh, 2013; Arena, 2008; Ward & Zurbruegg, 2000; Browne & Kim, 1993) leading to research on underlying factors contributing the insurance consumption (Beenstock et al., 1988; Esho et al., 2004; Hussels et al., 2005; Dragos, 2014; Garcia, 2012; Mitra & Ghosh, 2010). The world economy is facing an unprecedented crisis due to the recent Covid-19 pandemic posing an extraordinary and unforeseen challenge with 4.9% contraction expected in 2020 (IMF, June 2020a). Apart from stringent measures imposed by government of certain countries to stop the virus spread for avoiding health crisis, voluntary social distancing is also affecting the livelihood of people across the world with reduced movement and economic activities. In spite of ongoing unprecedented situation of Covid-19 adversely impacting the insurance sector in 2020, the emerging markets are expected to surpass the advanced markets with India projected to be an emerging giant in the sector (Sigma, 04/2020).

Ghosh (2013), Mitra and Ghosh (2010) studied the Indian life insurance market, its relation with economic growth and the factors affecting its consumption, however, studies on PLI segment are less except Ghosh et al. (2017) investigating the causal relationship between economic growth and PLI segment. None of the extant studies explored infrastructure development as a determinant in explaining the development of PLI sector. The present study endeavored to identify the role of infrastructure development in PLI and fills the gap in literature. The role of social factors on consumption of Indian PLI sector has been undertaken by Mukherjee and Ghosh (2020), however, the role of economic factors which is tangible and is more relevant at present with economic growth shrinking due to Covid-19 pandemic, is not studied in PLI segment. Further, country specific studies have been conducted by Garcia (2012) and Cavalcante et al. (2018) for Portugal and Brazil respectively on PLI taking into consideration only the economic growth and financial development factors with little focus on other economic aspects. The present study has taken an attempt by taking a wide range of economic factors and analyzing their role in the property liability insurance consumption in India measured by PLI premium.

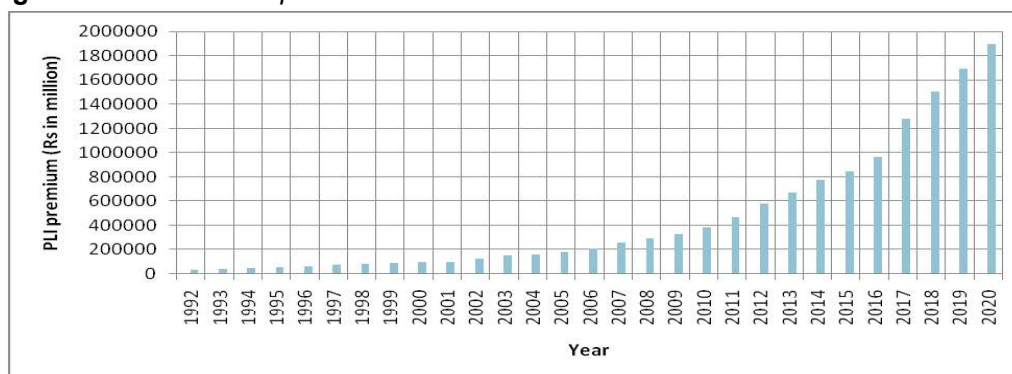
The next section of the study will highlight the PLI development in India with Section 3 covering the existing literatures of economic factors followed by presentation of the methodology, data and the results. The final section (Section 5) provides concluding remarks and policy recommendations.

## **2. Indian PLI segment and its development**

Government of India (GoI) brought reforms in insurance sector by setting up Malhotra Committee in 1992 which is in line with the liberalization of Indian economy introduced by way of new economic policy in 1991. Implementation of Committee recommendation commenced from 1999 and Insurance Regulatory and Development Authority of India (IRDA) was set up beginning a new era in the Indian insurance

sector. Year-wise movement of PLI premium provided in Figure 1 indicates a secular uptrend in the PLI figures.

**Figure 1: Yearwise PLI premium in India**



(Source: IRDA annual reports)

Indian insurance market ranked at 11 in 2019 with a premium of USD 106 billion is forecasted to be among the top 10 largest insurance markets (Sigma, 04/2020). With a market share of only 1.7 percent in the global premium, India has the opportunity to improve PLI business in future (IMF, 2018). In spite of low share in global premium, the inflation adjusted real premium growth rate (Table 1) reflects potential of the PLI/ non-life insurance sector in India.

**Table 1. Total Real Premium Growth Rate 2019**

(in percent)

| Regions/Countries | Life | Non-life | Total |
|-------------------|------|----------|-------|
| Advanced markets  | 1.3  | 2.7      | 2.1   |
| India             | 7.3  | 5.7      | 6.9   |
| World             | 2.2  | 3.5      | 2.9   |

(Source: Sigma 04/2020)

The growing importance of insurance sector can be gauged by Insurance penetration (ratio of premiums to GDP) and Insurance density (per capita insurance consumption) (Hussels et al., 2005; Outreville, 1996; Browne et al., 2000; Esho et al., 2004). In 2019 world insurance market reached a premium volume of 6.3 trillion USD comprising 7.2% of global GDP and experienced a 3% growth over the premium in 2018 (Sigma, 04/2020). Non-life insurance performance parameters of India vis-à-vis world are provided in Table 2.

**Table 2: Non-life Insurance penetration and density in India vis-à-vis world in 2019**

| Regions/Countries     | Non-life Insurance Penetration (%) | Non-life Insurance density (USD) |
|-----------------------|------------------------------------|----------------------------------|
| <b>India</b>          | <b>0.94</b>                        | <b>19</b>                        |
| Emerging Asia-Pacific | 1.64                               | 87                               |
| <b>World</b>          | <b>3.88</b>                        | <b>439</b>                       |

(Source: Sigma 04/2020)

India having a low penetration and density in PLI sector creates an opportunity for future PLI business which is in line with IMF, 2018 report. Insurance industry comprise of Life insurance and Non-life insurance segments with share of 75% and 25% respectively (IRDA, Annual Report 2019). To keep in tandem with the international context, non-life insurance is referred as property liability insurance (Outreville, 2013) and the study has used the terms interchangeably.

Inspite of the Covid-19 situation having an impact on world economy (IMF, April 2020; IMF, June 2020b) including India by supply chain disruptions and health crisis with infection rising to more than 5 million in September 2020 (Ministry of Health and Family Welfare, GoI) and lockdown of 21 days (Ministry of Home Affairs, 24.03.2020) commencing from 25<sup>th</sup> March 2020 & subsequent phase wise lockdown for another 47 days, PLI sector resilience is evident by way of improvement in premium figures from the month of March 2020 to August 2020 as provided in Table 3. The phase wise unlockdown process which commenced from 1<sup>st</sup> June 2020 (Ministry of Home Affairs) has contributed towards gradual recovery of the economy and consequently the same has got reflected in PLI premium figures.

**Table 3: Gross premium underwritten by property-liability insurers in India from March-August 2020**

(INR in million)

| Period      | PLI premium |
|-------------|-------------|
| March 2020  | 158598.40   |
| March 2019  | 173513.40   |
| Growth      | -8.60%      |
| April 2020  | 144765.20   |
| April 2019  | 158915.90   |
| Growth Rate | -8.90%      |
| May 2020    | 108914.60   |
| May 2019    | 122314.80   |
| Growth Rate | -10.96%     |
| June 2020   | 139614.90   |
| June 2019   | 129477.50   |
| Growth      | 7.83%       |
| July 2020   | 170126.90   |
| July 2019   | 143701.00   |
| Growth      | 18.39%      |
| August 2020 | 176258.60   |
| August 2019 | 159642.20   |
| Growth      | 10.41%      |

| Period            | PLI premium |
|-------------------|-------------|
| April-August 2020 | 739682.60   |
| April-August 2019 | 714061.70   |
| Growth            | 3.59%       |

(Source: IRDA)

IRDA and government have taken adequate steps for PLI segment to relieve the burden on policyholders due to Covid which, inter alia, includes timeline extension for depositing premium of motor third party and health insurance policies that fell due for renewal during the lockdown period to ensure continuity of policies, introduction of 'Corona Kavach' policy (IRDA) and mandatory health insurance coverage for workers (Ministry of Home Affairs, 15.04.2020). In addition, Govt has introduced an economic package amounting INR 20 lakh crores with an objective to build self-reliant India in the form of 'Atmanirbhar package' and keeping economic growth into consideration. Thus, effort of the policymakers to improve the sector and position of the Indian market vis-à-vis world justifies identifying the economic factors contributing property liability insurance consumption in India.

### **3. Literature Review**

The uptrend in the gross premium underwritten by non-life insurers in India has prompted to consider it for assessment of the PLI development and is in line with the insurance development measurement adopted by Beenstock et al. (1988), Ward and Zurbruegg (2000), Outreville (1990a), Garcia (2012), Esho et al. (2004), Cavalcante et al. (2018). The reviews of literatures of the economic factors assessed are as follows,

#### **3.1. Income**

Income and consumption of insurance products are expected to be directly related (Esho et al., 2004). Beenstock et al. (1988), Esho et al. (2004), Garcia (2012), Curak et al. (2009), Outreville (1990a,1992), Browne et al. (2000), Cavalcante et al. (2018) have found a significant relationship between PLI consumption and income. Higher economic growth lead to increase in income and with increase in income, PLI sector demand is estimated to develop. National income of industrialized countries has been measured by GNP per capita (Beenstock et al., 1988; Browne et al., 2000) with Ward and Zurbruegg (2000) pointing out country specific circumstances influencing the economic growth, supported by Enz (2000) concluding that insurance penetration rises with GDP per capita but differ with levels of GDP across countries. GDP per capita has been used to measure income by Outreville (1990a,1992), Esho et al. (2004), Petkovski and Jordan (2014).

A long-run relationship was observed between insurance development and GDP of 8 selected African countries by Alhassan and Biekpe (2016) while Trinh et al. (2016) covering the period from 2000 to 2011 of 31 developing and 36 developed

countries found that income is a key driver of non-life insurance expenditure and analyzed the role of heterogeneity among countries in the development level.

Income level is measured by GDP per capita in the present paper. GDP is preferred over GNP to evaluate the income variable to consider increasingly global nature of national economies with higher dependency on phenomenon like labour forces and supply chains.

### **3.2. Financial development**

A positive relation is found between financial development and PLI consumption in the studies of Cavalcante et al. (2018), Outreville (1990a,1992), Millo and Carmeci (2011), Feyen et al. (2011).

Banking sector dominance and lack of data on other financial assets in developing countries may encourage to take M2 (a broader measure of money supply) to quantify size of the financial sector. M2 to GDP ratio has been empirically tested with PLI consumption by Outreville (1990a) based on 55 developing countries concluding the importance of financial development in PLI and is supported by Outreville (1992). In a country specific study of Portugal, Garcia (2012) identified M1/M2 and M2/GDP as a measure of financial development to ascertain its relationship with PLI premiums. It was observed that financial development was relevant except M1/M2 although M2/GDP has a negative coefficient. In another country specific study of Brazil, Cavalcante et al. (2018) concluded a positive relationship between non-life insurance market and financial development measured by volume of credit operations which is in line with the conclusion drawn by Feyen et al. (2011) that financial development help PLI companies have better asset liability and risk management hence, raising the supply of insurance. Trinh et al. (2016) in its study has found a positive and significant relationship between financial development and the insurance market.

Financial development measured by ratio of Broad money (M3) to GDP is used in the study. M3 includes M2 in addition to large time deposits, short-term repurchase agreements, larger liquid assets and institutional money market funds.

### **3.3. Export and import as percentage of GDP**

Economic growth is supported by some of the factors like trade, commerce and entrepreneurial activities and property liability insurers help in facilitating those attributes. PLI reduce risk in trade activities especially through cargo insurance and helps in access to those foreign markets which otherwise would be very risky. Policymakers encourage export activities since it increases the country's foreign exchange reserves and helps in domestic currency appreciation. PLI of goods and services exported not only reduce the risks associated but also expected to encourage further exports. Import of goods and services entailing the trade activities also bears a

risk of loss or theft, thereby making insurance a necessity to minimize the risk involved. Since PLI promote trade development, growth in PLI may lead to increase in economic growth and may help in raising the productivity of the economy.

Arena (2008) measured the degree of openness of economy by ratio of export and import to GDP and a significant positive relationship with insurance was found based on a study of 56 industrialized and developing countries. Curak et al. (2009) used export of goods and services in relation to GDP as a measure of openness of the economy while studying 10 transition European countries for finding relationship between economic growth and insurance sector development. The results confirm a significant positive relationship with the degree of openness of the economy.

Webb et al. (2002) used ratio of total exports to GDP in its paper of effect of banking and insurance on capital growth and output, it was observed that export variable proved insignificant as a predictor of economic growth. Avram et al. (2010), Feyen et al. (2011) used ratio of export and import to GDP and a positive relationship was found between openness to trade and insurance growth as trade depends on the availability of marine, liability and cargo insurance. Volume of trade is an important drive of the PLI sector and a positive relationship was observed between openness of economy and insurance premium by Akinlo and Apanisile (2014). Petkovski and Jordan (2014) found a positive and significant relationship of trade with non-life insurance consumption while analyzing non-life insurance determinants for some countries in Central and South Eastern Europe over the period 1992-2011. Auboin and Engemann (2014) in a study for the period 2005-2011 identified a positive and significant effect of export credit insurance on trade which remains stable, irrespective of crisis and non-crisis periods.

Ratio of export and import as percentage of GDP is used as an indicator of openness of economy to gauge its effect on PLI consumption in the present study.

### **3.4. Infrastructure development**

Infrastructure development/investment may be relevant for PLI consumption in India and insurance facilitates investment in infrastructure activities, by generating sources of long-term finance. There is a gap in literature and no study has been found wherein association of infrastructure development and PLI is tested empirically in spite of Sigma 03/2020 report highlighting that infrastructure investment lead to increase in consumption of related insurance premiums with India being the second largest emerging market in infrastructure investment. Further for any infrastructure project loans, insurance of assets is a prerequisite for bank finance. Risk can be underwritten in both construction (viz. contractors all risk and marine) and operational phases (property insurance) of the infrastructure project (Sigma 03/2020). Thus, an empirical study investigating infrastructure development and PLI consumption may assist policymakers and state planners to allocate budget judiciously in infrastructure projects. Infrastructure development has been measured by annual infrastructure project cost or investment in India in the study.

### **3.5. Interest Rate**

Relationship of interest rate on alternative instruments and PLI consumption has been found to be inconclusive. In a cross sectional analysis of 12 industrialized countries (Beenstock et al., 1988) for the period 1970-1981 it was concluded that PLI premiums vary directly with interest rate. However, Haiss and Sumegi (2008) inferred that when interest rate is taken into consideration, premiums are negative for economic development, suggesting insufficient returns supported by Millo and Carmeci (2011) concluding that high interest rates lead to reduction of non-life insurance consumption, by way of increasing cost of borrowing which in turn increases the opportunity cost of insuring against self-insuring. Akinlo and Apanisile (2014) used deposit interest rate as a proxy of interest rate and it was inferred that interest rate has a negative effect on insurance premium.

Life insurance is a means to long-term investment, in contrary PLI are generally issued for one year and hence a comparison of movement of term deposit rates (Akinlo & Apanisile, 2014) for a period of 1 to a maximum of 3 years is examined to determine the effect of interest rate movement on PLI consumption and a negative effect is hypothesized.

### **3.6. Insurance price**

Demand of a product is always determined by price of product (not for exceptions) and is a determining factor in the consumption of that particular product and PLI is not an exception. This is proved in the studies conducted by Esho et al. (2004), Outreville (1990a,1990b), Browne et al. (2000) wherein it is observed that insurance price has a negative impact on PLI consumption.

Esho et al. (2004) used premiums divided by claims, also defined as inverse of the loss ratio, to measure price of insurance. Cummins and Danzon (1997), Cummins and Philips (2005) used economic premium ratio defined as premium netting off the dividends and underwriting expenses divided by the estimated present value of losses as a proxy to measure insurance price. Browne et al. (2000) used market share held by foreign insurers during a year to measure the price of insurance, but this is highly debatable and is an indirect measure of price.

Insurance price might also be affected by inflation and is expected that inflation effect has been embedded in the insurance price. Also Feyen et al. (2011) in its study reveals a positive relationship between PLI consumption and inflation which contradicts the anticipated role of inflation in the economy. Since, role of inflation in PLI is inconclusive and assuming that inflation effect is encapsulated in insurance price, inflation is not considered in the study.

Premium amount is expected to depend on claims incurred and increase of losses indicates rise in claims. Premiums need to be fixed in such a manner that it covers the increase in claims incurred as all other operating expenses are fixed in nature. Since the primary factor that decides premium amount is the incurred claims,

premiums divided by claims also known as the inverse of loss ratio, has been considered to measure insurance price in our study in line with Esho et al. (2004).

Based on above propositions, PLI consumption is hypothesized to have following relationships with the above-mentioned factors,

***PLI Consumption = f [Income (+), Financial development (+), Trade development (+), Infrastructure development (+), Interest rates (-), Insurance Price (-)]***

#### **4. Data, Research Methodology and Empirical Findings**

##### **4.1. Data**

Secondary data comprising of annual data series commencing from 1992 to 2019 are taken in the study. Data are obtained from Handbook of Statistics on Indian Economy, RBI; World Development Indicators of the World Bank, annual reports of IRDA, Economic Survey Data of Gol, Ministry of Road Transport and Highways, Gol; Department of Economic Affairs, Gol; various issues and reports from SwissRe and IMF.

##### **4.2. Methodology adopted**

The role of economic factors affecting PLI consumption has been analysed and studied as follows (Gujarati, 2011).

###### **4.2.1. Transforming variables**

Data needs to be transformed based on the model/s to be tested and nature of time series data i.e. rate values or level values. Transforming makes the variables into a more normally distributed dataset thereby enabling the model to fit in a linear regression for prediction. Rate values being a measure of change do not need any transformation, however, the level values needs transformation. Accordingly variables with level or absolute values viz. PLI premium (PLI), Infrastructure development (INFRA) and Income (INC) are transformed by taking natural logarithm of corresponding level values. Other variables- Interest rate (INT), Financial development (FD), Insurance price (PRICE) and Trade activities (EXIM) being rate values are not transformed and are in the form required in the analysis. Transformed variables and rate values are used in our analysis.

###### **4.2.2. Unit root test**

Time series variables whether transformed or not are examined to check their stationarity properties. Augmented Dickey-Fuller (ADF) test is commonly used to check the stationary properties of variables because using non-stationary time series variables in a regression analysis may give spurious results and such test analysis may not be relied upon for prediction and might provide erroneous conclusion.

However, non-stationary variables may be used in a regression analysis if the series are co-integrated (Engle & Granger, 1987).

Ordinary Least Squares (OLS) regression method has been deployed by most of the studies to determine the factors affecting PLI consumption (Outreville, 2013; Garcia, 2012; Haiss & Sumegi, 2008; Curak et al., 2009; Avram et al., 2010). The researchers have used log-linear or semi log-linear equations in their studies. Our study constructs the initial model which consists of a regression-equation with PLI consumption (PLI) as the dependent variable. The model is represented in log-linear form (Cavalcante et al., 2018; Feyen et al., 2011) and OLS is used to estimate the following equation to test our hypothesis:

$$\ln(\text{PLI}) = \alpha_1 + \beta_1 \ln(\text{INC}) + \beta_2 (\text{FD}) + \beta_3 (\text{EXIM}) + \beta_4 \ln(\text{INFRA}) + \beta_5 (\text{INT}) + \beta_6 (\text{PRICE}) + \varepsilon_1$$

...equation (1)

where

- $\ln$  = log to the base e (natural logarithm),
- $\alpha_i$  = intercept,
- $(\beta_1 \dots \beta_6)$  = slope coefficients, and
- $\varepsilon_i$  = error term

The initial estimation equation as mentioned above is subsequently simplified by removing the most insignificant variable from the equation. After removing the most insignificant variable, regression on remaining variables are again analysed for any successive insignificant variable. The process is sequentially repeated till all the variables become significant and a final estimation model is obtained.

Several diagnostic tests were conducted to validate the model. CUSUM test analyse the stability of coefficients ( $\beta$ ) in the OLS model and Breusch-Godfrey test of serial autocorrelation of residuals assess validity of the model with stochastic regressors.

### 4.3. Findings

Initially PLI, INFRA and INC are transformed by taking natural logarithm of their absolute values. Upon transforming the absolute level variables, unit root test is conducted to investigate stationary properties of the time series variables to avoid spurious results.

ADF unit root test results are presented in Table 4 with critical value tested at 5% significance level in our study. The statistical significance level is 5% for all hypothesis tests. ADF test do not reject the null hypothesis ( $H_0$ ) and all the variables (transformed and rate values) were found non-stationary and integrated of order one.

**Table 4. ADF Unit root test**

Lag length:(Automatic based on AIC, maxlag=3)

$H_0$ : Variables have a unit root

| Variable | Null Hypothesis ( $H_0$ ) | ADF test statistic | p-value* | Critical values (at | Remarks |
|----------|---------------------------|--------------------|----------|---------------------|---------|
|----------|---------------------------|--------------------|----------|---------------------|---------|

|       |                       |           |        | 5%)       |                     |
|-------|-----------------------|-----------|--------|-----------|---------------------|
| PLI   | PLI has a unit root   | 1.870795  | 0.9996 | -2.986225 | Do not reject $H_0$ |
| INC   | INC has a unit root   | 1.961437  | 0.9997 | -2.976263 | Do not reject $H_0$ |
| FD    | FD has a unit root    | -1.311740 | 0.6092 | -2.976263 | Do not reject $H_0$ |
| EXIM  | EXIM has a unit root  | -0.637376 | 0.8454 | -2.981038 | Do not reject $H_0$ |
| INFRA | INFRA has a unit root | -1.420931 | 0.5565 | -2.981038 | Do not reject $H_0$ |
| INT   | INT has a unit root   | -1.875957 | 0.3377 | -2.981038 | Do not reject $H_0$ |
| PRICE | PRICE has a unit root | -1.647782 | 0.4454 | -2.976263 | Do not reject $H_0$ |

\*MacKinnon (1996) one-sided p-values

As per Engle and Granger (1987), regression analysis of non-stationary variables may produce spurious results except if the series are co-integrated. Therefore, co-integration test is conducted using ADF test on the residual term of non-stationary level variables. Equation (1) can be re-written as follows:

$$e_i = \ln(\text{PLI}) - \alpha_1 - \beta_1 \ln(\text{INC}) - \beta_2 (\text{FD}) - \beta_3 (\text{EXIM}) - \beta_4 \ln(\text{INFRA}) - \beta_5 \ln(\text{INT}) - \beta_6 (\text{PRICE}) \dots \text{equation (2)}$$

For  $e_i$  to be stationary linear combination of non-stationary variables on the right hand side of equation (2) should be stationary. The results of the co-integration test are demonstrated in Table 5. It reveals that the series are co-integrated which is supported by Durbin-Watson statistics (DW stat) of 1.9308 indicating absence of any autocorrelation problem. Co-integration implies that the series have a long-term relationship allowing estimation of model considering level series without incurring spurious regression.

**Table 5.** ADF Unit root test of the residual variable ( $e_i$ )

$H_0$ : Residual variable has a unit root

| Variable | ADF test statistic | p-value * | Critical value (at 5%) | DW stat | Remarks      |
|----------|--------------------|-----------|------------------------|---------|--------------|
| $e_i$    | -4.9408            | 0.0005    | -2.9810                | 1.9308  | Reject $H_0$ |

\*MacKinnon (1996) one-sided p-values

The outcome infers that non-stationary variables in equation (1) are co-integrated which can subsequently be used for studying the relationship of PLI consumption with the explanatory factors. Results of the initial OLS estimation are furnished in Table 6.

**Table 6.** OLS estimation of initial equation (1) for the Regression of PLI on explanatory variables

Dependent Variable: PLI

Method: Least Squares

Sample: 28 (1992-2019)

| Variable     | Coefficient | Std. Error | t-Statistic | Prob.         |
|--------------|-------------|------------|-------------|---------------|
| INC          | 2.720482    | 0.136412   | 19.94314    | 0.0000        |
| FD           | -0.884703   | 0.551317   | -1.604709   | 0.1235        |
| EXIM         | 0.008980    | 0.004431   | 2.026671    | 0.0556        |
| <b>INFRA</b> | -0.003428   | 0.017439   | -0.196589   | <b>0.8460</b> |
| INT          | -0.030266   | 0.020364   | -1.486236   | 0.1521        |
| PRICE        | 0.163380    | 0.122788   | 1.330589    | 0.1976        |

|                    |           |                   |           |          |
|--------------------|-----------|-------------------|-----------|----------|
| C                  | -16.70783 | 1.766102          | -9.460288 | 0.0000   |
| R-squared          | 0.998040  | F-statistic       |           | 1782.161 |
| Adjusted R-squared | 0.997480  | Prob(F-statistic) |           | 0.000000 |

It is observed that regression estimation of equation (1) indicates infrastructure development (INFRA) is the most insignificant variable (Table 6), prompting us for simplification of the OLS estimation by deleting INFRA from the initial estimation equation. Infrastructure development was hypothesized to have a positive relationship with PLI consumption, however, in our analysis insignificant negative relationship is obtained. Possible reasons contributing to such a relationship may be Infrastructure project cost (taken as a proxy for infrastructure development in our study) is incurred over a period of time which often extends for more than one year from the date of award of project leading to non-generation of the entire assets equivalent to project cost with no insurance requirement in the year of award of project, & that infrastructure projects are not awarded uniformly every year depending on requirement and existing infrastructure projects may contribute a large share in PLI premiums which are not considered in the present study. Future research may consider other instrumental variable to represent the infrastructure development and its relationship with PLI consumption in India. The revised estimation after deleting INFRA is provided as,

$$\ln(\text{PLI}) = \alpha_1 + \beta_1 \ln(\text{INC}) + \beta_2(\text{FD}) + \beta_3(\text{EXIM}) + \beta_4(\text{INT}) + \beta_5(\text{PRICE}) + \varepsilon_1$$

...equation (3)

After deleting INFRA, estimation has been simplified and OLS regression is applied on the remaining variables as modeled in equation (3) and represented in Table 7.

**Table 7. OLS estimation of equation (3) for the Regression of PLI on explanatory variables**

Dependent Variable: PLI

Method: Least Squares

Sample: 28 (1992-2019)

| Variable           | Coefficient | Std. Error        | t-Statistic | Prob.         |
|--------------------|-------------|-------------------|-------------|---------------|
| INC                | 2.712839    | 0.127866          | 21.21622    | 0.0000        |
| FD                 | -0.961017   | 0.382835          | -2.510267   | 0.0199        |
| EXIM               | 0.009228    | 0.004154          | 2.221316    | 0.0369        |
| INT                | -0.032149   | 0.017574          | -1.829305   | 0.0809        |
| <b>PRICE</b>       | 0.151674    | 0.105009          | 1.444387    | <b>0.1627</b> |
| C                  | -16.59480   | 1.632999          | -10.16216   | 0.0000        |
| R-squared          | 0.998036    | F-statistic       |             | 2236.307      |
| Adjusted R-squared | 0.997590    | Prob(F-statistic) |             | 0.000000      |

Insurance price (PRICE) is hypothesized to have a negative relationship with PLI consumption, however, Table 7 infers a positive relationship with PLI but is not significant. Hence, the relationship is not confirmed in our study. Such an ambiguous

relationship may be attributed to the mandatory insurance of motor vehicles with premium comprising about 37% of the total PLI premiums (IRDA, segmentwise PLI premium figures 2020) and necessity of insuring assets as a pre-requisite of bank finance irrespective of insurance price. The estimation is subject to further simplification by deleting PRICE as follows and regression analysis of the estimation is represented in Table 8.

$$\ln(\text{PLI}) = \alpha_1 + \beta_1 \ln(\text{INC}) + \beta_2 (\text{FD}) + \beta_3 (\text{EXIM}) + \beta_4 (\text{INT}) + \varepsilon_1$$

...equation (4)

**Table 8.** OLS estimation of equation (4) for the Regression of PLI on explanatory variables

Dependent Variable: PLI

Method: Least Squares

Sample: 28 (1992-2019)

| Variable           | Coefficient | Std. Error        | t-Statistic | Prob.    |
|--------------------|-------------|-------------------|-------------|----------|
| INC                | 2.602237    | 0.104793          | 24.83227    | 0.0000   |
| FD                 | -1.253417   | 0.332516          | -3.769490   | 0.0010   |
| EXIM               | 0.011963    | 0.003784          | 3.161270    | 0.0044   |
| INT                | -0.052472   | 0.010775          | -4.869884   | 0.0001   |
| C                  | -14.88476   | 1.150981          | -12.93224   | 0.0000   |
| R-squared          | 0.997850    | F-statistic       |             | 2668.818 |
| Adjusted R-squared | 0.997476    | Prob(F-statistic) |             | 0.000000 |

OLS estimation of equation (4) exhibits that all the remaining explanatory variables (INC, FD, EXIM, INT) are significant in determining PLI consumption and model explains 99.74 percent of the variance in PLI consumption (Table 8). Income (INC) and Trade activities (EXIM) have a significant positive relationship in line with our hypothesized relationship, on the other hand, Financial development (FD) in contrary to the hypothesized assumption is negatively related with PLI and significant in nature. Interest rate of alternative instruments (INT) is negatively related with PLI in line with our hypothesis though the association is relatively less elastic.

The regression results of equation (4) are subject to validation to avoid any incorrect conclusion. To investigate the validity of regression results, autocorrelation in the residuals of the regression model should be checked. Breusch-Godfrey serial correlation LM test represented under Table 9 illustrates that there is no serial correlation in the estimation provided under equation (4) which is further emphasized by the Durbin-Watson statistic.

**Table 9.** Breusch-Godfrey Serial Correlation LM Test

Sample: 28 (1992-2019)

Null hypothesis: No serial correlation at up to 2 lags

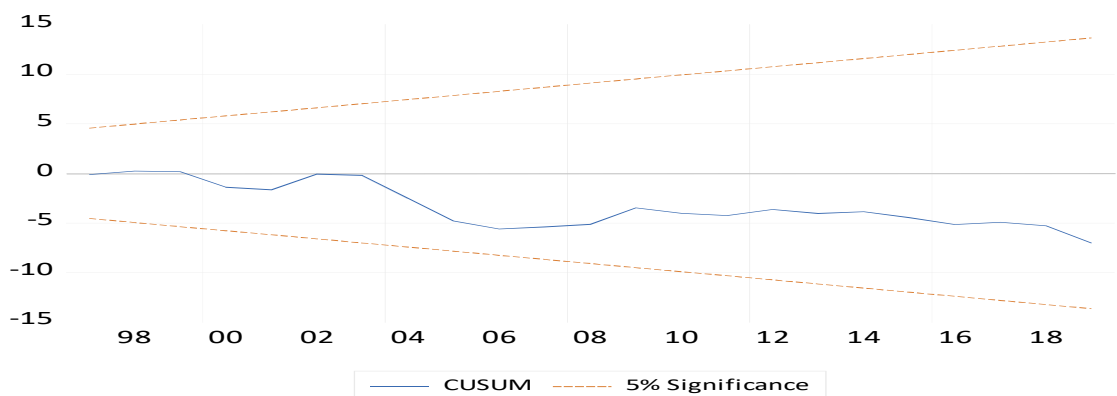
|                    |                 |                       |               |
|--------------------|-----------------|-----------------------|---------------|
| F-statistic        | 1.901571        | Prob. F(2,21)         | 0.1742        |
| Obs*R-squared      | 4.293326        | Prob. Chi-Square(2)   | <b>0.1169</b> |
| Durbin-Watson stat | <b>1.933744</b> | Akaike info criterion | -2.693139     |

From the results of Table 9, it is evident that the model is valid because both F and Chi-square values are not significant with p values more than 0.05 and do not reject the null hypothesis and final regression representation is obtained as under,

$$\ln(\text{PLI}) = -14.88476 + 2.602237 * \ln(\text{INC}) - 1.253417 * \text{FD} + 0.011963 * \text{EXIM} - 0.052472 * \text{INT} \dots \text{equation (5)}$$

After establishing validity of the model, CUSUM test (Figure 2) reveals that the coefficients of equation (5) are stable and regression results are correctly specified. The test concludes that final model represented under equation (5) is robust and explanatory variables significantly define the PLI consumption.

**Figure 2. CUSUM test for Stability**



#### 4.4. Discussion on Findings

Statistical evidence reveals that out of six explanatory factors comprising our study only four factors significantly explain PLI consumption without any autocorrelation among the variables. The four factors are Income, Financial development, Trade development and Interest rate on alternative instruments.

Income has a positive relationship with PLI consumption and the study is in line with the existing literatures of Browne et al. (2000), Beenstock et al. (1988), Outreville (1990a,1992), Petkovski and Jordan (2014), Alhassan and Biekpe (2016). A unit change in income increase the PLI consumption by 2.60 times which embarked on the fact that improvement of economic activities generates more employment opportunities consequently increasing real disposable income of the individuals. Further, increase of economic activities results in additional investment in business encouraging entrepreneurs to start new or expand business activities augmenting the necessity to cover business risks.

Surprisingly, Financial development is negatively related with PLI consumption which do not concur with the studies of Feyen et al. (2011), Outreville (1990a,1992),

Millo and Carmeci (2011) indicating that this area needs to be improved upon. FD measured by M3/GDP is a measure of the economy's money supply and might have overlooked the fiscal policy stance adopted by the government. Government can improve financial development by adjusting its spending levels and tax rates. Future research on PLI consumption may consider the fiscal viewpoint as a proxy for financial development. However, the study is supported by Garcia (2012) which measured FD as ratio of broader definition of money to GDP having a negative relationship though insignificant with PLI premium. Also Cavalcante et al. (2018) has not encountered any causal relation between financial development and PLI premium except in the case where FD is measured by real credit operations.

Interest rate on alternative instruments has a negative effect on PLI with result suggesting that 1% increase in interest rate leads to a 0.05% decrease in PLI consumption, reinforcing the fact that increase in interest rate on alternative instruments provides a better investment avenue with higher returns. The study is in line with extant literatures of Akinlo and Apanisile (2014), Haiss and Sumegi (2008). In India people still find bank deposits as more safe and liquid and PLI industry face challenge from banking industry if investment return is taken into consideration. Further, to keep the net interest margin at a certain level and maintain profitability of banks, increase in term deposit rates lead to escalation in lending rates which increase the borrowing cost. This raise the opportunity cost of insuring against self-insuring and is in line with the conclusion drawn by Millo and Carmeci (2011) supporting the negative association of interest rate with PLI.

Volume of trade is an important driver of economic growth with Economic Survey, 2020 acknowledging the fact that trade policy must facilitate export growth as it helps job creation in India. In line with the studies of Feyen et al. (2011), Arena (2008), Curak et al. (2009), Akinlo and Apanisile (2014) the degree of openness of the economy gauged by export and import as percentage of GDP has a positive and significant relationship with PLI consumption. PLI promotes trade development by way of risk coverage through marine, liability and cargo insurance. Our study suggest the importance of external trade in the PLI industry development and a 1% rise in trade development leads to an increase of 0.01% in PLI consumption.

## **5. Conclusion**

The post-liberalization period study of PLI sector reveal income, financial development, interest rate on alternative instruments and trade development as the explanatory factors significantly describing the PLI consumption. Positive relationships of income and trade development were observed with PLI, as contemplated. Notably, in contrary to the expected relationship, financial development has a negative impact on PLI consumption indicating that financial development needs more attention and scope of improvement exists. Infrastructure development relationship with PLI is found insignificant drawing attention of the policymakers to give more importance to infrastructure investment. It was also observed that relationship between PLI and

insurance price is not significant indicating the mandatory requirement of PLI in certain segments like motor and insurance requirements as a pre-requisite for bank finance, irrespective of price.

Supply chain disruptions, rising infection cases and voluntary social distancing by people due to Covid-19 has disrupted the economy. PLI may play a major role by covering the risks, both business & personal and providing health insurance coverage to overcome this unprecedented situation by saving the lives and livelihood of the people. Since the role of economic factors in property liability insurance consumption is empirically established, policymakers and regulator can have more attention to the sector by formulating policies with an aim to develop the property liability insurance market and stimulate the economic factors that have a positive impact on PLI, consequently promote economic activities and as in a virtuous circle, can drive the consumption for PLI. Future studies may further investigate the role of infrastructure development and financial development on property liability insurance consumption in India.

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