The relationship between climate parameters "temperature and precipitation" and its effects on function of insurance paying in Gilan province,Iran

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Abstract: Insurance companies in the incident of financial and criminal damages that appears for their insurers will pay the losses. And as given that Gilan Province has climate change at the Four Seasons of the year, investigate the effects of climate change (temperature and rainfall) on the amount of insurance compensation is so important. Method in this study is descriptive and analytical and to obtain the relationship between temperature with loss and rainfall with loss the statistical correlation method is used. The results indicate that with increasing temperature, atmospheric precipitation will be less and the amount of payment for loss will be less. With decreasing temperature, atmospheric precipitation will be more and the amount of payment for loss will increase, this indicates that increased rainfalls in order to loss are in one direction.

[Bahman Ramezani, Kobra Farahbod. **The relationship between climate parameters "temperature and precipitation" and its effects on function of insurance paying in Gilan province,Iran.** *J Am Sci* 2012;8(10):28-33]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 6

Key words: Climate change, insurance,Gilan,Iran

1. Introduction

Climate change, today, is one of the most important scientific issues that in the genesis and how it impacts on normal and abnormal phenomena have often been studied in different parts of the world. And scholars are looking to explore the relationship between climate change and insurance. And they are determined to know whether the insurance industry has the ability to have a good coverage during damages such as floods, storms, forest fires, increase in temperature and precipitation? What measures have been considered in this context by insurance companies? And what criterion they choose for insurance risks? Academic scholars in line with climate change and human response against natural hazards and performance of insurance against losses incurred to residents have done research that a selection of this research can be expressed as follows:

Astrid k. Rasmussen and Jan V.Hansen in 2009 were to investigate Nordic expectations for climate change and insurance. The study was taking in Nordic countries included Denmark and Norway and Sweden and Finland. They understand that changes were due to human factors and man-made carbon dioxide gas emission. And they concluded that insurance companyhas a major responsibility to remedy of proportionate damages of climate changes [9].

Reo Research in September in 2007 had an examination about insurance industries role in response of damages due to climate changes. This essay indicates on natural disasters like severe hurricane in states, flood water in England and fire accident in Greek. And it mention's that insurance is a big industry. And insurance clients in accordance with their insurance needs, attempt to buy for insurance policies (insurance companies in effect of climate changes enterprise to adjustment for specific rules in the place of occurrence of accident, the state of evaluation of damages and to schedule in choosing for essential prices). And finally a suggestion for appropriate solutions for the global economy and the pressures of climate change in the future is coming [10] . Rob White and Alice Cahill in the year of 2008 began to review about climate change,the insurance industry and non-miraculous solutions. They name climate change as a most threatening factor for insurance industry because climate change will increase losses and insurance company is not responsible for the amount of risk for climate change. Therefore insurance companies needs to determine the risk of certain types and specified price. One of the important actions of insurance companies the case studies in Zurich in Australia is to provide flood insurance coverage against climate change in the area [11] .

E. Lisa and F. Schipper in July in 2007 began to study climate change adaptation and development. This research was conducted in the context of the UN Framework Convention on Climate Change (UNFCCC). Signs of climate change that cause human and financial losses to the inhabitants of the Earth are temperature rise due to increase in greenhouse gases and advancing sea water [12].

W.J.W. Botzen and J.C.J.M. Van den Bergh in the year of 2008 were studied insurance against climate change and flooding in the Netherlands. In this study repeated precipitation and flooding were important factors in understanding the natural consequences of risk and providing an appropriate solution for flood insurance premiums and compensation for damages of flood by insurance company was introduced [13]. Stanley A.Changnon, David Changnon, E.Ray Fosse, Donald C.Hoganson, Richard J.Roth Sr. and James M.Totschstudy the intensity of recent climate on insurance industry and factors for atmospheric sciences. In this study the development of natural disasters and damages caused by storms that appeared in the US has been studied. In the years of 1991-1994 in a period of four years total losses resulting from climate change was about 40 $billion(34.5 $billion for financial and 5.4 $billion for events). Because in these years, hurricanes Andrew and Iniki repeatedly occurred so companies attempting to pay for so huge losses. This condition was caused to appear reinsurance insurances [14]. Benjamin Collier, Jerry SkeesandBarryBatnett in 2009 studied the type of insurance of weather and climate change. Insurance in the field of climate impacts plays an important role in human life. It studies agriculture-dependent economies, social security, reducing the small risks, reducing the vulnerability of the country on climate change [15]. Stephen Haddrill in 2007 studied the climate change. In this study, damages caused by floods and anomalous heat were considered and ability to cover losses by insurance company has been evaluated [16]. Allianz Group and WWFin October in 2006 studied climate change and insurance that was an issue for United States. Greater range of studies was on environments that tend to flood, storm and fire (heat). Two problems can be expressed with more attitudes:

- Insurance companies are preparing for negative effects by climate change
- Importance of this subject has an effective aid on the country's economy [17].

W. J. W. Botzen, J.C.M.Van den Bergh and L. M. Bouwerstudied climate change, increased risk for the insurance sector, world vision, an evaluation of the Netherland and intensity due to climate change. And in this field insurance companies have been predicted different strategies to cope with possible risks and taken over investigation floods are known as the most destructive phenomenon. E.g. the amount of damages from floods in Germany amounted to EUR 9.2 billion. England in 2007 saw two major flood events due to heavy rainfall that each of these damages were estimated over four billion dollars that three billion dollars of it was insured [18]. Rezaee and Tirandaz in 2010 studied the precipitation process of snow, rainfall, consequences and it features in the central plains of Gilan and named snowing in the Gilan province as a natural feature that every few years with high volumes will rain and is accompanied by financial losses and sometimes associated with life [5].Kaviani and Alijani in 2004 for making clear the weather or climate of any place, they have studied all together the elements of the air. With this method, they have discovered the relationship between elements and effective processes or the factors have been identified [8] . Shakour, Ghayour, Roshan and Vahedpour in 2010 in the articles of evaluation of monthly values of temperature and precipitation changes on Iran, under a doubling of atmospheric carbon dioxide, seeks to detect the effects of global warming on the process and temperature patterns over the country [6]. Abedpour in 2007 explained principles of insurance contract (the insured) that was based on legal and insurance information [7]. Rezaee and Khalatbari in 2011 explained the fire and study of causes of fires, issues of fire, ways to prevent and anticipation for safety [4]. Gilan climate is such that in some cases financial and human losses involve on residents into the area, such of these losses that caused by torrential rains appear can be noted as destruction of bridges, dams, residential and office buildings and …. Each of these losses can be followed with human and financial costs. In this regard should be a supporter to support the losses. Insurance companies always as a supporter in this area are pioneer and with their efforts compensate the people who are suffered. In Gilan province, citizens yearly buythe insurance policies (insurance by means of transportation, house insurance, duty insurance, engineering insurance and so on) that they desire and pay sum of money as a premium to insurers. The incentive of paying for premium to the insurers gives a peace to people that in this way at specific time the insurer companies charged with duty to aid insured people in the incidents like car accidents and fire accidents and … till insured people get the least harm. On the other hand also insurance companies according to the type of performance and investment achieve good profitability.

As regards of extensive studies by scholars in the field of climate, but writing an article or a book about study in the field of climate change and its impact on performance of paying by insurance was not observed. And it is likely that a new scientific research has been done in the area.

2. Materials and Methods

Analytical and descriptive study, using two parameters, temperature and rainfall has been done. Statistical information monthly (in 2001-2010) was obtained from the Bureau of Meteorology and Water Management

Table 1- The average of monthly temperatures and the average of monthly precipitation for selected stations –Gilan in 2001-2010.12.1

	The average of monthly rainfall						The average of monthly temperature					
	Astara	Talesh	Sombsara	Anzali	Lahijan	Rasht	Astara	Talesh	Somesara	Anzali	Lahijan	Rasht
April	109.2	99.6	77.7	81.8	93.3	102.8	11.5	11.9	12.4	12.1	12.4	12.8
May	109.2	99.2	71.7	58.5	72.1	73.1	16	16.2	16.2	16.4	16.3	17.1
June	47	47.8	42.8	30.1	42.1	44.1	21.7	21.7	22.1	22.5	21.9	22.5
July	46.2	58.4	58.1	52.6	71.2	56.1	25.1	24.6	24.8	25.7	24.6	25
August	37.3	84.6	49.1	58.9	59.4	40.7	26.3	26.1	26.3	26.8	26	26.4
September	169.2	134.9	112.4	248.6	138.1	133.5	23.6	23.5	23.9	24.4	23.8	24
October	210.5	155.8	118.5	247.6	180.1	140.2	19.7	20.1	19.6	20.8	20.4	20.4
November	170.2	115.3	126.3	254.2	175	179	14.2	14.9	14.9	15.9	15.5	15.2
December	138.1	123.3	147.1	288.4	189.5	175.1	9.2	10.1	9.8	11.2	10.3	10
January	68.6	65.6	85.8	156.6	114.2	110.5	6.2	7.2	7.5	8.1	7.5	7.2
February	82.7	68.5	73.4	131.3	122.6	127.2	6.2	7.1	7.7	7.8	7.7	7.4
March	97.7	74.7	68.2	79.8	104.6	91.7	8.2	8.8	9.5	9.2	9.6	9.7

Table 2 – the average amount of compensation monthly for car body, third party and fire in elected branches of insurance – Gilan province 2001-2010 (Figures in Thousand Rial)

	Car body	Third party	fire
April	351973	1437524	302404
May	1340958	4753817	972379
June	2334568	10479361	1758553
July	3129998	15789930	2478480
August	4077550	23218032	3438897
September	5157687	30367675	4509274
October	6099692	38242793	5095285
November	7213038	47212801	5801935
December	8270133	56148963	6679621
January	9137777	65852598	7528502
February	10075407	76655081	8388643
March	11725849	111540087	8088874

The seasonal and annual data for the assessment was calculated. (Table 1).Then statistical data that was processed on the amount of paying on losses for car body, third party and fire that from Iran Insurance Company received monthly, compared monthly, seasonal and yearly. Finally, for a significantrelationship between climate change and the amount of insurance payments, with using SPSS Software their correlation and implementation was evaluated.

3.Results and Discussion

3.1.Changes in temperature and rainfall

Between April and August the amount of temperature is rising in a way that in July and August due to the intense heat, air comes in the form of humid. From September the rate of temperature is decreasing and the regional air slowly cooled as far as the month of January and February are the coldest months of the year. From March the rate of temperature is increasingbut still cold weather prevails in the region due to lower temperature.(Figure 1)

With due attention to dates that obtained, in the month of April to August the amount of rainfall in the region is less but gradually from September the amount of atmospheric precipitation in the region will increase so in the months of January and February we have the most atmospheric precipitations. Sometimes these rains in the region are in the form of heavy snowfall that often leads to financial losses for the residents. Atmospheric precipitation is reduced from March. But the atmosphere of region is still cold due to rains plurality (Figure 2).

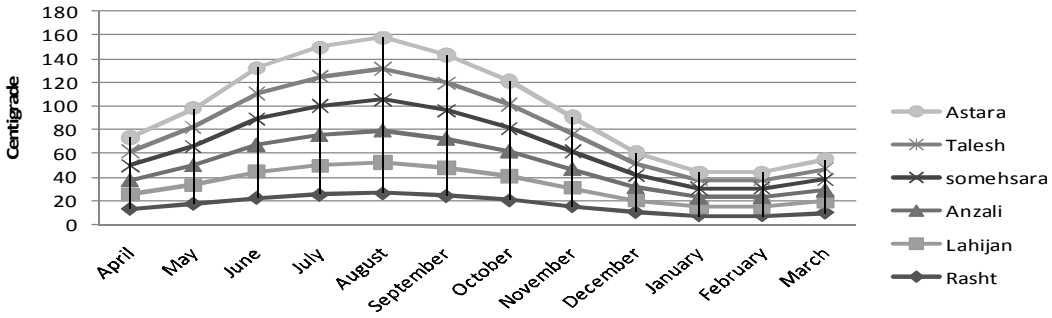

Figure 1 - The average of monthly temperature for selected stations in Guilan province 2001 - 2010

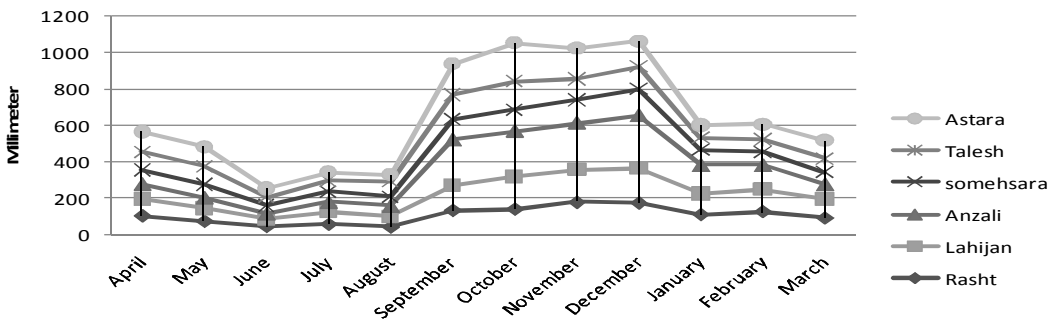

Figure 2 - The averqage of monthly rainfall for selected stations of Guilan province 2001 - 2010

The obtained data show that the amount of temperature is inversely related with atmospheric precipitation. With increasing of temperature, atmospheric precipitation will reduce and with decreasing of temperature, atmospheric precipitation will increase. (Table 1) According to statistical data obtained, it was determined that we had at least 72 mm rainfall in the spring and maximum rainfall of 172 mm in the autumn. The average of maximum temperature in summer was 25° C and 7 ° C in winter. This indicates that precipitation in the warmest season of the year is far less than other seasons. No matter how much the air temperature is reduced, the ambient air is colder and thus appeared more suitable conditions for rain. In 2004 and 2007 the average of minimum temperature was 15.7 ° C and in 2010 the average of maximum temperature was 17.9 ° C. In 2005 the average of minimum amount of rainfall was 89.6 mm and in 2004 the average of maximum amount of rainfall was 147.4 mm. Consequently 2010 was the warmest year and 2004 was the coldest year during the study period in ten years.

3.2 Temperature and the amount of compensation

The average total (car body insurance + third party insurance + fire insurance) of insurance compensation from April to March is going up, and the amount of damages in July is ten times in April. Increasing the amount of compensation in the month of August, September and October than the previous months was about 9 billion Riyals. From November this increasing the amount of compensation than the previous month was more than 10 billion Rials. So in March than February, increasing the amount of compensation will rise to 36 billion Rials. (Figure 3). Insurance company in April paid the lowest amount of average compensation that was about 2,091,901,000 Rials and in March, the highest amount of compensation that was about 131,354,810,000 Rials that the insurance company in the field of car body, third party and fire paid to its customers who had damages (Figure 2). The amount of compensation paying by insurance company in spring is less than in winter. The maximum of damages in the field of car body was about 2,052,131,000 Rials in 2010, and in the field of third party was about 11,693,221,000 Rials in 2009 and in the field of fire, it was about 1,397,935,000 Rials in 2010. Based on the obtained data by insurance company in the field of third party, most amount of compensation was in the field of third party, and the least amount of compensation to customers was in the field of fire.

3.3.The amount of rainfall and the amount of compensation

In 26 ° C in August, the average compensation paid by insurance company in the field of car body was 679,591,000 Rials, in the field of third

party was 3,869,672,000 Rials and in the field of fire was 573,149,000 Rials. In 7 ° C in January and February the total paid compensation in the field of car was 3,202,196,000 Rials, in the field of third party it was 23,751,279,000 Rials and in the field of fire, it was 2,652,857,000 Rials. In winter that the temperature goes down, the amount of paid compensation by insurance company goes up, and in spring the temperature gradually goes up, it shows that paying for compensation is the least. In 2010 the average temperature was 17 ° C in Gilan Province that it was of the warmest year from statistical studies and the amount of compensation that paid for car body was 2,052,131,000 Rials and 11,528,305,000 for third party and 1,397,935,000 for fire. Correlation of temperature and paying for compensation is R = 0.8 and this indicates a significant relationship between temperature and the amount of compensation.(Table 3)

3.4.Simultaneous analysis of temperature and rainfall and the amount of compensation

December has the highest average precipitation of 176 mm rainfall, the amount of compensation of the car body is 1,378,355,000 R, third party is 9,358,160,000 R and fire is 1,113,270,000 R. And June has the least rainfall of 42 mm; the amount of compensation of the car body is 389,094,000 R, third party is 1,746,560,000 R and fire is 293,092,000 R. In the autumn we are seeing the most rainfall in Gilan province that the average of rainfall is equal to 174 mm while in spring the lowest amount of rainfall that is 72 mm has emerged.

In 2004 most precipitation were obtained during the statistical period that the average of rainfall is 147 mm. In this year in the state heavy snow began to rain so that the snow height from ground level is over a meter and travel back and forth in the streets and passages was so difficult. Heavy snow was led to losses in residential and office and industrial buildings.Insurance companies in this respect, with plentiful try and persistent efforts had paid the damages. The average compensation in this year in the field of car body was 497,145,000 Rials, third party was 4,398,355,000 Rials and fire was 916,292,000 Rials. Correlation between rainfall and the compensation is R=0.6 and indicates significant factor of rainfall in the amount of compensation. (Table 4)

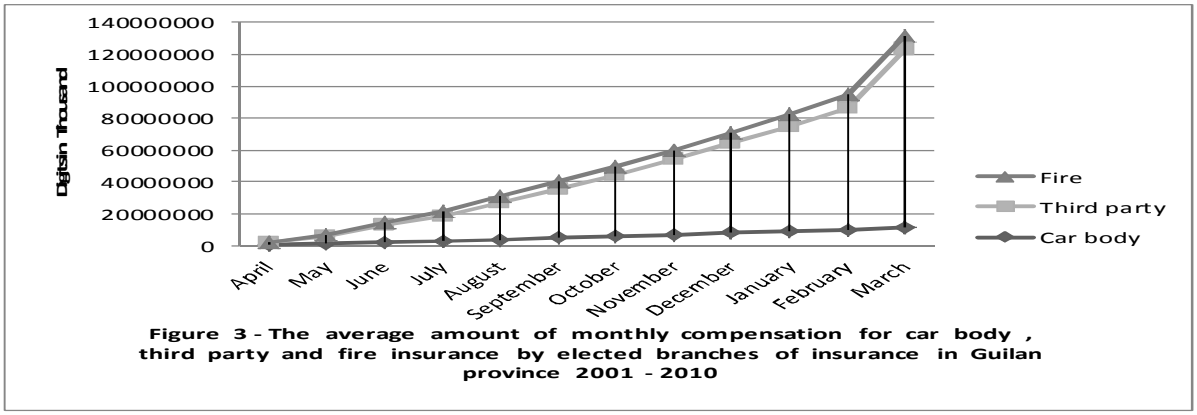

Figure 3 - The average amount of monthly compensation for car body , third party and fire insurance by elected branches of insurance in Guilan province 2001 - 2010

Table 3 – Minimum and maximum values of correlation coefficient of temperature with paid compensation for car body, third party and fire (monthly, quarterly, yearly) 2001 –2010

fire	Third party	Car body	[redacted]
-0.5 up to -0.8	-0.6 up to 0.6	-0.5 up to -0.7	monthly
-0.6 up to -0.7	-0.7 up to 0.7	-0.8 up to -0.6	quarterly
0 up to 0.8	-0.3 up to 0.7	-0.2 up to 0.7	yearly

Table 4 - Minimum and maximum of correlation coefficient of rainfall with car body, third party and fire compensation (monthly, quarterly, yearly) 2001 – 2010

	Third party	Car body	Fire
monthly	0 up to 0.4	0 up to 0.5	up to 0.5- 0.1
quarterly	-0.1 up to 0.5	-0.1 up to 0.6	0 up to 0.6
yearly	0 up to -0.6	0 up to -0.6	0 up to -0.4

3.5.Simultaneous analysis of temperature and rainfall and the amount of compensation

In the study identified that in the first half of the year the average of rainfall is at least 37 mm and

the maximum average of temperature is 20 ° C and the amount of compensation in the field of car body is 24%, third party is 18% and fire is 24%. In the second half of the year the maximum average of precipitation is 134 mm, the minimum average of temperature is 11 degrees Celsius (11 ° C), the amount of compensation in the field of car body is 76%, third party is 82% and fire is 76%. The percentages indicate that the amount of paid compensation has direct relationship with increased levels of atmospheric precipitation. Due to the increased and intensity of rainfall, in the area more damages will happen and insurance company must undertake a greater amount of compensation.

Conclusion:

Insurance companies are one of the primary and basic supports in the days of sudden occurrence of events to climate change. For this reason, this question can be created for insurance companies as an economic and commercial company that, whether the temperature changes can affect the amount of compensation paid by insurance as a factor? Does a change in precipitation can affect the amount of compensation paid by insurance as a factor? Now we can give this answer that both temperature and precipitation can affect the amount of compensation paid by insurance as a factor, and according to surveys that conducted, it was determined that how much colder the weather and how much lower the temperature is, then in the result of that the rainfall in the region will be more and it can cause unpredictable damages and in its order, it results in increasing in compensation paid by insurance in the region. So with the recognition of losses caused by climate change at one region by insurance commercial companies, suitable strategies in the event of damages can be done and also make a program for necessary forecasts.

In this study determined that the amount of compensation paid by insurance with the extent and circumstances of climate change has a direct relationship. The amount of third-party compensation is more than fire and car body compensation. It is due to payment of blood losses that the insurance companies in case of damages will pay to their insurers. Insurance companies must rethink arrangements in the field of how to get premium, accepting the risks of climate and how to pay compensations.

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