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THE IMPORTANCE OF KNOWING HEALTH CONSEQUENCES OF CLIMATE CHANGES FOR THE INSURANCE BUSINESS

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Abstract. *Global warming is occurring and is largely the result of greenhouse gas emissions from human activity. As a consequence of climate change, there are more frequently catastrophic events of a large–scale such as floods, fires, tsunamis, hurricanes, which endanger the human health largely, economy and society as a whole. Several issues relating to insurance and the damage costs of climate change are discussed. The greatest risks, which the insurance business is confronted with, are exactly those which occur as a result of potential climate change and which will have the largest effects on the insurers. The knowledge of the health consequences of climate change is of great importance for the insurance.*

Key words: *climate changes, risk management, risk, insurance*

1. INTRODUCTION

The climate on the Earth is constantly changing and climate change represents one of the biggest contemporary and global challenges. Recent research has demonstrated the multidimensional and multi-scalar nature of climate change [1-3]. Understanding the complex human and physical dimensions of climate change has become an area of great interest to researchers in recent decades and low-income countries, while countries in transition are significantly more at risk of climate-related disasters. In that sense, the insurance industry should be prepared for all that climate change might bring. Apart from this, climate change can have adverse impact on insurance affordability and availability, potentially slowing the growth of the industry and shifting more of the burden to governments and individuals. [4].

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Both natural and human factors change the Earth's climate. Global climate change has been primarily caused by the accumulation of so-called greenhouse gases in the lower layers of atmosphere and they represent a significant source of numerous and various risks affecting environmental and human health [5-8]. According to the United Nations data [9], the emission of carbon-dioxide was rising 6.4 gigatons on average per year during the nineties, and 7.2 gigatons on average during one year in the period from 2000 to 2005, which contributed to an increase in the heat on the Earth for twenty percent from 1995 to 2005. Likewise, from 1970 to 2004 it was registered that the emission of carbon-dioxide increased for 80 percent. It is known that 77 percent of total emission of gases which cause the greenhouse effect is exactly the emission of carbon-dioxide [10]. According to the World Meteorological Organization [11], the air temperature in 2006 was 0.42^{o}C higher than in the average period of thirty years from 1961 to 1990. Globally, the heating rate for the last fifty years has amounted to 0.13^{o}C per decade, which is almost twice as much than for the last one hundred years.

Climate change may affect health through a range of pathways, for example as a result of increased frequency and intensity of heat waves, reduction in cold related deaths, increased floods and droughts, changes in the distribution of vector-borne diseases and effects on the risk of disasters and malnutrition. The overall balance of effects on health is likely to be negative. It is also widely recognized that the costs of weather-related natural disasters have been rising and climate changes can increase poverty if disasters occur in a larger geographic area [12].

The aim of the study was to analyze the health consequences of climate change and their importance for the insurance business.

2. METHODOLOGY

We performed an electronic search on PubMed and Google Scholar using the following terms without time limits: "climate change", "health" and "insurance". The date of the last search was Septembar 30, 2014. We also reviewed additional reports on the relationship between climate change, insurance and human health from Serbian journals on SCIndeks (http://scindeks.ceon.rs).

3. THE CLIMATE CHANGE RISKS AND INSURANCE

3.1. Effects of climate change on human health

Effects of global climate change on human health may be direct or indirect. Climate change can influence the emergence of infectious diseases, affect food yields and nutrition, the supply of safe water and thereby increase the risks of climate-related disasters. Until now experts in many observational researches were mainly focused on the direct effects of extreme weather events, such as heat waves, droughts, cyclones and tropical storms, for which empirical data are readily available and correlations are easy to demonstrate. Secondary effects related to climate change, such as the worsening of ambient air quality and the impact on infectious disease diffusion are also relevant for human health.

The scientists in the first decade of the 21st century pointed out that the changes in the global climate were faster than it had been predicted during the nineties [13] so the early detection and measurement of climate change on health effects are necessary.

Epidemiological methods are mainly used in examining potential influences of climate change on the health. There are four major sorts of observational studies which examine the interdependence between climate change and health [14].

The study of health consequences which appear as the result of individual extreme events such as the heat waves [15], floods [16], storms and drought. For example, the extreme heat events affect cities in increasingly abrupt and catastrophic ways, but many of the deaths caused by exposure to heat have gone unnoticed or are inaccurately identified. Research identifying flood-related morbidity and mortality risk factors are limited and primarily examine demographic characteristics such as age and gender. During floods, females, elderly and children appear to be at greater risk of psychological and physical health effects, while males between 10 to 29 years may be at greater risk of mortality. Post-flood, those over 65 years and males are at increased risk of physical health effects, while females appear at greater risk of psychological health effects. Other risk factors include previous flood experiences, greater flood depth or flood trauma, existing illnesses, medication interruption, and low education or socio-economic status [16].

The spatial studies where the climate is the variable which explains the distribution of the health consequences.

The weather studies of the changes of the health consequences which are connected with climate, such as short-term changes of meteorological parameters, semi-annual climatic variations and long-term changes, which occur during several decades within the context of the detection of early effects of climate change.

Experimental examinations of the biological phenomena.

However, research in this area faces three main difficulties [17]:

1. It is difficult to describe clearly the main environmental and biological influences on health, while at the same time including important interactions with ecological and social processes. There must be a balance between complexity and simplicity.

2. There are many sources of scientific and contextual uncertainty. The Intergovernmental Panel on Climate Change has sought a satisfactory way to describe the level of confidence that can be assigned to each statement about a particular health impact.

3. Climate change is one of several global environmental changes that affect human health. Various large-scale environmental changes now simultaneously impinge on the health of human population, often interactively. An obvious example is the transmission of vector-borne infectious diseases. These are affected by: climatic conditions; population movement; forest clearance and land-use patterns; freshwater surface configurations; human population density; and the population density of insectivorous predators.

Some groups of people are more likely to be harmed by climate change than others. The most vulnerable tends to be the category of homeless people living in towns, especially if they live near water surfaces. This category includes the population of lower economic status, the people living in underdeveloped countries, sick people and elderly people.

The impact of climate change on global health is probably not yet large, compared with major risk factors, but will become greater later in this century. The cardiopulmonary system and the gastrointestinal tract are particularly vulnerable to global warming. There is also a higher risk of infectious and allergic diseases. There is a need to implement, at a global level, effective strategies for mitigation and adaptation meant to reduce the impact that global warming has on human health.

The World Health Organization has developed standardized comparative risk assessment methods for estimating aggregate disease burdens attributable to different risk factors [21]. These have been applied to existing and new models for a range of climate-sensitive diseases in order to estimate the effect of global climate change on current disease burdens and likely proportional changes in the future. The comparative risk assessment approach has been used to assess the health consequences of climate change worldwide [18]. The approach places climate change within the same criteria for epidemiologic assessment as other health risks and accounts for the size of the burden of climate-sensitive diseases rather than just proportional change, which highlights the importance of small proportional changes in diseases such as diarrhea and malnutrition that cause a large burden. A relatively poor understanding of the role of non-climatic factors (socioeconomic and other) which may modify future climatic influences and a lack of empiric evidence and methods for quantifying more complex climate–health relationships are often excluded from consideration. There is need for risk assessment frameworks that make the best use of traditional epidemiologic methods and that also fully consider the specific characteristics of climate change. These include the long-term and uncertain nature of the exposure and the effects on multiple physical and biotic systems that have the potential for diverse and widespread effects, including high-impact events.

3.2. The relevance of climate change for the insurance sector

Climate change will affect the economies in four main ways [19, 20]: 1. Local impacts: The direct and indirect impacts of gradual local climatic changes on assets, economic productivity (particularly climate-sensitive sectors, such as agriculture, insurance and water-intensive sectors), the local environment, human health and wellbeing, and the impacts of damages from extreme weather. 2. Local adaptation: Changing patterns of public and private financial flows, activity and resources in climate risk management, such as increases in investments in protective infrastructure, insurance systems and natural resource management. 3. Local greenhouse gas mitigation: Changing patterns of public and private financial flows, activity and resources in the energy markets, forestry and agriculture, and changing productivity of carbon intensive sectors. 4. Global impacts and responses: The influence of global climate change and responses at the local level, including through changes in the global geopolitical environment, international trade, growth, investment, policy, migration and commodity prices.

The relevance of weather risks for the insurance sector becomes evident by observing past trends in insured and other economic natural catastrophe losses. Data of past natural catastrophe losses collected by Munich Re (2006) indicate that increased global trends in losses can already be observed. The main factor behind this rise in losses has been societal change. The best strategy for insurers seems to incorporate expected changes in probabilities of weather extremes in assessing exposure to, and pricing and management of, risk. Nevertheless, the consequences of climate change for insurers are not only negative. For example, the probability of frost may decline in the future which could decrease claims on certain crop insurance policies. Climate change can further present new profitable business opportunities, which can lead to significant economic benefits if adequate measures are taken [20].

It is relevant for insurance companies that insured losses increased rapidly as well, which is partly due to higher insurance penetration. This is reflected by the *L/I* ratio,

where *L* denotes economic loss and *I* insured loss. This ratio has decreased from 30 in the 1950s to about 3 in the period 1996–2005, because of the development of insurance markets worldwide [21].

In the study of Ragner and Surminsky [22], five main pathways through which climate change could influence future demand on insurance: 1. Wealth: the overall impact of climate change on growth in per-capita income levels. 2. Public policy and regulatory environment: the changing landscape of risk, and the responses of the insurance industry and the public, could trigger public policy interventions that would alter the operating environment for (re)insurers. 3. Risk and willingness to pay: changing hazard levels will affect the willingness to pay for insurance, through both the price of insurance and the perceived risk. 4. Supply factors: rising hazard levels could challenge the insurability of some types of risk, regions and lines of business, reducing the availability of insurance. 5. New products: adaptation and the transition to a low carbon economy could create new demand for specialist lines of business, such as renewable energy insurance.

Virtually all segments of the industry have a degree of vulnerability to the likely impacts of climate change, including those covering damages to property (structures, automobiles, marine vessels, aircraft); crops and livestock; pollution-related liabilities; business interruptions, supply-chain disruptions or loss of utility services; equipment breakdown arising from extreme temperature events; data loss from power surges or outages; and a spectrum of life and health consequences.

Climate change is primarily a risk management problem – one of the most important goals of climate change policy should be to limit the probability of a very bad outcome to an acceptably small value. The risks of climate change should be assessed in the same way as risks to national security, financial stability or public health. A climate change risk assessment must consider at least three areas: the future pathway of global emissions; the direct risks arising from the climate's response to those emissions; and the risks arising from the interaction of climate change with complex human systems. Each of these areas contains large uncertainties.

Conclusions from existing scientific literature [23, 21] give several clues as to how climate change may influence demand for insurance. For example, over the coming few decades, climate change is expected to alter the global landscape of natural catastrophe risk. It could also alter the nature of energy markets and increase awareness of risk and climate risk management. This may impact many lines of business, including property, energy, agriculture, business interruption, life and health, political risk and liability. These changes are likely to influence insurance demand globally.

Understanding the global climate change and its effects on the human health is important for the institutions of insurance in order to estimate the potential effects within the context of various outcomes of catastrophic events caused by climate change, and therefore, to be protected on time from the adverse accumulation of risks resulting from the catastrophic events. Some risks are not connected with weather conditions, but they can be under the influence of climate change, for example, life insurance and health insurance. The future directions of risk management resulting from climate change are particularly important for the house owners, farmers, private companies and state agencies.

The consequences of climate change can be catastrophic for the entire economy, and especially for the insurance market, due to the burden of health care funds. The continuation of the manifested trend of global warming in the next couple of decades can cause new risks which can, again, endanger the realization of economic activities, and later, during this and the

next century, can lead to the break-out of economic crisis and great wars. Climate change increases the likelihood of catastrophic events occurring, and it can change insurance terms and conditions of the individual risk. The changes have the potential to influence the determination of the insurance premium, the policy of the provision of funds, as well as the solvency of insurance companies.

However, it is unlikely that adaptation and risk reduction will completely offset the increasing loss trends caused by natural disasters that have already been observed because of socioeconomic developments and are likely to increase more rapidly due to climate change. It can be expected that the insurance sector will face increased weather risk in the future. There are several ways for insurers to respond to increased risks caused by climate change. Insurers can use four main traditional strategies to manage their exposure to natural hazards, namely insurers can limit their risk, adjust premiums, control the damage, and transfer the risk [24]. Strategies that may not impair the availability and affordability of insurance could be implemented to cope with increased risks as well. Reinsurance—insurance coverage that primary insurance companies buy to manage their own risk—is commonly used to transfer risk. Another strategy for primary insurers is to diversify risks by operating in various insurance branches or in several geographical areas. Further harmonization of the European financial service market may foster robustness of the insurance sector to climate change by creating a larger geographically spread market. Also, insurance regulation and accounting standards are crucial factors that can support or hinder adaptation to climate change, but that has not been studied in detail yet. The allowance for insurance to efficiently build up sufficient reserves for catastrophic events in order to cover disaster losses is a particular example of regulation, which affects the adaptability of the financial sector. Large reinsurers are often better able to handle natural hazard risks as they are better equipped to diversify risks geographically due to operating in large global markets. Limitations of reinsurance are that in certain cases prices are considerably above actuarially fair levels and that coverage obtainable is restricted. High prices of reinsurance may be passed on to consumer via higher premiums. Another option for insurance companies is to hedge risks on capital markets using financial instruments, such as catastrophe bonds, options or futures. Such financial instruments can be used to help acquire funds at times when an insurance company suffers large losses. However, these markets have not adequately developed yet and their use in hedging large weather risks is still limited despite recent growth. Apart from these traditional measures to manage risk, the industry in collaboration with governments could promote long-term policies that limit global warming and its consequences. These greenhouse gas mitigation and adaptation policies may help to maintain the insurability of extreme weather risks. This involves undertaking and stimulating greenhouse gas emission reduction policies, investing in risk assessment research, building public awareness for climate change issues, and promoting adaptation strategies. Another strategy for insurance companies to reduce weather-related losses is to stimulate adaptation of societies to climate change impacts. This can involve the undertaking of loss-reducing measures at the policy holder level, by rewarding lower risk with lower premiums, higher coverage and lower deductibles [21]. Moreover, providing information about how to reduce vulnerabilities of properties and establishing maximum thresholds of acceptable risks may be effective policies to reduce exposure to weather extremes [20]. For example, insurers could recommend fire or flood resistant building materials.

4. CONCLUSION

Climate has already changed. Additional climate change is inevitable in the forthcoming decades, primarily due to the emission of gases, which has not been stopped. Climate change may affect health through a range of pathways. Research so far has mostly focused on thermal stress, extreme weather events and infectious diseases, with some attention given to assessments of future regional food yields and hunger prevalence. An emerging broader approach addresses a wider spectrum of health risks due to the social, demographic and economic disruptions of climate change.

The option of insuring climate change is severely limited because the associated damages are hardly quantifiable and little diversifiable. New challenges lie ahead the whole society regarding finding possibilities for adjusting technical and socio-economic systems to global climate change, and for preventing further increase of anthropogenic greenhouse effects.

Climate change can have adverse impact on insurance affordability and availability, potentially slowing the growth of the industry and shifting more of the burden to governments and individuals. Most forms of insurance are vulnerable, including property, liability, health and life. It is incumbent on insurers, their regulators and the policy community to develop a better grasp of physical and business risks. The financial sector and insurance especially, are sensitive to the influence of global climate change, and therefore their adjustment is necessary in terms of developing an appropriate regulation.

The sector of property insurance is most sensitive to climate change, especially regarding its influence on generating natural disasters, and it has suffered the most serious consequences of these changes so far. However, climate change not only affects property insurance, but it also affects other kinds of insurance, and ultimately it affects the entire management of insurance companies.

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ZNAČAJ POZNAVANJA ZDRAVSTVENIH POSLEDICA KLIMATSKIH PROMENA ZA DELATNOST OSIGURANJA

Kao posledica klimatskih promena, sve se češće javljaju katastrofalni događaji velikih razmera poput poplava, požara, cunamija, uragana, koji u velikoj meri ugrožavaju zdravlje, privredu i društvo u celosti. Najveći rizici s kojima se danas suočava delatnost osiguranja upravo su oni što nastaju kao posledica potencijalnih klimatskih promena i koji će imati najveće posledice po osiguravače. Poznavanje zdravstvenih posledica klimatskih promena značajno je za osiguranje, životnu sredinu i društvo

Ključne reči: *klimatske promene, upravljanje rizicima, rizik, osiguranje*