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# Comparing the economic effects of climate change and zooanthroponosis in Korea: Prerequisites for the creative economy?☆

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ABSTRACT

Societies in the 21st century require more proactive management of risks in many areas owing to the complexities people have built into socioeconomic systems, ranging from science and technology, economics, and finance to education, entertainment, and tourism infrastructure. All these systems thrive on stability, which can easily be challenged by unexpected risks. This study compares zooanthroponosis and climate change-induced sea level rise through a cost–benefit analysis in Korea. Borrowing from other methodological approaches, this study shows that the cost–benefit estimation is consistent with the existing macroeconomic speculations, which assume potential loss of GDP due to the two risks. This paper also presents a policy alternative of creating research institutions specializing in the two risks from a cost–benefit perspective as a prerequisite for the "Creative Economy".



## 1. Introduction

Societies in the 21st century require more proactive management of risks in many areas due to the complexities people have built into socioeconomic systems, ranging from science and technology, economic, and finance to education, entertainment, and tourism infrastructure. These systems thrive on stability, which can easily be challenged by unexpected risks (Commission, 2008; Fraser et al., 2004). Thus, preparing for unexpected risks is a significant component of sustainable growth management. We have focused more on traditional factors of production even when we consider creative economy. Theoretical and practical debate, such as the introduction of more robotics can be an agenda from the supply side. Yet, in thinking of creative economy, just considering supply and demand will not be sufficient. Our global economy as a whole can be endangered with an unexpected outbreak of a symptom, whether it could come from naturally or unnaturally. Actualizing the creative economy depends on risk management at social and global levels, and especially depends on the most serious upcoming risks this research selected, which we tend to under invest due to our socio-economic decision making system. This paper, with the backdrop, compares economic risks that may arise from climate change-based sea level increases (Stern, 2007b) and zooanthroponosis by conducting a cost–benefit analysis using data on the Korean economy (Parker, 2013b). By comparing the two risks, this study suggests the relative magnitude of preparation that societies may choose to undertake. Second, this study shows how a policy measure could be cost effective by proposing the hypothetical alternative of creating research institutions for both the climate change and zooanthroponosis cases. Specifically, a cost–benefit analysis was presented to examine whether these institutions can be effective against the risks related to climate change and disease.

## 2. Literature review

### 2.1. Economic impact of zooanthroponosis

Zooanthroponosis refers to diseases common to animals and humans (Newcomb, 2004a). Such diseases have become a global

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concern since the late 20th century owing to the increase in air and surface traffic (Newcomb, 2004a; Institute of Medicine of the National Academies, 2009). In addition to the independent economic analysis conducted and presented in this study, the literature on zooanthroponosis is presented and utilized to check the robustness of the study's calculations.

*2.1.1. West Nile Virus case in the US*

In a study, the West Nile Virus, which is carried through mosquitos and was once foreign to the US environment, was found to be epidemic enough to be traced. In the past 15 years in the US, about 17,367 medical cases have been reported, of which 1654 lives were lost (Barrett, 2014). Delving further into the cases, in 2003, in 17 hospitals in four counties in the state of Colorado, 80 of 221 hospitalized patients were investigated. Among them, 38 patients participated in a longitudinal study for 5 years. From this patient group, a median medical cost of US$22,628 was found. The same research has estimated that during 1999–2012, the West Nile Virus led to a cost of US$778 million, which can be converted to an annual figure of US$56 million (Bode et al., 2006).

Applying the result to the national level in the US was found to be meaningful, considering that the national average medical cost per patient because of the virus was US$28,151 in 1997. Especially, the case from Colorado took a conservative approach in calculating the average medical costs by including diagnosed patients but not non-hospitalized ones. Further, the Colorado medical costs did not include sanitation costs or diagnosis-related costs (Newcomb, 2004b).

To compare and apply this estimation to the Korean context, this study tried an independent calculation and reached the following estimation. While the difference between the actual GDP size between the US and Korea is more than 10 times, an individual level consumption or PPP level comparison roughly gives about a ratio of 1:2 between the two countries. Based on this assumption, if cases of the West Nile Virus should arise, individual level medical costs could be between US$14,000 and 15,000; and if about 0.027% of the total population of 48 million people in South Korea contracts the virus, the estimated total medical costs would be approximately KRW195 billion. The calculation is based on 1300 patients, of which 500 patients were from the Seoul and Gyung gi Province, which takes about half of the population, and the other 800 patients from 8 major cities generating 100 patients each. This figure is compared in terms of absolute size with the estimation from this study in the following section.

*2.1.2. Economic impact of SARS from the US Geological Service — National Wild Life Health Center data*

According to the USGS and its Wild Life Health Center, the economic impact from SARS could be between US$50 and 100 billion (Newcomb, 2004b). In other words, the size of the impact could be about 2% of the national GDP of the US. Considering this proportionally in the Korean case, an impact of US$5–10 billion can be anticipated.

For comparison purposes, as shown in Fig. 1, SARS in Asian countries was estimated to have an economic impact of US$30–50 billion during 2002–2005. It is estimated that this figure will still be valid after considering inflation factors.

*2.1.3. Other economic estimations*

According to the Asian Development Bank's estimation, if the incidence of zooanthroponosis is mild, it will cause about a

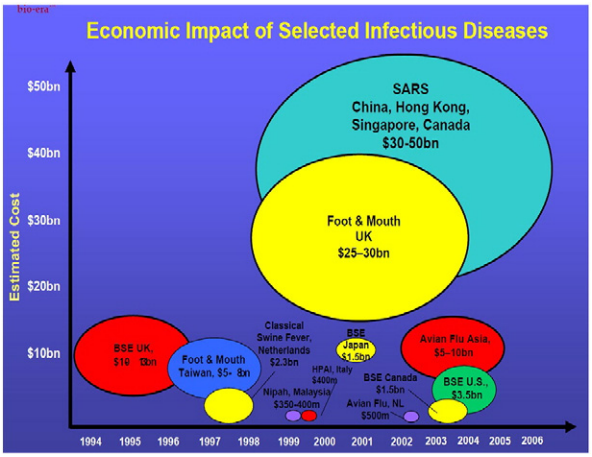


**Fig. 1.** Economic impact of selected infectious diseases.

2.6% decrease in GDP in Asian countries (Asia Development Bank, 2005). If the incidence of zooanthroponosis is significant, regional Asian GDP will drop by a maximum of 6.8%. While the USGS has estimated losses of approximately US$50–100 billion for SARS, other estimations have predicted about a 50 billion worldwide loss of economic value (Fineberg and Wilson, 2010; Wilson, 2010b).

Avian Flu is another zooanthroponosis case. AI was estimated to have caused a US$150–200 billion loss in the US, or a 3% loss in the GDP of the originating country (Smith, 2005; Nelson Rodrigo da Silva Martins, 2012).

The same study estimated a 0.5% loss in GDP worldwide. Another study showed a 2% GDP loss in East Asia from AI (Nelson Rodrigo da Silva Martins, 2012). For AI, the World Bank has estimated a 0.6%–2% loss in GDP and loss of US$800 billion worldwide (Bank, 2005; Wilson, 2010a).

*2.2. Economic impact of the sea level rise from climate change*

Scholars and organizations have been keenly monitoring the rise in sea level due to climate change. Especially, the United Nation's Fifth IPCC (Intergovernment Panel on Climate Change) report has mainly focused on the issue of sea level rise with scientific evidence gathered through different studies in many countries (Stocker et al., 2013). According to the report, between 1901 and 2010 (about 110 years), the sea level has risen by 19 cm. Moreover, since 1993, the average annual rise in sea level was estimated to be 3.2 mm. Based on the evidence and trend, toward the end of the 21st century, the sea level is expected to rise by 28–98 cm, based on different scenarios (Cayan et al., 2008; Russell et al., 2000).

Korea is not an exception from this global trend. According to research conducted in Korea, in recent years, the sea level has risen by 2.37 mm annually in Korea and by 5.14 mm annually near Jeju island, which has been higher than the global average (Kim and Cho, 2013). Even more concerning is the fact that another study has estimated that the sea level could go up to a maximum of 1.36 m.

The sea level rise has repercussions on different dimensions. Sea level rise will reduce wet land, but the impact does not end there (Perrette et al., 2013; Milly et al., 2003). According to a scenario-based forecast for Korea, in 2100, the loss of residential