Financial Comparison of the Kyoto Protocol Obligations and the Natural Disaster Losses

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Geliş Tarihi/Received:	Kabul Tarihi/Accepted:	Yayın Tarihi/Published:
12.09.2017	12.09.2017	11.10.2017

ABSTRACT

The global climate change (GCC) has occupied the world's attention in the last few decades. It has serious impacts on all aspects of the life (i.e. ecology, energy, global economy, etc.)It directed the scientists, politicians and non-governmental civil society organizations towards adaptation, mitigation and combat with the problem. It has signed for this purpose both United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol (KP) have been signed in 1992 and 1997, respectively. In this study, by considering a medium-term target, the impact percentage of the USA on global climate change is projected approximately as 20% for the year 2030. In this content, the financial obligations due to Kyoto Protocol of USA with the cost of natural disasters on USA economy is compared. In this comparison, It has been considered only financial damages of natural disasters. It has not considered the human deaths. As a result, if USA approve the protocol and fulfill the financial obligations arising from Kyoto Protocol; it can reached to conclude that USA will have more profits on the long run.

Keywords: USA, natural disaster losses, Kyoto Protocol

Kyoto Protokolü Yükümlülükleri ve Doğal Afet Zararlarının Finansal Açıdan Karşılaştırılması

ÖZ

Küresel İklim değişikliği ve insan kaynaklı sera gazı salımlarının neden olduğu kabul edilen küresel ısınma, 1990 yılından beri dünya gündemini ciddi olarak meşgul eden bir konudur. İklim değişikliğinin ekolojiye, ekonomiye, canlı hayatına olan olumsuz etkisi, küresel düzeyde bilim adamlarını araştırma yapmaya, hükümetleri tedbir almaya ve sivil toplum örgütlerini gönüllü mücadeleye itmektedir. Bunların sonucunda 1992 yılında, Birleşmiş Milletler İklim Değişikliği Çerçeve Sözleşmesi (BMİDÇS) ve bu kapsamda 1997 yılında Kyoto Protokol'ü imzalanmış, Hükümetlerarası İklim Değişikliği Paneli (HAİDP) periyodik olarak yapılıp raporlar yayınlanmıştır. Bu çalışmada; ABD için, orta ölçekli bir hedef olan 2030 yılında küresel ısınmaya katkısı yaklaşık %20 olarak hesaplanmıştır. Bu kapsamda, ABD'nin küresel iklim değişikliği nedeniyle uğramış olduğu doğal afetlerin maliyeti ile Kyoto Protokolü'nü onayladığı takdirde altına gireceği mali yükümlülük karşılaştırılmıştır. Karşılaştırmada, doğal afetlerin sadece mali zararları dikkate alınmış, can kayıpları hesaplamalara katılmamıştır. Bu zararların da ancak ABD'ye düşen %20'si (salım oranında) dikkate alınmıştır.

Sonuç olarak, ABD'nin protokolü imzalaması ve Kyoto Protokolü'ne taraf ülkeler ile birlikte yükümlülüklerini yerine getirmesi halinde uzun vadede daha kazançlı çıkacağı söylenebilir.

Anahtar Kelimeler: ABD, doğal afet zararları, Kyoto Protokolü.

1.INTRODUCTİON

Due to the potentially serious impacts upon the atmosphere, earth and ocean, the global climate change issue becomes internationally disputable a subject among climatologists, atmospheric researchers, oceanographers, hydro-meteorologists, agriculturalists and in particular, among local administrators including politicians as well as the people at different walks of life [Toprak et al., 2013]. The natural disasters that are thought to be the results of the GCC cause economic losses and hence, the insurance expenditure companies fulfill the funding of such losses. Scientific assessments help to see clearly the size of the problem. For example, 1998 included abnormal and extreme meteorological and natural events. It was the warmest year of the last 140 years. Furthermore, 240 strong storms, 170 floods, 190 forest fire, numerous severe droughts and the warm as well as cold weather waves occurred in the same year (Turkeş et. al., 2000). Such serious impacts of the GCC triggered the scientists, the governments and the social organizations for make further researches such as measure and predict the consequences of the global climate change impacts.

United Nations Framework Climate Change Convention (UNFCCC) and then Kyoto Protocol were signed in 1992 and 1997, respectively to alleviate the current situation. In addition to the protocols, Intergovernmental Panels on Climate Change (IPCC) are organized and their reports are published (Batan et al., 2013; Toprak et al., 2013; Toprak, 2013; Toprak, 2011).

Short-wave radiation that comes from the sun is reflected by the earth surface as long waves. However, it is well-known that increase in greenhouse gases (i.e. water vapor, CO_2, CO, SO_2, NO_x, CFC, etc.) in the atmosphere restrains reflection of such shortwave solar radiation from the earth surface to the atmosphere or space (Arıkan and Ozsoy, 2008). Emission of greenhouse gases led to changes in the atmospheric as meteorological, hydrologic, climatic conditions in the short or long-term. Today it is clear that the use of fossil energy sources produce the greenhouse gases and IPCC reports claim that the emission of such gases mostly depends on human activities at high percentages of 98% or 99% (IPCC, 2007; IPCC, 2013).

On the other hand, COB (2009) states that; among all countries, USA has the greatest responsibility in greenhouse gases emission which has globally negative consequences not for humanity only but more effectively on the nature. According to the 2004 measurements, USA produces 39% of globally emitted greenhouse gases. However, the USA has not yet signed the Kyoto Protocol whereas many developed countries already signed it and they requested from the USA to have the same financial obligations. Otherwise, the USA is bound to be accused as not caring for the implementations of the contract (COB, 2009).

1.1. Political Aproach of USA on Climate Change

The approach of the USA can be discussed in two periods as before 2008 and after. In the first period, USA was more stable in the position taken in rejecting the Protocol.

The most important priority of the new period during the election campaign was the fighting against the climate change impacts. At that time, the presidential candidate of the new period pledged to reduce 80% of the greenhouse gas emissions of USA by 2050. So, in the second period, it is hoped that USA will give more trust towards the expectancies. American Congress is vitally important in

international agreements. First, the United Council must approve the implementation of the new USA administration's decisions on climate change.

In this context, the USA administration tries to enforce their own national legislation that includes national targets and implementation mechanisms for the approval of the agreement by Congress. Congress has started the process for regulations of national climate legislation based on limitations and trade systems. House of Representatives has completed the process by accepting a bill for this aim. The legislative process continued until the approval of the bill in the Senate. The bill recommendations indicated the reduction 80% the greenhouse gas emissions in USA by 2050 according 2005 legislation. The bill includes two different medium-term targets as 17% and 20% for 2020. The new USA administration considers the negotiations since 5th session of the Bali Action Plan in Bonn in 2008. USA has accepted the position that the problem cannot be solved by USA only (COB, 2009).

USA argues that all countries producing high emissions should take place in greenhouse gases mitigation efforts and also countries should determine their emission reduction commitments as a reflection of their national requirements. In such a task, they should consider emission reduction potential, emission sources and economic, technological capacities (COB, 2009).

The present stand of USA is observed carefully by the international community. Since, Turkey is a member of Organisation for Economic Co-operation and Development (OECD). It was replaced in both lists of the contract. However, later Turkey was removed from the Annex-II List of United Nations Framework Convention on Climate Change (UNFCC) as a result of her own initiatives.

Turkey Status Report was voluntarily submitted to Third Parties Conference in 1997 as a very critical step. Although it is not legally binded, this report can be accepted instead of National Notification and Greenhouse Gas Inventory Reports, which are obliged to the Annex-I countries. Turkey has conducted negotiations successfully after this initiative. Thus, Turkey was accepted to be removed from Annex-II List and listed in the Annex-I List with another position (differently from other countries) according to the 26/CP7 decision number in the 7th Conference of the Parties held in Marrakech in 2001.

2.MATERIALS AND METHODS

2.1. Financial Comparison of the Kyoto Protocol Obligations and the Natural Disasters Losses in USA

2.1.1 Kyoto Obligations of USA: Obligations of parties are stated in 3th clause of the Kyoto Protocol. It is stated in the 3.1 clause that participating countries should protect the climate system based on common interest with differentiated responsibilities, on the basis of equality and according to their capacities for the benefit of humanity. It is stated in the Protocol that developed countries should combat with the harmful effects of climate change (COB, 2009). This will bring some financial burdens to the developed countries including the USA.

Total greenhouse gas emissions of Annex-I countries reached up to 17.9 billion ton equal of CO_2 in the period 1990-2004. The share of the USA in total emission of Annex-I countries reached to 39% in 2004 from 33% in 1990. In another words, the greenhouse gas emissions of the USA alone was equal to 45 % of other 39 countries of Annex I in 1990 and it increased up to 65% in 2004.

The greenhouse gases emission data of Annex-I countries was unclear in 1997. So, each country has identified its emission percentage of 1990 as a national target. This percentage was 93% for USA. Based on 1990 data, in total 5.2% of reduction target has been identified for the first obligation period

(2008-2012) for Annex-B List of the Kyoto Protocol. Annex-I countries have created their own greenhouse gas inventory in 2004.

Under the flexibility mechanisms in the 3th clause, the Kyoto Protocol has stated that "Countries must be taken into account the own particular circumstances". Therefore, countries should be able to determine any year as the reference for mitigation of greenhouse gases. In this context, USA has accepted the 2005 year as the reference year and suggested about 80% of mitigation in 2050. The greenhouse gases emissions of USA were 7063 million ton equal of CO_2 in 2004 (Arıkan ve Ozsoy, 2008). Greenhouse gases reduction costs for 2030 projection were presented according to A1B climate change scenario in Table 1. In another words, Table 1 shows the economic potential and costs of measures for combating with climate change according to A1B scenario for 2030. The reduction costs per ton-equal of CO_2 in USA dollars are given in the first column. In the second column, annual global economic potential is given as per billion ton-equal of CO_2 (in USA dollars / ton-eq CO_2) and in the thirth column, the rates for global emissions are presented based on 2030 emissions data (which is about 67 billion ton-equal of CO_2/year according to A1B scenario). Proportionally calculated values presented in the table are representable the mid-term target in 2030 for USA.

Table 1. The economic potential and costs of measures for combat with climate change according A1B scenario for 2030 (Arıkan and Ozsoy, 2008).

The Cost ($ USA/ton eq-CO_2)	**Global Economic Potential (Billion ton-eq CO_2/year) ($ USA/ton eq-CO_2)**	**The rate in global emissions (emissions the year 2030 is 67 Billion ton-eq CO_2/year according to A1B scenario)**
0	**5-7**	**7-10**
20	**9-17**	**14-25**
50	**13-26**	**20-38**
100	**16-31**	**23-46**

The weighted average method is used in the calculations, because, the financial obligation of each country should be determined according to the proportional contribution on the greenhouse gases emission. Herein, the calculations are based on the reduction cost of per ton equal of CO_2 as given in Table 1. A1B scenario predicts the increase in global average temperatures until 2100 as 2.8 ^oC. A1B scenario was taken into consideration because it is not too pessimistic compared to the others. Thus, it is be possible to stay on the safe side in favor of the USA. So, it is not expected to be high enough of the inflation, it is neglected from the considerations. Another assumption is the consideration of maximum (highest) unit costs. Specific calculations made for USA.This calculations can be presented step by step as follows.

1.The global emission costs (GEMC, USA dollars) for 1 ton equal of CO_2 can be calculated for 2030 according to the following expression.

$$GEMC = HGC_2xP_4 + HGC_1xP_3 + LWC_2xP_2 + LWC_1xP_1 \qquad (1)$$

where GEMC is the global emission mitigation cost per ton equal of CO_2, HGC_2 is the highest global cost, HGC_1 is the second highest global cost, LWC_2 is the second lowest global cost, LWC_1 is the lowest global cost, with P_1, P_2, P_3, and P_4 , as the global emission cost rates given in Table 1. In this case, the GEMC can be calculated as,

$$GEMC = 100x\left(\frac{46}{100}\right) + 50x\left(\frac{38}{100}\right) + 20x\left(\frac{16}{100}\right) + 0x\left(\frac{0}{100}\right) = \$\ 68.2$$

P_2 has been taken 16% instead of 14% to complete to %100.

Total global emissions (*TGE*, in Billion $) is reported as 67 billion tons approximately according to A1B scenario. Then, the cost of total global mitigation (*K*, in Billion $) can be calculated by Equation (2).

$$K = TGE * 10^9 * GEMC \qquad (2)$$

In this case, the ***K*** can be obtained as 4569.4 as follows.

$$K = 67 * 10^9 * 68.2 = 4569.4$$

Arıkan et al. (2008) reported the contribution of USA to the global climate change graphically as in Figure 1. Accordingly, it is possible to predict the impact of USA on global warming as 25%, 23%, 18%, and 14% in 1990 and 2000, 2050, and 2100, respectively. By taking the given time dependent trend under consideration, the percentage for the year 2030 can be deduced as 20%.

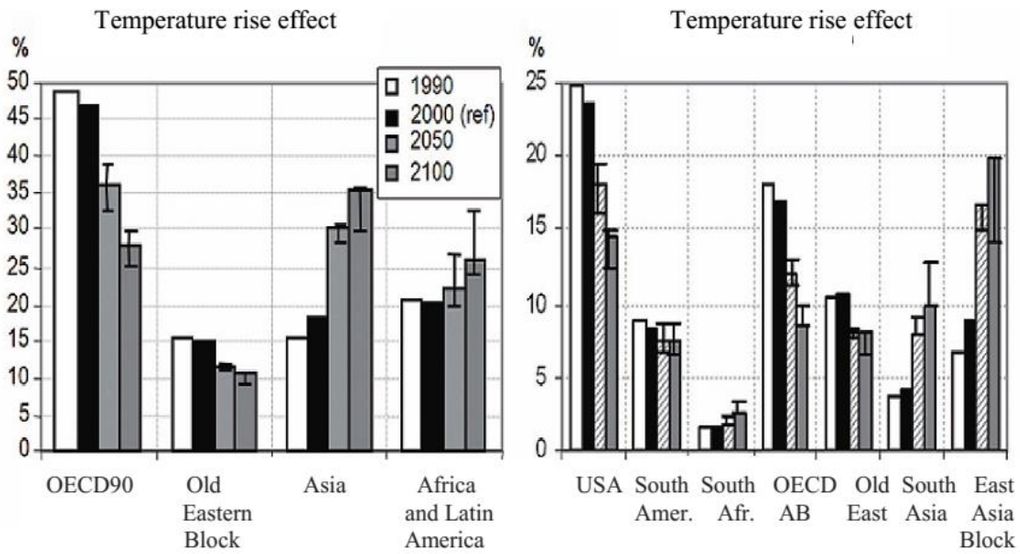

Figure 1. The contributes of countries and regions on global warming in different years (Arıkan and Ozsoy, 2008).

It should be noted here that, although the global greenhouse gases emissions of USA may seem in decrease according to the trend given in the figure. In reality, this is due to the increase in the globally emitted greenhouse gases especially by developed countries.

2.Under the light of above reported analysis, U.S. is responsible from 20% of greenhouse gases emissions affecting global warming. On the other hand, according to the IPCC 5th Assessment Report, human is responsible for 98% of emissions (IPCC, 2013, where the final report gives this percentage as

99%). Accordingly, the impact rate of the U.S. on global emission (*P*, percentage) can be calculated rationally as given in Equation (3).

$$P = R * HE \quad (3)$$

Where *R* is responsibility of U.S in the global greenhouse gases emissions and *HE* is human effect on global climate change according to 5th report of IPCC.

$$P = 20 * 0.99 = 0.198 \; or \; 19.8\%$$

In this case, the financial responsibility of U.S. due to the global greenhouse gases emissions (*O*, in Billion U.S. Dolars) can be calculated by Equation (4)

$$O = P * K \quad (4)$$

$$O = 0.198 * 4569.4 = 904.74$$

Herein, *O* is the obligation due to the Kyoto Protocol for U.S., *P* is globally percentage of the emission for U.S., and *K* is the cost of total global mitigation. Although, it is possible to take 80% of this value according to the Kyoto liability of U.S. mentioned above, however, in order to stay at the safe side, herein 100% of the calculated value has been taken under consideration.

2.1.2. Costs of Natural Disasters in USA

Toprak et al. (2013) stated that it is necessary to ask, what happened to our climate? The answer could be found in the related literature simply as 'the earth has a fever' according to most researches since the beginning of climate change issues prior to 1990. The authors indicaded that, about 90% of the scientific articles among all the publications put forward evidences on the existence of the global warming or global climate change (i.e. Kondratyev, 1991; Fields et al., 1993; Buyukyildiz et al., 2009; Culley and Angelique, 2010; Ekholm et al., 2010; Falk, 2010; Kreuzwieser and Gessler, 2010; Schreurs, 2010; Thompson, 2010 and numerious other researchers). Accordingly, the Kyoto Protocol and IPCC established in 1992 are among responses to this questions in a dubious manner to the climate change effects (Toprak et al., 2013). Although there is not a strong consensus among the researchers on the causative reasons, size, and effects, however, it is clear that there is a strong correlation among the temperature with the amount of greenhouse gases emitted into atmosphere, anomaly in the meteorological events, sea surface level rises, ice and snow melts, natural disasters and many other measurements. This correlation can be put forward as evidences not only for the presence of global climate change but also for its probable causes and its expectable results. It is now possible to say that humans live the global climate change and the environmental impacts and the globe warms up. Specifically, it is necessary to ask the same question for the USA: What happened to the USA climate? In this respect, 10 largest climate-related natural disasters occurred in USA and they are reported in detail by the National Oceanic and Atmospheric Administration (NOAA, 2012).

They are presented in Table 2 for same comparison purposes and further interpretations. It has been used the datas of National Oceanic and Atmospheric Administration (NOAA, 2012) between different information sources in the presentation of this table.

Table 2. Climate change economic losses (NOAA, 2013).

YEAR	BİGGEST DISASTERS	CASUALTIES (person)	ECONOMIC LOSSES (Billion $)
1980	Drought and the Heat Wave	10.000	56.4
1988	Drought and the Heat Wave	7.500	78.8
1992	Hurricane Andrew	61	44.8
1993	The Flood Disaster in Central America	48	33.8
2004	Hurricane Charley	35	18.5
2005	Hurricane Rita and Wilma	154	38
2005	Hurricane Katrina	1.833	148.8
2008	Hurricane Ike	112	29.2
2012	Drought and the Heat Wave	123	30.3
2012	Super Storm Sandy	159	65.7

These are disasters caused to the biggest losses and damages. They have been arranged according to dates. It should be noted that all of them occurred after 1980s parallel to the rise of global warming. After all of these disasters, the share of USA in global greenhouse gas emissions can be said the effect to the global climate and it's own climate. On the other hand, a research on the greatest storms in the past indicates that it is possible to expect a huge damage by a major storm as Hurricane Sandy in the every 5-year period in the USA (Sigma Report of Swiss Re, 2012). Hurricane Katrina being biggest natural disaster occurred in USA has been demonstrated in Figure 2. As a consequence, the above mentioned natural disasters can be considered as the nature's a punishment for the USA.

Figure 2. Hurricane Katrina has caused major disasters (NOAA, 2013).

The total cost and the number of deaths due to the above mentioned 10 natural disasters are calculated as $544.3 billion USA dollars and 20,025 people, respectively. Although, there were many minor natural disasters, however, only the greatest ones are reported in herein.

3. COMPARİSON

It is now possible to compare economically the Kyoto Protocol obligations and the natural disaster losses for the USA. The economic cost of the Kyoto Protocol obligations for USA is expected to be at 904.74 billion USA dollars for 2030. On the other hand, the total cost of the above mentioned major atmospheric disasters was about 544.3 billion USA dollars between 1980-2012. This means that the annually average cost is about 16.5 billion USA dollars, which is approximately obtained by dividing 544.3 billion dollars to the 33-years duration. However, the expectation of natural disaster costs in a period from 2012 to 2030 (in 18 years), i.e., over the next 18 years should also be added on the overall cost, because the Kyoto Protocol Obligations are valid up to 2030. The natural disaster cost over these 18 years is expected to be around 18x16.5 = 297 billion USA dollars on the basis of 2012 financial data. In this case, the total natural disaster cost adds up to 297+544.3 = 841.3 billion USA dollars just for the USA.

This means that USA will be able to cover all the financial obligations up to 2065 by preventing the possible disasters. USA will be able to cover in 51 years (1980-2030 between). This calculation is obtained by dividing 841.3 billion USA dollars to the 51-years duration. In this calculation, the death tolls are not taken into consideration, because the human life can not be measured financially.

4. CONCLUSİONS AND RECOMMENDATİONS

The Kyoto Protocol Obligations and the natural atmospheric disaster losses are compared specially for the USA. The economic cost of the Kyoto Protocol obligations for USA is expected to be at **904.74 billion USA dollars** for 2030. And only the total natural disaster cost for the USA calculates generally as **841.3 billion USA dollars**. This comparison demonstrates that Kyoto Protocol obligations and total natural disaster costs of USA are close to each other for 2030 year.

In this comparison, only the financial losses are taken into consideration without any account for death tolls and the contributions of minor disasters. Only 20% of the financial losses (which is equal to the USA emission percent) have been evaluated throughout the study. As a result, if USA approves and fulfills the financial obligations arising from Kyoto Protocol together with other countries then the USA may be able to cover all the financial obligations up to 2065 by preventing the possibility of further natural disaster occurrences. This means that USA will be more on the profitable side in the long run.

Acknowledgement:

1.This study supported by Dicle University Scientific Research Project Coordinations with the project number of 13-MF-70.

2.This study was produced from the PhD thesis of Murat Batan supervised by Dr. Z. Fuat Toprak in Institute of Science in Dicle University.

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