The challenging economics of climate change

Selim Raihan

Global climate change has become one of the dominant discourses in the scientific and public policy arena. Studies from scientific research show that the global warming is now a real phenomenon, as there has been an unusually rapid increase in Earth’s average surface temperature over the past century primarily due to the unprecedented accumulation of carbon dioxide resulting from the burning of fossil fuels, together with emissions of other human-induced greenhouse gases. The effect of this temperature rise includes increased frequency of severe weather events (such as heat waves, hurricanes, and tornadoes), proliferated intensity of storms, and sea level rise. These changes, no doubt, pose serious threats to the welfare and existence of mankind and other living things on earth through impacting on the functioning of the ecosystem, biodiversity, and human health.

The economics of climate change refers to the study of the economic costs and benefits of climate change, and the analysis of the economic impact of actions targeting at limiting its effects. However, the economics of climate change is challenging due to the fact that there are huge uncertainties in the estimation of both the costs and benefits related to climate change. The precision of climate change. The 2018 Environmental Performance Index (EPI) of the Yale University ranks countries on 24 performance indicators across 180 countries. Among the bottom 10 countries in the ranking, three (Bangladesh, India and Nepal) are from South Asia. Bangladesh’s position is 179 out these 180 countries.

There are also considerable debates in the discourse of climate change with respect to the policies and actions needed to address the challenges. Two instruments are widely referred in the policy discussion. The first one is the carbon tax, which is the mandatory fee charged for the emission of a given quantity of carbon dioxide or some other greenhouse gas. The second one is carbon trading, which is buying and selling of carbon credits, abstract instruments (like money) that each represents the right to emit 1 ton of carbon dioxide or an equivalent amount of other greenhouse gases. The other policies include technology promoting programs. One more instrument, which is less explored but can be effective, is the liberalization of trade in environmental goods (EGs), which can play a crucial role in protecting the environment as well as promoting international trade in EGs. Trade has a positive effect on the environment only if environmental policy advances alongside trade liberalization. However, most of the developing countries are seriously lagging behind in conceptualizing as well as in building national capacities to implement these aforementioned instruments.

One important challenge in the economics of climate change is the political economy aspect of it. Both the global and national political economy factors are critical in addressing climate change issues. The USA President Donald Trump’s unfavorable attitude towards the warning of devastating effects from climate change, and eventually USA’s withdrawal from the Paris climate agreement has created huge uncertainties for a global partnership. At the national level, many developing countries, due to their national priorities of industrialization and lobbying power of different quarters, find it extremely difficult to contain the polluting industries. Therefore, the developing countries have uphill tasks in the future given the aforementioned challenging economics of climate change.

Dr. Selim Raihan. Email: selim.raihan@gmail.com
Some distinguished features of GBM Bangladesh delta: An analysis using the Input-Output Table

Zubayer Hossen, Bazil Haque Khondker and Selim Raihan

The Ganges-Brahmaputra-Meghna (GBM) Basin spans across Bangladesh, Bhutan, Nepal, China and India, and presents one of the largest estuarine regions of the world - the Sundarbans delta. The delta area in Bangladesh comprises about 48 thousand square km. This article sheds light on some of the remarkable features of GBM Bangladesh delta. Those features have to do with the socio-economic and biophysical context, with their relations and interdependencies with the economy through the supply chain up to the final demand of goods and services in both the delta and non-delta regions. At the end, it comes up with some relevant policy measures based on the analysis.

This study employs an environmentally extended input-output table (IOT) for the Bangladesh economy. The IOT splits the economy into two parts: delta and non-delta. The delta part covers the coastal zone comprising 19 districts, and the non-delta part covers the rest of the country other than delta. This allows studying the interdependency between delta and non-delta parts of the country. The IOT for GBM Bangladesh delta has been developed based on the Bangladesh IOT 2012 prepared for the Seventh Five Year Plan under the aegis of Bangladesh Planning Commission. The Bangladesh IOT has 57 activities, and four types of factors – capital, labour (skilled and unskilled), natural resources and land. Various data sets namely, National Accounts Data, Household Income and Expenditure Survey data of 2010, and Labour Force Survey data of 2010 have been used to split national estimates into delta and non-delta regions.

Analysis of the IOT for GBM Bangladesh reveals some distinguished features of the delta region of the Bangladesh economy which make the delta region very different from the non-delta region. These features are discussed below.

The agriculture sector has a great importance in delta region, notably the fishing sector, which is relatively much bigger in the delta than in the rest of the country. Also, the construction, and the trade and transport activities -which quite often go unnoticed when highlighting important sectors of the deltas, such as small business trade, etc.- were revealed relatively more important in the delta than in the rest of the country (non-delta) (Figure 1).

The majority share of employment in agriculture, food, construction and services for delta region is demanded by the delta region itself. The fishing sector is another sector that has a sizeable share of employment demanded by the delta region itself (Figure 2).

The share of embodied (both direct and indirect) employment of women in the delta region is most present in agriculture. This is very different from what is observed in some other deltas in the world - Indian Bengal delta, Mahanadi delta and Volta delta. On the contrary, the share of embodied employment of women in the delta region is less present in services. For male counterpart, service sector has the highest share of embodied employment in the delta region (Figure 3).

In delta region, the predominance of unskilled work is embodied in the agriculture and forestry, services, construction and manufacturing and mining sectors. In both delta and non-delta regions, we can see the low share of skilled labour in the particular, the embodied land use in vegetables, fruits and nuts are particularly relevant, mostly occurring to satisfy the final demand of the non-delta region. We also observe how sectors not directly using agricultural land the most, such as processed rice and food industry sectors, have notable embodied (directly and indirectly) agricultural land levels.

Due to reliance on agriculture and services activities, the delta region is a net importer of several environmental metrics, embodied in goods and services bought from other regions, but net exporter of energy and carbon dioxide emissions to the non-delta region.

Some features of GBM Bangladesh delta are quite diverse which may have different implications and call for more specific policy responses. Services (including construction) turn out to be important economic activities for delta region following agriculture. Industrial activity (including manufacturing and mining) appears less significant in terms of income and employment generation in delta. Thus, safeguarding agricultural activities should be a top priority in delta and appropriate adaptive and mitigating measures are needed.

Another key observation is the self-sufficiency in employment generation in delta region. More than 60% of the delta employment has been used to satisfy the final demand needs of the delta area. Therefore, loss of livelihood in delta due to damage of natural resources and climate change may have deleterious impact on employment in delta region in particular and overall employment in general.

For this reason, protecting delta livelihood should be a top policy priority. Furthermore, since the delta region is a net importer of several environmental metrics, embodied in goods and services bought from other regions, compensatory fiscal measures should be undertaken to address the disproportionate burden of environmental metrics.

This work was carried out as an outcome of Deltas, Vulnerability and Climate Change: Migration and Adaptation (DECCMA) project (IDRC 107642) under the CARAIA programme with financial support from DFID, UK and IDRC, Canada.

Zubayer Hossen, Dr. Bazil Haque Khondker and Dr. Selim Raihan are Senior Research Associate, Chairman and Executive Director of SANEM respectively.
Relooking at the Energy Dependence of South Asian Neighbours

Suvajit Banerjee

For development to be sustainable, an uninterrupted flow of energy services is a precondition which requires a stable power equilibrium at both regional and global level. The services that energy provides are necessary and desirable, because of its essentiality for economic growth, and to improve the living standards of the population. Major South Asian economies with their long drawn colonial heritage and developing economic character rely on energy supplies mostly from outside the region in order to deliver their growth outcomes and achieve other developmental ambitions. However, the oil price shocks in the post-World-War-II phase starting from Suez Crisis of 1956-57, the OPEC Oil Embargo of 1973-74, the Iranian revolution of 1978-79, the Iran-Iraq War of 1980s, the Persian Gulf War of 1990-91, oil price spike of 2007-08, and drop in 2014-15 were few of the important external blows that these South Asian economies had to struggle with huge internal consequences. This article is an attempt to observe the import directions of energy resources for three major South Asian economies in order to understand the level of risk associated with such dependence. This study chose Bangladesh, India, and Pakistan to analyse these three neighbours have a huge potential for intra-regional trade of less carbon emission intensive natural gas. However, the prospects of such trade are disputed with political arguments and counter-arguments beyond the scope of this article. Bangladesh, India, and Pakistan were compared based on the flow of import values as a proportion of total imports for three years: 2009, 2012 and 2015 in terms of their top 20 import relationships. A common feature was observed for all three South Asian neighbours, only for a few relationships there are high import values and for most of the other relationships imports are lower. Therefore, the distribution of import values is much skewed across the importing partners. This phenomenon is extreme in the case of Pakistan, followed by Bangladesh and India. For Pakistan, the top three import partners dominating the entire fuel import of the nation are UAE, Saudi Arabia, and Kuwait. During 2009 to 2015 the top 5 import partners of Pakistan contributed around 89 percent of the entire fuel import. The import dependence for energy resources of Bangladesh shows a pattern to pattern with Pakistan. Bangladesh is found having strong fuel import relationships with Singapore, Kuwait, Malaysia and UAE with the ranks of these import partners changing within the top 4 positions. In terms of the dependence on top 5 import partners Bangladesh is marginally less dependent than Pakistan. However, in terms of top 10 import relationships Pakistan’s external dependence is slightly lower than Bangladesh. In case of India, the top 10 fuel import relationships are moderately high. This indicates that India meets its demand for energy resources from diversified import source points. Important fuel import sources of India are found located in various geographical spaces, from the Middle East, West Africa and Latin America which has helped reduce India’s risk of sudden supply shock of energy resources. Therefore, among Bangladesh, India and Pakistan India’s dependence on fuel import is more equally distributed. In terms of the Skewness as well on the distribution of average import values from top 5 import partners for the years 2009, 2012 and 2015, Pakistan scored the highest (4.47), followed by Bangladesh (4.39) and India (2.35). All three distributions are found leptokurtic with a maximum peak for Pakistan and a minimum for India. This study proceeds further by using an index much similar to the concept of ‘Revealed Comparative Advantage (RCA)’ constructed by Bela Balassa and Mark Noland (1965). This index is shown below as equation (1) and understood as ‘revealed comparative fuel import dependence index (RCFMDI)’. RCFMDI = (Mis / Mit) / (Mws / Mwt)  (1) Where Mis and Mws are the country-i’s fuel import and world’s fuel import from a source country ‘s’ respectively. On the other hand, Mit and Mwt denote country-i’s and the world’s total imports respectively. Therefore, RCFMDI, as indicated in equation (1), reveals the import dependence of any country ‘i’ on a source country ‘s’ for fuels in comparison to total imports as a proportion of total imports of the source country in comparison to total world import. Similarly, a value of RCFMDI more than 1 reveals the comparative dependence of country-i and a value less than 1 reveals a non-dependence.

This study calculated the RCFMDI values of Bangladesh, India, and Pakistan for the years 2009, 2012 and 2015 in terms of their top five import partners. The figure shows the average of these index values. To arrive at a more consistent average score for each South Asian countries and for all three years this study used the geometric mean of the index values with corresponding top five import partners. The figure shows Bangladesh’s average fuel dependence reduced remarkably in 2012 and 2015. Pakistan’s average dependence has been slightly higher than Pakistan’s for 2009 and 2015. Therefore, even though India has a geographically slightly higher than Pakistan’s for 2009 and 2015. For India and Pakistan, the dependence has been quite noticeable in all three years and India’s average dependence has been slightly higher than Pakistan’s for 2009 and 2015. Therefore, even though India has a geographically diversified fuel import source points, however, in terms it revealed comparative average with five top imported partners the dependence for energy resources is higher than its closest neighbors. This study in a way provokes further agendas on how these three countries could engage in mutually benefiting intra-regional energy trade in order to eliminate heavy inter-regional dependence. Various cross-country natural gas pipeline network proposals are at various levels of negotiation stages have the possibilities to connect these South Asian neighbors together and with other Asian countries, like – Kazakhstan, Iran, and Myanmar. This study is an initiative to introduce a much larger research question on how to bring an optimal energy demand and supply equilibrium at a regional level in South Asia.

Suvajit Banerjee, Ph.D. Researcher, Department of Economics and Politics Visva Bharati University, India. Email: suvabnb1983@gmail.com

Climate Change and Energy Efficiency: From Nash Equilibrium Perspective

Farhan Khan

One of the root factors for climate change is the high rate of exploitation of energy (fossil fuels) to stimulate economic growth which indirectly causes environmental degradation. To reduce high rate of exploitation, energy efficiency is usually considered as a recommended solution by the experts perhaps because of its tangibility and accessibility. In simple, energy efficiency refers to the fact where same amount of output can be produced by consuming relatively less amount of particular energy source. By doing this, two important outcomes can be attained. Firstly, reduced amount of GHG gas emission and secondly, ensuring sustainable social welfare for tomorrow.

The significance of initiating energy efficiency can be showed by setting up a simple game where cooperation between stakeholders (players) can lead to long run prosperity. The table illustrates outcome of a simple finite game where government and other stakeholders are the two groups of players. If both players are cooperative and given the chance to analyze others move, then the game will end with a perfect ‘Nash Equilibrium’ or the optimal outcome by incorporating energy efficiency while other player shows reluctance, then damage will increase to a certain degree (T**). In contrast, if both of the players refuse the energy efficiency program then the damage cost (T*) (for example, cost of rise in temperature) will be minimum or zero and there will be a social welfare (S) gain in the long run which is the result of former pay-offs. If one player steps forward for energy efficiency while other player shows reluctance, then damage will increase to a certain degree (T**). In contrast, if both of the players refuse the energy efficiency program then the damage cost will be even more dangerous (T***). But the social welfare in the long run will be completely ruled out due to negative effects of climate change. It is clear from the game that when there is a cooperation between players only then there will be a win-win situation.

Cooperative Game on Climate Change and Energy Efficiency

<table>
<thead>
<tr>
<th>Player 1</th>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(T**+S)</td>
<td>T*(C**+S)</td>
<td></td>
</tr>
<tr>
<td>C(T**+S)</td>
<td>T*(C**+S)</td>
<td></td>
</tr>
</tbody>
</table>

Although from the above game, cooperation can lead to desirable outcome to tackle climate change but reaching to the equilibrium is difficult because of hesitations or myopic self-interest (ignoring long run externalities for short run profits or gains) while making the decision which is associated with uncertainty. Some of the well-known reasons of uncertainty are asymmetry of information, inadequate technology, moral hazard and lack of commitment towards society. All of these can lead to wrong choice of strategy given the strategy of the other player. Therefore, creating awareness regarding the worst possible scenario of climate change, promoting energy efficiency to reshape the demand side, clearing market barriers and making a clear path for technological innovation and diffusion can lead to better decision making strategies. Hence, a successful energy efficiency program can be implemented for preventing climate change.

Farhan Khan, Research Assistant, SANEM. Email: farhan.khan008@northsouth.edu
import sources of India are found located in various terms of top 10 import relationships Pakistan's marginally less dependent than Pakistan. However, dependence on top 5 import partners Bangladesh is UAE, Saudi Arabia, and Kuwait. During 2009 to 2015 dominating the entire fuel import of the nation are distribution of import values is much skewed across relationships imports are lower. Therefore, the common feature was import relationships. A imports for three years flow of import values as compared based on the prospects of such trade are disputed with political have a huge potential for intra-regional trade of less order to understand the level of risk associated with 2014-15 were few of the important external blows Iran-Iraq War of 1980s, the Persian Gulf War of 1973-74, the Iranian revolution of 1978-79, the Suez Crisis of 1956-57, the OPEC Oil Embargo of shocks in the post-World-War-II phase starting from living standards of the population. Major South Asian flow of energy services is a precondition which For development to be sustainable, an uninterrupted that these South Asian economies had to struggle 2015, Pakistan scored the highest (4.47), followed by these three countries could engage in mutually Minor increase in 2015. For India and Pakistan, the minor increase in 2015. For India and Pakistan, the countries-i and a value less than 1 reveals a country-i's dependence on a source country-s for fuels in world import. Similar to RCA, a value of RCFMDI more equation (1) and understood as 'revealed index values with all three years this Asian countries and for these index values. To arrive at a more desirable outcome to tackle climate change but due to negative effects of climate change. It is clear inadequate technology, moral hazard and lack of hesitations or myopic self-interest (ignoring long run to desirable outcome to tackle climate change but due to negative effects of climate change. It is clear due to negative effects of climate change. It is clear