

Disaster Risk and Impact of Urbanization of Megacities in Bangladesh: Evidence from Dhaka and Chittagong

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Two major trade cities in Bangladesh, namely Dhaka and Chittagong, have undergone rapid rates of urbanization in the past decade. This is a good sign as many academics, policy makers and economists regard rapid urbanization as an important indicator of the country's development. One of the causes of urbanization is the shift of labour from rural areas to urban areas. This implies that labour is shifting from the primary sector to the manufacturing sector or service sector, which provides them with a better standard of living due to higher wages earned. However, this also makes Dhaka and Chittagong highly vulnerable to disaster risk. This is because, the high density of people and assets in a particular area may lead to significant loss of life and capital accumulated through years of development efforts. Over the past decade, Bangladesh has experienced an increase in frequency of natural disasters. According to the Global Climate Risk Index (2015), Bangladesh has been ranked 6th in the world based on vulnerability of Climate Change. As a result, proper disaster risk management measures are necessary to mitigate the adverse effect of disasters in Dhaka and Chittagong. The paper finds a positive correlation between disaster risk and the rate of uncontrolled rural to urban migration in most countries. However, in some countries like Nicaragua, there is a negative correlation between disaster risk and the rate of rural to urban migration. In Dhaka, there is a strong positive linkage between the country's exposure to disaster risk and the rate of urbanization in Dhaka and Chittagong.

Field of Research: Economics

1. Introduction

Along with rising global population and globalization, most countries all over the world are urbanizing at an incredibly fast pace. UN estimates show that in 2016, 54.5 per cent of the world's total population have lived in urban areas; and this is expected to rise to around 60 per cent by 2030. In Africa and Asia, a major proportion of the population have been living in the rural regions over the years. This is expected to decline as more and more people are moving to the urban areas and the number of cities in Asia with a population of at least 500,000 is expected to rise by 30 per cent by 2030.

According to the UN, there were 31 megacities in the world in 2016, which may reach 41 in 2030. Moreover, 10 cities which have populations between 5 and 10

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million are projected to become megacities by 2030. In 2016, 6.8 per cent of the world's population resided in megacities, which is also projected to increase as the cities are expanding in both size and population. Majority of the megacities are located in the less developed or developing countries, particularly in the south Asian region. Out of the world's 31 megacities, six are from China and five are from India. Other countries include Japan, Mexico, Brazil, Egypt, USA, Bangladesh, Pakistan, Indonesia, Argentina, Turkey, Nigeria, Philippines, Russian Federation, Democratic Republic of the Congo, France, United Kingdom and Peru. Ten new cities are expected to be added in the list of megacities by 2030, while Tokyo remains at the first position.

Although rapid urbanization is an indication of development progress of an economy, it is also a major source of concern for both the urban and rural people as they are gradually becoming more exposed to shocks and disturbances in the environment, as well as changes in the climate. A significant proportion of the world's cities are at high risk of exposure to at least one type of natural disaster and highly vulnerable to economic losses associated with disasters (UN, 2016). Compared to the developed countries, cities in the less developed or developing countries are more vulnerable in terms of mortality and economic losses, as well as higher risk of exposure to natural disasters such as floods, droughts, cyclones, earthquakes, etc. Therefore, the need for adequate disaster risk management, mitigation and prevention is an increasing concern in the development world. Identification and addressing disaster risks through a proper system can help the countries in achieving both short and long-term goals.

Within the southeast Asian region, Bangladesh is one of the most disaster-prone countries – vulnerable to many types of hazards such as floods, droughts, hurricanes, tornados, etc. which affect the agriculture, homes and force the rural people to migrate to the urban areas in search of safer grounds for survival. The three major cities in Bangladesh are Dhaka, Chittagong and Khulna which are termed as 'metropolitan areas' (UN, 2016). Despite of the exceptionally high performance in terms of meeting development goals, Bangladesh has a severe lack of infrastructure and urban services, and traffic congestion due to insufficient planning and investment. Since 2004, Bangladesh has been able to maintain an average growth rate of 6.5 per cent per annum and was regarded as the second fastest growing economy in the world in 2016 (World Bank, 2016). Along with sustained growth, demand for energy and transport has also increased, while urbanization took place (World Bank, 2017). Nevertheless, lack of planning combined with high rate of urbanization has led to a significant increase in disaster risk. According to UN OCHA's Global Focus Model (2015), Bangladesh is regarded as the second most disaster-prone country in Asia and the Pacific. More than 46 million people have been affected by natural disasters like floods, droughts, landslides, and storm affected areas from 2005 to 2015.

Bangladesh's location in a highly dense delta near the Bay of Bengal between two active tectonic plates greatly increases its natural exposure to disaster risk. However, a major constituent of the disaster risk in Bangladesh is derived more from manmade factors rather than its location, due to the unavailability of adequate Disaster Risk Management infrastructure as a result of lack of investments in this area. According to the United Nations Framework Convention on Climate Change (UNFCCC), poorly constructed roads, unsafe and unreliable methods of transferring electricity grids and gas, substandard drainage and traditional construction methods

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in Bangladesh significantly increase the probability of damage due to disasters. Moreover, it stems efficient rescue operations and aid delivery to the affected areas.

To make matters worse, the frequency and severity of these disasters have been on the rise as an impact of climate change and external factors such as increased concentration of population and property in hazardous areas (Marshall, 2013). According to the World Risk Report of the United Nations (2016), sectoral impacts of these disasters are hard felt in urban areas both directly and indirectly. Cities located in the coastal belt could experience increased flood, drainage congestion and water logging as a consequence of storm level rise and storm surges. Indirect impacts include an increase in the number of temporary rural migrants who are looking for an alternate source of income or shelter, increase in prices due to impact on agriculture and fisheries, and increase in unemployment and crime.

As a consequence of growth and development, Bangladesh has been experiencing a higher rate of internal migration from rural to urban areas. Nearly 35 per cent of the population of Bangladesh lives in urban areas and this has been steadily increasing at an average rate of 3.5 per cent per annum (World Bank, 2016). People move in order to capitalize on the opportunities of higher wage, better institutional access, greater employment opportunities in both the formal and informal sector and better expected living standards. Therefore, commercial cities like Dhaka and Chittagong have experienced overwhelming growth in population. Future predictions about the Bangladeshi urban population are quite worrying as it has been estimated to grow by around 2.0 per cent to 2.9 per cent within the next fifteen years in Dhaka, Chittagong and Khulna. By 2030, around 27 million people will be living in the capital (UN, 2016).

While urbanization has offered socioeconomic benefits to the migrants, it has also resulted in a large proportion of the migrants settling as informal squatters and the sprawling slums of the cities. These people are mainly absorbed in the informal sector as they often lack adequate training and required skills in the formal sector. The informal sector is characterized by lower wages and security, which means that migrants cannot afford proper houses, forcing them to live in slums and squatter settlements. Those who are unable to find a job have to resort to crime in order to make a living, leading to issues regarding security of the localities. World Bank also predicts that by 2050, nearly 50 percent of the entire population of the country will live in urban areas, which might lead to more problems than benefits if proper initiatives are not taken. Considering the higher frequency of natural disasters and increase in disaster risk fostered by manmade factors, it can be said that disaster risk leads to increase in environmental migration to cities, which might be both permanent and temporary in nature. As these workers do not get absorbed properly, more people end up living under the poverty line which, in turn, has long term impacts on child mortality, nutritional status, food security and crime.

This paper intends to draw attention to the fact that in the upcoming years, urban growth in Bangladesh will continue to grow, and the problems associated with urbanization will also continue to expand, especially in the large cities. There is a lack of research addressing the impact of urbanization associated with disaster risk and environmental migration. More specifically, to the best of our knowledge, there have been no studies on how disaster risk contributes to uncontrollable urbanization, leading to a negative impact on growth and development in the context of Bangladesh. The little body of research that already exists, generally focuses on the

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socio-economic and environmental impact of urbanization. Therefore, the main objective of this paper is to analyze the impact of disaster risk on urbanization of two major cities in Bangladesh, namely Dhaka and Chittagong.

This study follows a qualitative, case study approach based on secondary research. It will mainly investigate the internal, external, direct and indirect reasons which contribute to disaster risk, urban pull factors which lead to environmental and economic migration, the ways in which these risks can be mitigated, measures and government initiatives which are necessary in order to mitigate disaster risk and the positive and negative impacts of these initiatives. The paper is organized into six sections including the earlier introduction and methodology of the study. Section 2 describes the review of previous theoretical and empirical literatures. Section 3 discusses existing studies in the context of Bangladesh. Section 4 reports cases from countries with similar economies. The lessons learned from these cases are reported in section 5 and lastly, section 6 presents conclusion along with some observations, government policy recommendations and limitations of the study.

1.1 Defining Megacities

According to the UN, megacities are typically defined as cities or urban agglomerations with a population of more than ten million residents. However, in some cases, it is also defined in terms of population density, which is 2,000 inhabitants per square kilometer.

1.2 Defining “Urbanization”

Although the definition of ‘urban’ varies from country to country, it can be defined both in terms of various aspects— administrative standards, population size, population density, political boundaries, economic features and/or urban characteristics such as availability of electricity, adequate infrastructure facilities, etc. (UNICEF, 2012). With respect to economic functions, urban areas typically have surplus employment and a significant proportion of the population is primarily engaged in non-agricultural activities.

Urbanization is defined as the increase in the proportion of people living in urban areas (RGS, 2013). It refers to the process of population shift from the rural to urban regions within a country, through which towns and cities are created and expand. Apart from rural-urban migration, other aspects of urbanization include employment generation, industrialization, changes in living conditions and availability of social public services.

1.3 Defining “Disaster Risk”

According to the UNISDR Global Assessment Report (2015), disaster risk is defined as the probability of loss of life, injury or destruction and damage from a disaster at any point in time. This disaster can be both **manmade** (mudslides due to construction, fire due to electrical short circuits, etc.) and **natural** (earthquakes, cyclones, tornadoes, droughts, river erosion, etc.) The broad concept of disaster risk can be seen as a consequence of interaction between a hazard and the characteristics that make people and places vulnerable and exposed. Therefore, disaster risk can be expressed as a function of hazard, exposure and vulnerability:

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Disaster Risk = Function (Hazard, Exposure, Vulnerability)

A **hazard** is defined as any source of potential damage, harm or adverse health effects on property, economic capital and people.

Exposure to a hazard includes all population and property which are likely to experience damage or loss of value due to a hazard occurring in close vicinity. For instance, an area which is susceptible to mudslides occurring in an area which does not have any property of economic value or does not have any people living in it lacks exposure and will therefore not be considered as a risky.

Vulnerability is referred to as the susceptibility of a group of people and property to the impact of a hazard as a result of prevailing physical, social, economic and environmental factors and processes. Examples which increase vulnerability of an area includes factors such as (i) Poorly designed buildings which lack safety features like fire escapes, or poorly constructed buildings made out of cheap, brittle or hazardous materials, (ii) Poor protection of assets, like lack of gabions around rivers which experience erosion, (iii) Poorly managed electrical lines which lack proper safety features, poor drainage facilities, (iv) Poor environmental management, like over-construction in hilly areas, and (v) Lack of public information and awareness.

Vulnerability can be broadly categorized into four main types, which include:

- i. **Physical Vulnerability:** Physical vulnerability results from the characteristics of a locality. These characteristics include:
 - The population and population density levels of a locality
 - Whether the locality has undergone planned or unplanned growth and development
 - The access of the locality by roads and the availability and skill of emergency services
 - The materials used for construction of infrastructure. For instance, many apartments in London are constructed using cheap insulation to keep internal temperatures high. This material is however highly vulnerable to fire.
- ii. **Social Vulnerability:** Social vulnerability results from the lack of information and awareness amongst the people residing in a locality, and the lack of institutions and system of cultural values. This can be a consequence of lack of literacy and education, access to human rights, poor governance and the prevalence of peace and security.
- iii. **Economic Vulnerability:** Economic vulnerability results from the economic status of people living in a locality. For instance, the poor living in squatter settlements in cities may find it unnecessary to invest in measures to prevent disaster risk. As a result, they are most likely to be negatively affected by disasters compared to richer localities where people invest more on safety features.
- iv. **Environmental Vulnerability:** Environmental vulnerability results from the frequency and severity of natural disasters occurring in an area. For instance, a locality of farmers living near a river which is prone to flash floods are highly

vulnerable to natural disasters. Natural resource depletion like river erosion, and resource degradation resulting from over cultivation and overuse of fertilizers may also increase environmental vulnerability.

2. Literature Review

2.1 Development Status and Disaster Risk

Based on evidences provided by the Disaster Risk Index (UNDP, 2004), there is an expected positive correlation between development status and disaster risk. Disaster risk results from the probability of a hazard occurring in an area, the exposure of the hazard, and the vulnerability of the property and people who are exposed to the hazard. High levels of disaster risk can, therefore, be viewed as an indicator of poor development (UNISDR, 2015). Direct outcomes of a disaster can directly destroy infrastructure, erode livelihoods, damage the environment and ecosystems and cause illness and death. However, the social impacts of a disaster can have more devastating impacts on the economy in the long run.

One of the major impacts of disasters on development status is that it undermines policies and efforts for policy alleviation (ICS, 2014). One of the characteristics of a developing country is the prevalence of a relatively large primary sector compared to other economic sectors. People are dependent on agriculture, fisheries, forestry, livestock rearing and other forms of incomes from the environment. Disasters which destroy assets and resources of households might lead to the destruction of livelihoods, productive economic activity and public capacities which keep poverty at bay (Shepard, 2013). This can lead to higher unemployment and fall in output in the economy. The fall in output can also lead to an increase in prices, causing a fall in the per capita real incomes. Disasters can also lead to the destruction of social investments like education, health services, safe housing with proper water supply and sanitation. As a result, it can worsen the situation of existing poor in addition to generating a greater number of poor people. Rodriguez-Oreggia (2010) tried to analyze the impact of natural disasters on Human Development and Municipalities in Mexico. The study found that there was a 0.8 per cent decrease in the Human Development Index in municipalities affected by disasters which is equivalent to a two-year setback, with a 3.6 per cent increase in extreme poverty.

Ensor (2009) analyzed the impact of Hurricane Mitch in Honduras and found that areas where development lead to over cultivation of flood plains, deforestation and soil degradation were more severely affected. This proved that a great deal of disaster risk is generated by human activity. Similar results were also seen in studies conducted in studies conducted in developing countries. Another study conducted by the World Bank in 2011 found that the absolute losses in larger and richer countries are larger as a consequence of disasters. However, smaller countries experience a greater relative loss compared to richer countries. Therefore, it is safe to conclude that disaster risk does have adverse effects on the development status of a country.

2.2 Disaster Impacts on Urbanization

According to the United Nations World Urbanization Prospects Report (2014), more people live in urban areas than in rural areas, with around 54 percent living in urban areas. By 2050, nearly 66 percent of the world's population are expected to live in

urban areas. This rapid rate of urbanization calls for meticulous planning and implementation of policies to reduce the impact of an increase in population in these cities. It also calls for the need of better disaster risk reduction investments to reduce the impact of an increase in unplanned growth.

Fagen (2014) found a positive relationship between environmental processes and events and migration to cities. This migration is usually uncontrolled and unexpected in nature, forcing new arrivals to settle in densely populated, unregulated slums and squatter settlements. This might have a negative impact on the status of disaster risk of the urban area itself, in addition to increasing environmental hazards. Historically, policies to mitigate the impacts of disasters focused more on emergency response. As a result, Humanitarian assistance and Government intervention was not present in urban areas in order to improve the conditions of such migrants and to help them get jobs in the formal sector. However, recently, the focus has shifted more towards managing disaster risk in order to prevent loss and damage (UNISDR,2015). Therefore, governments and development NGOs have extended their reach into cities, recognizing the need to cope with the increase in population through better governance and disaster risk reduction policies.

The Bureau for Crisis Prevention and Recovery of UNDP (2014) states that urbanization does not necessarily lead to an increase in disaster risk but can actually reduce risk if managed properly. It has identified a number of factors which lead to migrants usually being worse off than they were before migration. Disaster might lead to an increase in the population of cities and if this expansion is faster than the capacity of urban authorities to supply safe, secure and hazard free housing, they will have to resort to living in cheaper, usually illegal housing in slums and squatter settlements. Migrant populations also have loose social and economic networks. They are usually faced with hostility from long term residents in the city, who see them as a potential competitor for jobs (Fagen, 2014). Most of the people with low social status are politically marginalized, leading to a fall in their access to resources. These people are usually working in the informal sector with low paid jobs, which are barely sufficient for subsistence. Moreover, they cannot afford proper healthcare and sanitary utilities and afford to send their children to proper schools. This leads to long term impacts such as poor adolescent health (creating labor with low productivity and therefore lower wages), malnutrition, sanitation and weaker food security. Therefore, such migration, if not controlled, can have severe long run impacts on the development of a country even after the disaster itself. Migrant populations also have loose social and economic networks. They are usually faced with hostility from long term residents in the city, who see them as a potential competitor for jobs (Fagen, 2014). Most of the people with low social status are politically marginalized, leading to a fall in their access to resources.

2.3 The Need for Disaster Risk Reduction

The occurrence of a disaster may push back both economic and social investments which took years to achieve. **Economic investments** include policies to increase national income, private sector engagement and wages and **social investments** include policies to reduce poverty and hunger, increase access to education, healthcare, housing, water and sanitation and measures to protect the environment. Therefore, reducing the exposure and vulnerability of disaster risk is essential for sustainable social and economic development. As a result, disaster risk reduction

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has been considered as a part of policies to achieve sustainable development in many countries.

After the Indian Ocean Tsunami in 2004, International Federation of Red Cross and Red Crescent Societies (IFRC) has conducted a study based on interviews with affected people in Sri Lanka, Indonesia, Thailand and Maldives in order to evaluate the measures taken to help those affected by the Tsunami. Based on this study, IFRC concluded that a resilient community with proper leverage to deal with disaster risk has an effective risk management system, ability to identify problems and priorities and act upon them, a good network of support groups, efficient infrastructure and services, adequate economic opportunities and ability to manage natural assets.

Disasters can push back years of development effort by leading to large scale destruction of infrastructure, assets, accommodations, livestock, land and lives. It can have a discernable impact on the ultra-poor, leading to more severe cases of malnutrition, disease and food insecurity. Healthcare and educational institutions could also be destroyed in affected regions, leading to significant loss in access to such services. Marginalized farmers with small or no land can completely lose their sources of income. This can have a negative spillover effect on the economy as a whole, as a fall in income can lead to food insecurity and malnutrition, which in turn leads to a fall in their productivity and ultimately causes a further reduction of their income. The cycle continues, trapping people in an endless cycle of poverty.

Moreover, it can also affect the service delivery of Government and Non-Government Extension Services, which works to develop the poor and ultra-poor. Utilities such as water, electricity and gas can be affected as well due to destruction of pipelines and electrical lines. The supply of consumer products falls in affected areas due to disruptions in supply chains due to destruction of roads and highways. The impact of natural disasters is more profound in cities, due to its high density of people and infrastructure. Therefore, it is highly essential to address the underlying risk drivers to reduce disaster risk in order to lessen the impact of climate change and maintain the sustainability of development (UNISDR, 2015).

2.4 Aspects of Disaster Risk Mitigation

Only recently, the importance of proper initiatives to mitigate the manmade causes of climate change has been realized. Therefore, we are still not able to reduce the severity of disasters, even if these disasters are a consequence of human activity. So, the focus of an effective risk reduction strategy should focus mainly on vulnerability and exposure (UNISDR, 2015).

In order to reduce the causal factors of disasters, systematic approaches need to be undertaken. The aspects of disaster risk mitigation include:

- i. **Risk Identification and Measurement:** According to UNESCO (2017), there has been a conceptual shift from post-disaster reactions such as emergency responses and evacuation and relief strategies towards pre-disaster entities. Prediction of any potential disaster beforehand and taking appropriate measures to mitigate the risk can be more effective in saving lives and resources. Therefore, studying weather patterns and trying to predict disasters and finding areas vulnerable in risk can be an effective method for

planning and implementing proper risk mitigation strategies. However, Early warning systems usually are not designed to effectively warn the people of a community in mass, as people often lack the knowledge of understanding these signals (IFRC, n.d.).

- ii. **Disaster Preparedness:** Disaster preparedness refers to measures taken to prepare for and reduce the effects of disasters once the potential disaster has been identified (IFRC, n.d.). Disaster Preparedness strategies are mainly focused on making households and communities aware of the disaster and engage the community in effective design of disaster risk mitigation strategies. This includes training people about what to do when a disaster occurs through various awareness programs and making them aware of evacuation routes and emergency supplies (GFDRR, 2014). Disaster Preparedness also includes contributions to many different areas, such as training and logistics, healthcare, recovery, livelihood to institutional development. Some nonstructural initiatives include: advanced response planning and drilling, establishment of resilient communications, preparing emergency team management team and planning recovery and restoration activity (CAI, 2017). Some disaster preparedness tools include: Better Programming initiatives (BPI), Vulnerability and Capacity Assessment (VCA), Contingency planning, Training, Logistics preparedness. Preparedness also includes structural initiatives such as construction of shelters, embankments, dykes, etc.
- iii. **Disaster Recovery:** Disaster recovery are the set of policies in order to bring the community back on the road of development after a natural or man-made disaster has occurred. Policies include quick response by emergency services, relief and food aid in order to help people affected by disaster to become economically active as fast as possible. The main recovery policies involve: assessing recovery needs, developing institutional arrangements, preparing sector plans, implementing recovery interventions and ensuring people's participation (UNDP, n.d.). Setting up a proper Disaster Recovery Preparedness Strategy can create an inclusive environment for both the people of a community and emergency response teams to enable a well-executed reconstruction and recovery procedure. This can also limit damage and prevent the loss of life.
- iv. **Disaster Financing:** Investments in Disaster Risk Finance can increase the financial response capability of a country to meet post-disaster funding needs without compromising fiscal balances and development objectives (World Bank, n.d.). The Disaster Risk Financing and Insurance Program (DRFIP) of the World Bank has been designed to reduce the financial losses of natural and manmade disasters in developing country in order to mitigate fiscal risk and eliminating major budget volatility.

3. Disaster Risk and Urbanization in the Major Cities of Bangladesh: An Overview

3.1 Dhaka

Dhaka is the capital and the largest city in Bangladesh, with a population of over

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14.4 million (BBS, 2011). It is an attractive destination for many migrants, as there is an easy access to informal markets, availability of formal sector jobs, greater probability of earning higher income, and so on (Ullah, 2004). Being home to some of the biggest conglomerates in the country, the city is well connected in terms of roads and highways and has a relatively better supply of utilities such as electricity and water. Moreover, government and non-government services are available anywhere at close vicinity. Advantages of scale and agglomeration economies are achieved by several industries located within Dhaka, making this place an attractive location for both investors and workers. Diseconomies of scale and agglomeration mean that investors do not have the incentive to move their industries out of Dhaka. As a result, Dhaka has developed to be one of the emerging megacities of the world, making it a destination for not only the poor, but also the educated and skilled. There seems to be an urban bias, where the government tends to invest more in urban areas compared to rural areas in terms of public expenditure, amenities, etc. Therefore, people migrate to Dhaka from other cities as well.

In Bangladesh, there is a gap between rural agricultural wages and urban industrial wages, and this wage gap has been widening ever since the 1980s. The relatively higher wages in the formal sector often attract people to cities. However, most of the migrants are unable to get proper formal sector jobs due to lack of training and get absorbed in the informal sector where wages are lower compared to formal sector wages. Even though most of these people are employed in the informal sector, it still does not ensure a decent livelihood. This is mainly due to the low level of wages in the informal sector, along with lack of proper labor laws to ensure their security. Due to higher expenses of living in the city, being employed in the urban does not create much of a difference in their living standards. However, most of these migrants lack the desire to go back to their places of origin, mainly due to the substantial increase in their income.

Although the informal sector in Dhaka city employs about 75% of the urban people, it poses serious challenges in terms of space and public services. The influx of migrants has also created gaps in infrastructure and service provision. Most migrants come from relatively poorer financial backgrounds and are therefore unable to afford proper housing with adequate water and sanitation, as well as healthcare and educational services.

As a result, most of the migrants who move into Dhaka end up living in squatter settlements known and sprawling slums, due to the high cost of formal housing. Most of these slums are overpopulated, lack proper access to clean drinking water, electricity, security, sewerage and drainage systems. This makes people living in slums highly vulnerable to diseases, malnutrition and poor hygiene. There are more than 3,394 slums in Dhaka city according to the Slum and Floating Population Survey (2014). Among them, 7.04 per cent consist of migrants who came to the city as a consequence of river erosion and 0.84 per cent due to natural calamities in the slums of Dhaka South. The remaining migrated because of evictions, insecurity and poverty. Similarly, in the slums of Dhaka North, 7.58 per cent of the migrants came to Dhaka as a result of river erosion and a small proportion were found to migrate due to natural calamities. Migration due to river erosion is high, as it causes an irreversible damage to migrant's assets in the area of origin. In contrast, migration due to natural calamities is very low and more temporary in nature. Nevertheless, it is important to address migration as a result of natural calamities, as the frequency

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of such disasters is expected to increase in the future due to climate change, causing such migrants to migrate permanently.

There are mainly two types of migration to Dhaka city as a consequence of Disasters: temporary and permanent migration. People who have lost their assets, land, livestock or homestead as a consequence of natural disasters migrate to cities in order to raise finances to replenish asset values. These people usually live in Dhaka for a period of one or two years, before travelling back to their places of origin. Some disasters, however, cause a permanent movement as it is impossible to replenish the value of assets lost. The disasters which cause irreversible damage include river erosion, loss of fertility of land due to salt water intrusion and coastal erosion.

Urbanization of Dhaka is still under control, due to proper government and private sector initiatives to expand transportation, extension services and so on. However, in terms of employment, most migrants are not absorbed into the formal sector due to lack of proper education and training. The unemployment rate as of 2013 lies at 16 per cent which is considerably high. These people usually resort to crime in order to earn a living, which have severe consequences on security and corruption.

Dhaka is bounded by the Buriganga, Turag, Dhaleswari and Shitalakshya rivers, which causes it to be highly vulnerable to floods. The most recent major flood occurred in 1988, due to the overflowing of Buriganga river due to heavy rains. Nearly 85 per cent of the city was submerged. Since then, the city has been experiencing water logging due to poor drainage facilities during monsoon. The frequency of earthquakes has been increasing in Dhaka due to increased tectonic activity. The most prevalent man-made disasters in Dhaka are fires, which have caused significant damage to commercial buildings and slums. The most recent fire occurred in Korail Slum in March 2017, which affected over 40,000 people (Dhaka Tribute, 2017).

As the frequency of disasters increase, Dhaka might experience an increase in the rate of uncontrolled migration from rural and disaster exposed areas, leading to considerable increase in unemployment. Although disaster risk within Dhaka city is also increasing, it is still not significant enough to slow down inflow of migrants from surrounding regions. The increase in unemployment due to uncontrolled inflow of migrants can have severe consequences such as increase in poverty, malnutrition, crime, and so on.

3.2 Chittagong

Chittagong is the second largest city in Bangladesh with a population of over 2.5 million (BBS, 2011). The Port of Chittagong is one of the largest international seaports in the Bay of Bengal and a center for imports and exports. The Chittagong Export Processing Zone (EPZ) is ranked third amongst the most competitive industrial zones in the world (Yunus, 2014). A number of multinational companies such as Glaxo Smith Kline, Reckitt Benckiser, Unilever and Berger have their regional headquarters located in Chittagong. Chittagong is also home to the shipbuilding industry, where ships are exported to countries such as Denmark, Germany, New Zealand, the Netherlands, etc. Many industries tend to locate in

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Chittagong due to their close vicinity to the port and EPZ. Similar to Dhaka, Chittagong is an attractive destination for many migrants, due to easy access to informal markets, availability of formal sector jobs and greater income opportunities.

Chittagong is regarded as the commercial capital of Bangladesh, as it contributes to nearly half of the total revenue earned by the country (NBR, 2011). As a result, it is experiencing rapid industrialization and employment generation (Ashraf, 2013). The expansion of the job market in Chittagong has led to large-scale migration from rural areas. Natural growth rate and growth due to migration might lead to the city achieving mega city status by 2050, with a population of around 10.8 million (Bayes and Yiaser, 2013). The real estate industry has also flourished in Chittagong, with an increase in demand for housing. There has also been an increase in the development of urban infrastructure, making Chittagong a very well-connected city, where its inhabitants have adequate access to services and amenities.

However, similar to Dhaka, most of the migrants from rural areas are often constrained to live in slums and remain as urban poor, due to the unavailability of proper, affordable housing. There has been a huge increase in the number of slums in Chittagong City Corporation, from 186 slums in 1997 to 2,216 slums in the slum census of 2014. The slum census of Chittagong has also revealed similar situations of slums, such as poor drainage and sewerage systems, lack of amenities and poor hygiene. According to the Slum and Floating Population Survey (2014), 58.27% of people migrate to cities in search of better jobs, 25.52% due to poverty and 6.27% due to river erosion.

Chittagong is highly vulnerable and exposed to disaster risk compared to Dhaka, which are both natural and manmade. One of the most prevalent man-made disasters in Chittagong is landslides. As Chittagong is experiencing rapid industrialization and growth, there has been an increase in mechanical excavation of hills and cutting down trees for construction. This makes the land very unstable, significantly increasing the risk of landslides in the city. Although the government has banned "hill cutting," such activities still go on illegally. Illegal land grabbers prefer to cut hills at the foot of hills, resulting in excessive steepness which are vulnerable to landslides. During the monsoon season, rainfall causes the slopes to lose their stability, as the soil is unable to absorb the extra weight of rainwater, resulting in landslides.

Chittagong's location near the coast makes it highly vulnerable to cyclones and floods. North Potenga, which is a low-lying area between the Karnaphuli river and the Bay of Bengal is highly vulnerable to flooding in the monsoon season, when the Karnaphuli river overflows its banks. South Potenga is located close to the sea and is highly vulnerable to salt water intrusion. Therefore, people living in these regions usually have to walk a distance of 5 kilometers in order to access clean drinking water. Chittagong is also highly vulnerable to earthquakes due to its location between two active tectonic plates: the India Plate and the Burma Plate.

Migrants living in slums are more vulnerable to these disasters due to lack of disaster risk awareness. They are usually unaware of what to do when a disaster has occurred, who to contact for assistance and what not to do under such circumstances. Illiteracy and lack of finance also makes it highly difficult for them to recover from any damages from disaster.

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Based on our findings from previous case studies and the literature review, the frequency of natural disasters is expected to increase due to climate change. The frequency of manmade disasters within Chittagong is also expected to increase due to unplanned growth. As Chittagong is more exposed to risk compared to Dhaka, if the frequency of disaster increases, migrants might prefer to migrate to Dhaka as opposed to Chittagong. There might also be an outflow of migrants back to their place of origin or to other cities due to high disaster risk, as seen in the case of Nicaragua.

4. Case Studies from Similar Countries

4.1 Philippines

Philippines is ranked 5th in the World Climate Risk Index (2017). According to Philippines Atmospheric, Geophysical and Astronomical Services Administration (PAGASA, n.d.), the Philippines is prone to tropical cyclones as it is located in the Pacific Typhoon Belt. It is hit by 20 tropical cyclones annually on average, half of which makes landfall. Cyclones lead to heavy rains, flooding and strong winds which leads to massive fatalities and destruction to property. As a result, Philippines is classified as category IV, which implies that there is an “urgent need for action” to improve infrastructure and electric supply. Therefore, Philippines is ranked third in the disaster risk index of the UNDP.

The disaster risk is significantly increased by the rapid urbanization and settlement in areas with high disaster risk. Failure to maintain building codes and construction standards, and the high rates of deforestation resulting from urbanization. The high incidence of poverty means that people are not prepared to invest in disaster risk. Fishing and rice being two of the primary industries in Philippines makes it highly vulnerable to any hazard. The frequent occurrence of cyclones and other environmental hazards have detrimental effects on these industries, leading to a large number of migrants to move to urban areas. More than 27.6 million Filipinos, who are among the poorest and marginalized are often trapped in a seemingly never-ending cycle of disaster, displacement and rebuilding due to the frequent occurrence of natural disasters (UNICEF, 2017).

Enomoto and Trang (2016) conducted a research in Barangay Humilog in Philippines. The study carried out a series of household surveys and focus group discussions with 2785 residents of the Barangay, amongst which 14 per cent were migrants from surrounding areas. The research concluded that migrants have limited access to disaster information, and often are faced with one-way access to early warnings and early response system. It also found that they were not a part of any disaster risk reduction training activity. This implies that, the DRR mechanism which is being undertaken by the government needs to be more inclusive, so that the vulnerable people can participate more in the planning and decision-making process.

The findings demonstrated above lead to the need for a policy to make the Disaster risk mitigation policies more inclusive. The Philippine Disaster Risk Reduction and Management Act of 2010 led to the planning and implementation of the National Disaster Risk Reduction and Management Plan (NDRRMP) in 2010, which is to be implemented between 2011 to 2028. The objective of this plan is to create safer,

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adaptive and disaster resilient communities by focusing on four areas: Disaster Prevention and Mitigation, Disaster Preparedness, Disaster Response and Disaster Rehabilitation and recovery. Domingo (2016) tried to evaluate the sectoral and institutional implementation of the NDRRMP by comparing the variation between the NDRRMP and institutional translation. The findings found a significant increase in both Calamity Fund and Quick Respond Fund and their geographical coverage. This proves that the government is taking proper initiative to ensure that disaster risk is mitigated and people and their livelihoods are protected in case of disasters. Institutional resources include allocating funds to agencies outside the DRRM to ensure diversity and coordination amongst DRRM agencies, ensuring a wider geographical scope and source of funding. The plan also looks to invest in human security, knowledge capacity building, food security and ecological sustainability, which is consistent with their goals to improve resilience. The plan was successful in these regards, but still faces severe problems when it comes to lack of DRR worker stationed at municipal level which greatly compromise capacity building levels, and still has huge shortfalls+ when it comes to coordination amongst relevant agencies.

4.2 Cambodia

Cambodia is ranked 13th in the World Climate Risk Index (2017) because of its high exposure to floods, storms, droughts, salt water intrusion due to sea level rise and epidemics. Physical hazards like flood and drought are cyclic in nature as a consequence of fluctuations in water levels in wet and dry seasons and have major implications on key sectors such as agriculture, fisheries and forestry. With nearly 80 per cent of Cambodia's population living in rural areas and the high dependency on the primary sector for livelihood makes Cambodia highly vulnerable to disaster risk.

According to the Cambodia Disaster Loss and Damage Analysis Report (2013), the frequency and severity of flood and drought has been increasing from year to year. Moreover, in recent years, Cambodia has also become vulnerable to an increase in severe storms and lightning strikes. As a result, Cambodia has been experiencing a higher degree of disaster vulnerability, leading more people to migrate to cities such as Phnom Penh and Siem Rea. This large-scale migration is usually unplanned, leading to the accumulation of urban vulnerabilities such as lacking building codes, enforcement, and proper drainage in urban centers. Rural vulnerabilities have also been high due to deforestation and soil erosion, inadequate irrigation systems and water conservation measures.

The migration which is induced by disaster risk lead to an unplanned and unregulated process of urbanization. Based on a study by NGO Sahmakum Teang Tnaut (SST, 2012), there has been an expansion of cities such as Phnom Penh, Siem Reap, Battambang and Sihanouk Ville as a consequence of rural to urban migration, and this growth has been faced with few planning restrictions. Therefore, these cities are facing key challenges for development which include, increasing economic and spatial disparity, lack of affordable housing, prevalence of informal settlements which lack basic utilities, safety and sanitation and lack of participatory urban planning.

The Phnom Penh Urban Poor Assessment Report (2012) tried to assess the situation of slum dwellers in Phnom Penh. The study revealed that the unregulated and unplanned growth has led to severe problems which include traffic congestions

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and water logging and urban flooding. Most importantly, it revealed the neglect of the urban poor and the environment. Increase in migration has caused a significant increase in the demand for housing in urban areas. Lack of government interventions in real estate and too much freedom given to the private sector has encouraged the construction of a greater number of better-quality buildings. However, these buildings are of higher price, which are usually unaffordable for poorer migrants. (STT, 2012). Therefore, urbanization has led to benefits such as increased wages, better jobs, safety and security and better access to utilities was limited to the relatively well-off community, whereas the urban poor were neglected. These consequently lead poor migrants to be pushed away from city centres to squatter settlements and slums located mainly along main roads, railways, sewage systems and lakes. The most common type of housing was one room wooden houses which are not secure from theft and the elements of nature. Most of these households also have an average of 6 members, leading to high dependency ratio per main income earner in the family.

Low rate of education attainment and literacy has led to very low incomes per household, with nearly 60 per cent of households earning less than \$75 per month. This makes it difficult for them to afford food and other basic utilities. This poses serious threats to food security, education, health and nutrition which has a long run impact on future generations. The Urban Poor Development Fund undertaken in 1998 has been able to successfully improve the conditions of urban poor communities, but not much have been done to help slum dwellers. Investments are needed to improve public and social service/assistance, healthcare, upgrading urban infrastructure and increasing access to basic and affordable utilities and sanitation facilities at lowest cost to ensure that the urban poor can improve their living conditions.

It is easy to perceive that the frequent occurrence of natural calamities has stemmed development efforts and have worsened poverty both in rural and urban areas. Therefore, the Government of Cambodia developed the Strategic National Action Plan for Disaster Risk Reduction (SNAP-DRR) which was implemented between 2008 to 2013, and the SNAP-DRR2, which is still under implementation. The main objective of these plans was to study disaster risk and create a digital web-based risk map of the country; to create an effective Early Warning System (EWS) using up-to-date technology; and to implement planning for quick flood and drought response in rural areas. More importantly, the plan also includes efforts to create safer housing in both rural and urban areas in order to create better and more disaster resilient structures. However, these plans are limited more to rural areas in order to make rural communities more resilient and does not include much efforts to help the urban poor. This might have an impact on reducing the rate of migration to cities, which can keep urbanization under control.

4.3 Nicaragua

Nicaragua is ranked fourth in the disaster risk index along with Philippines, particularly due to its location in the Central American Volcanic Arc and in the path of both Pacific and Atlantic Cyclones. This makes the country highly vulnerable to extreme hurricanes, volcanic eruptions, landslides, earthquakes, severe flooding and storms. The severity and frequency of these natural disasters are expected to increase due to its high vulnerability to Climate Change (UNFCCC, 2016). Its vulnerability to disaster risk has been made worse due to several factors which

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include high poverty levels and high dependency on the primary sector as an income source.

There are also major fluctuations in weather throughout the year similar to that in the Philippines: a wet season which ranges from May to October and a dry season which ranges from November to April. Ever since the 1960s, Nicaragua has experienced an increase in temperatures and a greater variability in the amount of rainfall between seasons. This is expected to pose serious challenges to Nicaragua's water resources, which might have severe implications on agricultural production. Reduced rainfall during dry seasons also leaves a great deal of people in rural communities surrounding heavily deforested watersheds without access to clean water for half a year. Water availability is also expected to fall in most basins located in the west and south west of the country. The high rates of malnutrition, food insecurity, and limited access to clean water and sanitation generates push factors from rural areas to move to urban areas.

Mangroves in the west of Nicaragua are exposed to an increased frequency of hurricanes, leading to significant damages of forest area. This leads to rural push factors due to an increase in severity of erosion, salt water intrusion and storm surges in the region, which such forests previously protected. This also affects people who are dependent of such forests for income. Manmade rural push factors include over fishing and water extraction to increase water supply in areas which lack access, depleting renewable resources to levels where marginalized fishermen and farmers do not find it profitable to depend on such sources of income.

Due to extreme rural push factors in Nicaragua, there has been an increase in the rate of urbanization between 1852 to 1930s (Managua, 2013), which was regarded to as extreme. The existence of majority of the country's educational facilities, industry and other institutions make it an attractive destination for migrants moving from rural areas to urban areas. This "extreme" form of migration was not planned, and therefore most migrants were not able to be absorbed both in the formal and informal sector. However, this urbanization has experienced a slowdown after the devastating hurricane in 1972 which caused massive loss of live and destruction to institutions and property, reducing urban push factors. Hurricane Mitch in 1998, which is regarded as the second Atlantic Hurricane in the world also had devastating consequences in slowing down progress and the rate of urbanization. Hence, what makes Nicaragua unique to the case studies analysed before is that, there has been a fall in the overall rate of urbanization due to disaster risk, rather than an increase(National Climatic Data Center, 2014).

5. Lessons Learned from Case Studies

Based on the case studies, we can see that there are two main types of outcomes of an increase in disaster risk, depending on whether the increase is concentrated more on rural areas or urban areas. If the disaster risk is concentrated more in rural areas as opposed to urban areas, people tend to migrate from rural to urban areas leading to an increase in the rate of urbanization. If the increase in disaster risk is concentrated more in urban areas as opposed to rural areas, people tend to migrate from urban areas to rural areas, leading to a fall in the rate of urbanization.

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In the case of Cambodia and Philippines, disaster risk has caused an increase in the rate of rural to urban areas, as it was concentrated more in rural areas. People migrate to cities either to earn back money to rebuild their homes and refurbish assets lost at their place of origin, or to find jobs in the formal or informal sector jobs, where their incomes will be exposed to lower risk due to disaster. Consequently, an increase in urbanization also causes an increase in disaster risk in urban areas. This is because, most migrants have low levels of education and financial stability. They also resort to live in squatter settlements, which are characterized by low quality and insecure housing without proper sanitation and access to basic utilities. These people become highly vulnerable to disaster risk if a natural calamity ever strikes urban areas. However, disasters in rural areas can be more devastating, as people are more dependent on the environment in order to make a living. Factories constructed for manufacturing are usually more resilient to disasters, and migrants do not face significant a significant fall in their incomes. Urban areas also have a relatively higher presence to emergency responses in close vicinity, which means that people have a sense of security from disaster risk. Therefore, even though migrants still remain vulnerable to disasters after migration to cities, people will still prefer to migrate from rural to urban areas. In the future, both manmade and natural disasters are expected to increase as a consequence of an increase in population and climate change respectively. An increase in disaster risk might lead to an uncontrollable increase in urbanization, which might have a negative impact on the economy as a whole, if the formal and informal sector is unable to absorb these migrants. Therefore, proper policy needs to be undertaken in order to ensure that disaster risk does not lead to an uncontrollable level of urbanization.

If the increase in disaster risk is concentrated more in urban areas as opposed to rural areas, there might be a fall in the rate of urbanization, as seen in the case of Nicaragua. Hurricane Mitch, which struck Nicaragua in 1998, had caused significant damage in Managua, the capital of Nicaragua destroying factories, infrastructure, hospitals, schools, government institutions, etc. Before the hurricane, migration into Managua was almost uncontrollable, due to rapid industrialization. The destruction to factories and other institutions during the hurricane left migrants with a lower probability of finding a proper job, in addition to destruction of their homestead. Therefore, they had to migrate back to rural areas to make a living, leading to a fall in the rate of urbanization.

Dhaka and Chittagong have been experiencing a massive inflow of migrants over the past decade due to rapid industrialization. There has also been an increase in disaster risk in rural areas due to climate change. Although migration due to disasters still remains low, the probability of an increase in disaster risk due to climate change is high. Dhaka is comparatively less exposed to any kind of risk compared to rural areas due to its location and infrastructure. Therefore, the number of environmental migrations into Dhaka might increase in the future due to disaster risk and may become uncontrollable if proper government initiatives are not taken. Chittagong's location along the Karnaphuli River and by the coast of the Bay of Bengal leaves it more vulnerable to disaster risk compared to Dhaka and surrounding rural areas. Therefore, in the future, people might migrate from Chittagong back to rural areas or to Dhaka if there is a significant increase in disaster risk and proper government initiatives are not taken.

6. Policy Recommendations and Conclusion

This paper looks to explore how disaster risk can affect the rates of urbanization in Bangladesh. In particular, the impact of disaster risk on Dhaka and Chittagong has been studied in details in order to evaluate the impact of disaster risk on the urbanization of these two cities. The paper finds that, people who are highly vulnerable to disaster risk in rural areas move to Dhaka to capitalize on expectations of finding formal sector jobs where the wage rate is high compared to the agricultural sector. However, most of them are unable to find formal sector jobs and are absorbed in the informal sector, where wage rates are not as high. The same can be seen for Chittagong, where people migrate to from surrounding rural areas. However, Chittagong has been found to be comparatively more exposed to disaster risks than Dhaka, thus migrants often prefer Dhaka over Chittagong due to increase in frequency of disasters.

Based on the findings of this paper, it can be inferred that disaster risk is strongly associated with urbanization and development, specifically in the underdeveloped or less developed countries. Despite the fact that rapid urbanization in Bangladesh is leading to various social, economic and environmental changes; unplanned and unregulated urbanization is also causing a capacity drainage of the economies, thus affecting the ability of the economy to sustain provision of basic services such as healthcare, education, electricity, water, sanitation, etc. A growing population of the urban poor are being forced to live on the margin, in slums and informal squatter settlements outside the city centres. The most concerning factor is the neglect of the urban poor.

Although there have been various actions taken regarding laws and regulations related to urban planning, there is a lack of a coherent, adequate regulatory framework due to poor planning, lack of transparency and implementation. A decent number of development project interventions by NGOs and development partners have been undertaken targeting the rural areas and urban poor. However, the effects of these interventions often do not sustain, and there has been very limited support from the government.

The government can invest in better Geographic Information System (GIS) and Early Warning Systems to accurately predict a disaster and relay the information to people quickly. A better Geographic Information System can help the government analyse which regions are more vulnerable to disaster and can help the government predict more accurately the chances of a disaster occurring. Bangladesh has an Early Warning System in place, but the effectiveness of such systems is still questionable. The relay of warning via the Early Warning System is also poor due to inadequate linkages with proper media. The information is usually relayed through mikes or through newspapers, televisions and radios. Most people who are vulnerable to disaster are not able to afford televisions or radios. Some areas are not well connected and do not have access to electricity. The government could set up relay stations within a certain proximity, which can receive get information quickly whenever there is a risk of disaster and can quickly relay the information to people through mikes. Local Mosques can also be used to relay information to people. The system should also try to relay information out to sea, where fishermen usually fish in trawlers. These trawlers usually have a radio installed, but fishermen lack the proper

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knowledge on how to operate them. Therefore, the government needs to find a way in which to relay information to such fishermen. The best approach would be to relay information through the navy and coast guard.

The Government should also invest in providing people with proper training in case disaster strikes. Most of the people who are vulnerable to risk lack proper training on what to do and what not to do when disaster strikes. The government should therefore plan and adopt proper training which can be effective and inclusive for people who do not know how to read. The training should familiarize people with possible evacuation routes in case a disaster strikes.

Government should impose strict building codes, so that people construct buildings which are more resilient to disasters. Emphasis should also be given on installing proper fire escapes, shelters, and extinguishers to prepare people for disasters. Investing in proper disaster preparedness through quick response of emergency workers can also help mitigate disaster risk. Government also needs to try to stop the illegal cutting of hills, particularly in Chittagong, so that the chances of landslides are lowered.

Lastly, the Government should invest in proper disaster preparedness and recovery schemes, and construction of infrastructure to mitigate disaster risk. Disaster preparedness schemes can include the construction of shelters, training of emergency response teams and pre-planning in case a disaster strikes. Recovery schemes can include insurance schemes which can be inclusive of vulnerable ultra-poor people, and proper aid delivery to disaster struck areas. Government could also invest in the construction of proper drainage systems to prevent water logging during floods, river embankments to stop overflowing of rivers and river erosion and so on.

It should be noted that this study has been limited by various constraints, restricting the paper from being more detailed. Firstly, there has not been much study regarding environmental migration and its demographics in the developing or underdeveloped countries, leading to unavailability of imperial data and information. Also, internal migration in most countries is fast and might not be incorporated in census data. Secondly, the percentage of people living in urban areas has been used as a measure for urbanization, as there is no direct measure. This measure includes both natural population growth and migration. Moreover, for this research to be more detailed, more time is required for collection of more information and review of few more studies. Future researchers can consider the cases of a few more developing countries and conduct studies in a more empirical approach.

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