Risk and Development in Developing Countries

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Author's contribution

This whole work was carried out author MQD.

ABSTRACT

This paper examines the impact of risk management on economic development in developing countries. Based on data from the World Bank, we use a sample of seventy-eight developing economies and find that selected risk indicators do have an effect on economic development in these countries. We observe that the coefficient estimates of two explanatory variables do not have their anticipated sign due possibly to the severe degree of collinearity between them. Regression results show that over three-quarters of cross-developing country variations in purchasing power parity per capita gross national income can be explained by its linear dependency on the number of years over which the country was in a large recession both for the 1991-2000 and the 2001-2010 periods, the adult male mortality rate, the homicide rate, the risk preparation index, and the $2.50 a day poverty headcount ratio. The study's findings were objective in the sense that raw data was not "fitted" in a bias way to support a certain view and stemmed directly from the data used in the World Bank report.

Statistical results of such empirical examination will assist governments in developing countries identify risk management strategies that may be used as powerful instruments for economic development.

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1. INTRODUCTION

The effective management of risk can be a powerful tool for economic development [1]. Not only does it help build people's resilience and, as a result, reduce the adverse effects of events, it also permits them to take advantage of opportunities for improving their lot. The report identifies five key insights on the process of risk management. First, it is necessary to take on risks in order to pursue opportunities for development. Not doing anything may be the worst of all options. Second, it is critical to move away from unplanned as well as ad hoc responses during crises towards proactive, systematic, and integrated risk management if one is to confront risk successfully. Third, the identification of risks alone is not sufficient: one also needs to identify, prioritize, and address the trade-offs and obstacles to risk management through private and collective action. Fourth, the management of risks that are above and beyond the means of individuals to handle alone necessitates shared action and responsibility at different layers of society, from the household to the international community. Fifth, there is an essential role for governments to play in managing systemic risks, fostering an environment for shared action and responsibility as well as providing direct support to the vulnerable segment of the population.

The current study empirically examines the effect of selected risk indicators on economic development. Using data from the World Bank for a sample of seventy-eight[i] developing economies for the period from 1991 to 2013, we find that the adult female mortality rate, the incidence of natural hazards such as drought, earthquake, flood, or storm for both the 1993-2002 and 2003-2012 periods, as well as that of epidemics for the same two periods as well as the volatility of per capita GDP growth as measured by the standard deviation of percentage changes in per capita GDP are not statistically significant in explaining economic development in these countries.

On the other hand, we are able to show that over three-quarters of cross-developing country variations in purchasing power parity per capita gross national income can be explained by its linear dependency on the number of years over which the country was in a large recession both for the 1991-2000 and the 2001-2010 periods, the adult male mortality rate, the homicide rate, the risk preparation index, and the $2.50 a day poverty headcount ratio. The study's findings were objective in the sense that raw data was not "fitted" in a bias way to support a certain view and stemmed directly from the data used in the World Bank report. Statistical results of such empirical examination will assist governments in developing countries identify risk management strategies that may be used as powerful instruments for economic development.

This paper is organized as follows. In the next section, a brief review of the economic literature on the impact of risk and risk management on economic development is presented. Next, the formulation of a statistical model to be estimated is discussed. Theoretical underpinnings for the inclusion of explanatory variables are presented in this section. Statistical results are reported in the subsequent section. A final section gives concluding remarks as well as policy recommendations.

2 LITERATURE REVIEW

Idiosyncratic risks (those specific to people or households) are as important for individuals' welfare as systemic ones [1]. For example, households in Ethiopia who have seriously ill members were forced to decrease their consumption by almost 10 percent and went on to

be adversely impacted three to five years later [2]. A study shows that health expenses due to high levels of crime and violence account for 0.3 to 5 percent of gross domestic product a year for countries in Latin American, in addition to the effect of crime on lost output from decreased investment and labor participation [3].

According to one World Bank report, not only have income and consumption been lowered, but individuals' ability to find new employment has been reduced, social cohesion has been reduced, and occasionally domestic violence has augmented by the loss of jobs in countries as diverse as Argentina, Bulgaria, and Guyana [4]. In addition, poor people are often hit the hardest by the adverse consequences of both systemic and idiosyncratic risks. A publication by the World Health Organization (WHO) reports that men under the age of 60 in low-income countries are two and half times and women in the same age cohort four times more likely to die from illness and injury than in high-income countries, while children under age five are almost twenty times more likely [5].

Yet, economic development can take place only if countries can successfully confront risk and purse opportunity. Improved preparation for natural hazards in Bangladesh, for example, has dramatically decreased deaths from cyclones. A countrywide program to build shelters (from only 12 in 1970 to more than 2,000 in 2007) together with better forecasting capacity as well as a relatively simple but effective way for warning people have resulted in a great reduction in casualties [6]. A study of the cross-country incidence of the 2008-2009 global financial crisis documented a structural break in the way emerging economies responded to the global shock [7]. It found that these economies resumed their higher growth rates earlier and converged more quickly to their pre-crisis growth trend than developed economies. This was the result of emerging economies being able to break with the past and, in this regard, their ability of conducting countercyclical policies during the global crisis, making them more similar to developed economies.

The fact that risk management can help unleash opportunity can be seen by comparing the experience of farmers in Ethiopia to that of farmers in Ghana and India. In Ethiopia farmers' lack of insurance or alternative means of keeping consumption smooth left some of them trapped in low return, lower risk agriculture, which was one of the ways in which poverty perpetuated itself in agrarian settings [8]. On the other hand, several experiments were conducted in northern Ghana in which farmers were randomly assigned to receive cash grants, grants of or opportunities to purchase rainfall index insurance, or a combination of the two [9]. When provided with insurance against the primary catastrophic risk they faced, farmers were able to find resources to increase expenditure on their farms. Similarly, the provision of insurance induced Indian farmers to shift production towards higher-return but higher-risk cash crops, particularly amongst more educated farmers [10].

The 2014 World Development Report team conducted benefit-cost analyses across a number of areas and found that risk preparation was beneficial in averting costs. For example, a diet high in mineral supplements intended to lower malnutrition and its related health hazards might produce benefits at least 15 times higher than the cost of the program [11]. In a similar way, the potential benefits from upgrading to developed-country standards the hydro-meteorological information production and early warning capacity in all developing countries are estimated [12]. The researcher argues that since some of the most expensive components of early warning systems have already been built (e.g., earth observation satellites, global weather forecasts), these investments are relatively modest, estimated here around 1 billion US per year, reaching benefit-cost ratios between 4 and 36.

In this paper, we empirically examine the effect of selected risk indicators on economic development in developing countries[ii]. In the next section we formulate a statistical model to be estimated using data from the World Bank for a sample of seventy-eight developing economies for the period from 1991 to 2013.

3. THE STATISTICAL MODEL

If we assume that various risk indicators linearly affect the level of per capita GDP in a developing country, we can state the following statistical model:

$$PPPGNI = \beta_0 + \beta_1 RecessYrs9100 + \beta_2 RecessYrs0110 + \beta_3 MaleMort + \beta_4 Homicide$$

$$(-) \qquad\qquad (-) \qquad\qquad (-) \qquad (-)$$

$$+ \beta_5 RiskPrepIndex + \beta_6 2010PPPPov2.5 + \beta_7 FemMort + \beta_8 NatHazrds9302$$

$$(+) \qquad\qquad (-) \qquad\qquad (-) \qquad (-)$$

$$+ \beta_9 NatHazrds0312 + \beta_{10} Epid9302 + \beta_{11} Epid0312 + \beta_{12} PGDPGrwStD + \varepsilon \ (1)$$

$$(-) \qquad\qquad (-) \qquad (-) \qquad (-)$$

where

    PPPGNI = Purchasing Power Parity GNI per capita, in dollars in 2012.
    RecessYrs9100 = Number of years country was in a large recession, 1991-2000[iii].
    RecessYrs0110 = Number of years country was in a large recession, 2001-2010[iv].
    MaleMort = Male adult mortality rate, per 1,000 people, 2007-11[v].
    Homicide = Homicide rate, per 100,000, in 2010.
    Risk PrepIndex = Risk preparation index, in 2013[vi].
    2010PPPPov2.5 = $2.50 a day Poverty headcount ratio, in 2010.
    FemMort = Female adult mortality rate, per 1,000 people, 2007-11.
    NatHazrds9302 = Incidence of natural hazards, 1993-2002[vii].
    NatHazrds0312 = Incidence of natural hazards, 2003-12.
    Epid9302 = Incidence of epidemics, 1993-2002[viii].
    Epid0312 = Incidence of epidemics, 2003-12.
    PGDPGrwStD = Volatility of GDP growth per capita, in percent, in 2000s[ix].
    ε = Random error term, with mean 0 and uniform variance.

Major economic crises such as large recessions that have taken place in recent decades underscore how vulnerable individuals, communities, and nations are to systemic risks, especially in developing countries. To capture this effect we use the number of years during which a country was in a large recession and expect the coefficient estimate for this variable to have a negative sign. We are interested in both the short-term and long-term effects of these economic downturns on development and thus choose to include this variable for the 1991-2000 and 2001-10 periods.

Similarly, to capture the effect of disasters on development, we include the incidence of natural hazards and epidemics for both the 1993-2002 and 2003-12 periods and expect the coefficient estimates of these variables to have a negative sign. On the other hand, countries that prepare well for risk as measured by their risk preparation index are expected to experience a higher level of development compared to those who are ill equipped for risk

management. We thus expect that the coefficient estimate on the risk preparation index variable to have a positive sign.

Since synergies are taken into account under risk management, they can reduce risks and increase expected benefits. Investments in nutrition and preventive health, for instance, are likely to make individuals more productive while at the same time lowering their vulnerability to disease. On the other hand, a high mortality rate, both for males and females, which may result from lack of investments in nutrition and preventive health, is more likely to reduce the labor force, a necessary input in the aggregate production, and hence adversely affect economic development. Likewise, developing countries with a high homicide rate are expected to have a lower level of development as well[x].

While impressive progress has been made in alleviating poverty in the past thirty years, a significant proportion of people in developing countries remains poor and thus is vulnerable to tumbling into deeper poverty whenever they experience negative shocks that may come from both systemic and idiosyncratic risks. A large body of evidence indicates that adverse shocks play a significant role in pushing households below the poverty line and keeping them there (see [13] for a useful survey). We thus use the $2.50 a day poverty headcount ratio as a means of capturing the effect of this risk indicator on development in developing countries and expect its coefficient estimate to have a negative sign.

Following [14], we wish to measure the effect of GDP volatility on development by including the standard deviation of percentage changes in GDP per capita (observed volatility)[xi]. We expect that this variable will make a negative impact on the level of per capita income. Data for all variables are from the 2012 and 2014 World Development Reports and the 2013 World Development Indicators [15,1,16].

4. EMPIRICAL RESULTS

Table 1 gives least-squares estimates of regression coefficients in equation (1) for a sample of seventy-eight developing countries. The goodness of fit of the model to the data is very good as indicated by the value of 0.753 of the adjusted coefficient of determination. We observe that only five explanatory variables are significant, the coefficient estimate of two of which does not have the anticipated sign, namely the number of years during which there was a large recession for the 2001-10 period. If a developing country experienced a large recession during the 1991-2000 period, for every additional year that the recession lasted, we would expect a four hundred and fifty-three-dollar decrease in purchasing power parity gross national income per capita, other things being equal. On the other hand, the positive sign of the coefficient estimate for risk preparation index variable suggests that, all else equal, a one-point increase in this index is expected to lead to an increase of $157 in per capita purchasing power parity gross national income. Regression results also show that a one-person-per-100,000 increase in the homicide rate is expected to bring about a $49 decrease in per capita GNI, ceteris paribus. In addition, as the $2.50 a day poverty headcount ratio increases by one percentage point, we would expect per capita GDP to decrease by about $99, all else being equal.

Using the backward elimination stepwise method we arrive at a revised model, the regression results of which are reported in Table 2. We note that the goodness of fit of the model to the data is better as indicated by the higher value of 0.767 of the adjusted coefficient of determination. We observe that all six explanatory variables are statistically significant at the 5 percent or lower level.

Table 1. Empirical Results (Full Model)

	Coefficient Estimates	t-Statistics
Intercept	2738.896	0.737
RecessYrs9100	-452.970	-2.399**
RecessYrs0110	1220.038	2.609**
MaleMort	7.690	1.236
Homicide	-48.544	-2.138**
RiskPrepIndex	156.549	3.153*
2010PPPPov2.5	-98.598	-3.174*
FemMort	1.540	0.261
NatHazrds9302	-20.366	-0.438
NatHazrds0312	11.841	0.332
Epid9302	94.695	0.807
Epid0312	20.605	0.177
PGDPGrwStD	36.127	0.186

Adjusted R^2 = 0.753
*Significant at the 1 percent level.
**Significant at the 5 percent level.

We note that the number of years during which a developing country experienced a large recession for the 2001-10 period continues to have the unexpected positive sign. The impact of the number of years during which a country had a large recession for the 1991-2000 period on per capita GDP has been reduced to $416 for every year increase in the value of this variable, while that of the risk preparation index has been slightly reduced to $149 for every point increase in the value of the latter variable. The male adult mortality rate variable is now statistically significant at the 5 percent level, but its coefficient estimate continues to have the unexpected positive sign. On the other hand, all else equal, a one-percentage point increase in the homicide rate is expected to lead to a $48 dollar increase in per capita GDP, virtually unchanged from when we had the full statistical model. We also observe that there is a decrease in the negative effect of the $2.50 a day poverty headcount ratio (from about $99 to $91 for every one- percentage point increase) on per capita GDP.

Table 2. Empirical Results (Revised Model)

	Coefficient Estimates	t-Statistics
Intercept	2987.570	0.870
RecessYrs9100	-416.018	-2.362**
RecessYrs0110	1154.594	3.031*
MaleMort	10.131	2.339**
Homicide	-47.928	-2.276**
RiskPrepIndex	148.600	3.239*
2010PPPPov2.5	-90.714	-3.328*

Adjusted R^2 = 0.767
*Significant at the 1 percent level.
**Significant at the 5 percent level.

The fact that we obtain statistical results that seem to be inconsistent with our hypothesis about the impact of the male adult mortality rate and the number of years during which a developing country had a large recession over the 2001-10 period on per capita income could be due to a simultaneity bias or the extent of the multicollinearity among explanatory

variables[xii]. The extent of the latter problem is reported by the sample correlation coefficient matrix on Table 3. For instance, the male adult mortality rate is strongly linearly related to the homicide rate, the risk preparation index, and the $2.50 a day poverty headcount ratio, while the number of years during which a developing country was in a large recession for the 2001-10 period is also linearly related to the homicide rate.

Table3. Sample Correlation Coefficient Matrix

	RecessYrs9100	**RecessYrs0110**	**MaleMort**	**Homicide**	**RiskPrepIndex**	**2010PPPPov2.5**
RecessYrs9100	1					
RecessYrs0110	0.324	1				
	2.988					
MaleMort	0.402	0.090	1			
	3.822	0.786				
Homicide	0.092	0.260	0.194	1		
	0.809	2.351	1.724			
RiskPrepIndex	-0.321	-0.072	-0.523	-0.218	1	
	-2.950	-0.628	-5.352	-1.947		
2010PPPPov2.5	0.247	-0.019	0.533	0.103	-0.904	1
	2.225	-0.163	5.488	0.907	-18.450	

Note:Bold t-statistics imply statistical significance at the 10 percent or lower level.

5. CONCLUSION

In this paper we use a statistical model and data from a sample of seventy-eight developing economies to empirically analyze the impact of selected risk indicators on the level of per capita GDP. From the statistical results we are able to draw the following conclusions:

1. Within the set of developing economies in this study, over the 1991-2000 period, the longer a country experienced a large recession, the lower its level of per capita income. Governments in these countries need to devise fiscal policies aimed at countering the adverse effect of large recessions while putting a premium on transparency and discipline by building buffers during good times with an eye toward future recessions.

2. Developing countries that have a high homicide rate tend to have a lower level of per capita income. Governments in these countries need to find ways of reducing violence so that people living in affected communities may face lower safety, health and property risks. This, in turn, is expected to foster economic development.

3. Developing countries that have a higher risk preparation index do experience a higher level of development. Efforts should then be aimed at increasing the average years of schooling, providing more immunizations against measles, raising the proportion of households with more than $1,000 in net assets as well as the percentage of the labor force who are contributors to a pension scheme. In addition, governments in these countries need to promote trust among their citizens, increase ccess of the latter to improved sanitation facilities, while lowering the share of gross public debt in revenues.

4. Developing countries in which there is a large proportion of their population living on less than $2.50 a day in 2010 are more likely to have a lower level of economic development two years later. Governments in these countries thus need to find ways of alleviating poverty as the poor are the hardest hit by the effect of adverse shocks such as health and weather shocks as well as economic crises and these shocks are more likely to push them below the poverty line and keep them there.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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APPENDIX

Notes

[1]*The sample consists of the following countries: Albania, Armenia, Azerbaijan, Bangladesh, Belarus, Benin, Bolivia, Brazil, Bulgaria, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Chile, China, Colombia, Democratic Republic of Congo, Republic of Congo, Costa Rica, Côte d'Ivoire, Croatia, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Ghana, Guatemala, Honduras, Hungary, India, Indonesia, Kazakhstan, Kenya, Kyrgyz Republic, Lao PDR, Liberia, Lithuania, Madagascar, Malawi, Mali, Mauritania, Mexico, Moldova, Morocco, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Romania, Russian Federation, Rwanda, Senegal, Serbia, Sierra Leone, Slovak Republic, South Africa, Sri Lanka, Sudan, Tajikistan, Tanzania, Thailand, Togo, Turkey, Uganda, Ukraine, Uruguay, Venezuela, Vietnam, Yemen Republic, and Zambia.*

[ii] *At the suggestion of an anonymous reviewer, we wish to clarify that the use of risk indicators is an indirect way of examining the impact of risk management on economic development in developing countries.*

[iii] *Following [17], a large recession is defined as a 5% decline in GDP per capita growth from peak to trough.*

[iv] *The fact that the time periods vary from one risk indicator to another is due to the availability of the data as provided by the World Bank.*

[v] *With the exception of the risk preparation index, data on all other risk indicator variables are from a prior time period. This effectively reduces the likelihood of endogeneity bias.*

[vi] *The risk preparation index is a composite index that estimates preparation for risk across countries. The components of the index are average years of schooling; immunization rate (measles); proportion of households with less than $1,000 in net assets; access to finance index; contributors to a pension scheme (% of labor force); proportion of respondents stating that "in general, people can be trusted"; access to improved sanitation facilities (% of population); and gross public debt (% of revenues).*

[vii]*The incidence of natural hazards is the number of droughts, earthquakes, floods, and storms (as defined by the EM-DAT database) that occurred in the specified time period.*

[viii] *An epidemic is defined as either an unusual increase in the number of cases of an infectious disease that already exists in a region or population, or the appearance of an infection previously absent from a region. Disasters that affect multiple countries are considered to be separate events for the purpose of calculating summary groups.*

[ix] *Historical volatility is calculated by looking at past changes in GDP per capita. GDP per capita growth is approximated using natural logarithm differences. The standard deviation of percentage changes in GDP per capita (observed volatility) is calculated within decades with at least nine observations.*

[x]*Intentional homicides are estimates of unlawful homicides deliberately inflicted as a result of domestic disputes, violence among people, conflicts over land resources, gang violence over turf control, and predatory violence and killing by armed groups. However, these do not encompass all intentional killing; the difference being usually in terms of the way the killing is organized. Homicides are usually committed by individuals or small groups, whereas these do not include killing in armed conflict that is usually committed by fairly cohesive groups of up to several hundred members.*

[xi]*Actually, [14] estimate the impact of GDP volatility from normal to crisis-related levels on long-run per capita GDP growth while we attempt to measure the effect of the volatility of per capita GDP growth on per capita GDP. Hence, here the causality is in the reverse direction.*

[xii]*Another plausible explanation for the positive effect of years in which a developing country experienced a large recession for the 2001-10 period may be that, with regard to risk management, fiscal policy in developing countries has suffered from a procyclical bias that has had the tendency of amplifying upswings and worsen downturns. See, for example, [18].*