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An Econometric Analysis of the Statistical Relationship between Carbon Dioxide Emissions and Infant Mortality in South Asia

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Authors' contributions

This work was carried out in collaboration between all authors. Authors MIUH and AH designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors AS and FS managed the literature searches, analyses of the study performed and authors MK and HMZ draw the policy implications and overall editing the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

This study provides an econometric analysis of the link between infant mortality and carbon dioxide emissions in four south Asian countries-Pakistan, India, Sri Lanka and Bangladesh- for the period 1978-2010 while controlling other variables, inflation, trade, remittance and rural population growth, socioeconomic characteristics of the household, that can potentially impact the number of infant deaths. Panel data technique Fixed Effect was preferred to Random Effect on the basis of Hausman test. The results show that high carbon emissions lead to higher rate of infant mortality and the link is indirect instead of direct. The different intercept show that the impact of carbon emission is higher in Bangladesh followed by India, Pakistan and Sri Lanka. Trade and remittances

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reduce mortality rates while rural population growth works in opposite direction. Inflation has a negative sign yet statistically not significant. The results suggest that carbon dioxide emissions must be reduced to improve infant health at least in the long run. Measures to check population growth are mandatory to overcome infant deaths. Trade and remittance increase should be ensured to improve health index of infants. However our results are suggestive and be taken with care as different other channels can reverse the results which require further research on this front.

Keywords: Carbon dioxide emissions; mortality; South Asia; inflation; trade; population growth; fixed effect model.

1. INTRODUCTION

Evidence is mounting that our planet faces long term and irreversible changes in the earth's climate system [1] and these climatic changes have an unparalleled impact upon poor and marginalized groups of the population [2]. In literature there is consensus that emission of greenhouse gases due to human activity is a notable contributor to this climate change as it causes increase in temperature and precipitation and Intergovernmental Panel on Climate Change (IPPC) in its fourth reports warns that the global warming are likely to affect human health [3]. Climate affects human being directly and indirectly; in direct channel human health suffers as a result of extreme events that results in increase in disease environment. The indirect way, large-scale and global environmental hazards to human health include climate change, for example as a result of extreme events. The indirect health effects could be related to the stress or to physiological effects or even with the income of the person that wants to act or work [4].

South Asia suffers from grave consequences of climate change due to its large agriculture base that is highly vulnerable to climatic events. A huge populace is directly affected by the climate change that affects their life and livelihood through different ways. This study aims to map the relationship between carbon dioxide (CO_2) emissions and infant mortality in this region while controlling other factors that can influence mortality. The heart of the debate in this context comes from a number of warnings from scientists and others concerned authorities that give the impression that human induced climate change is an immediate threat to society [5-8]. Millions of people might be vulnerable to health effects and production falls related to global warming [9].

A handful of studies have already established the theoretical link between Global Warming and its impact on human health. For example [10] conclude that "Fossil fuel energy consumption and industrialization both have an indirect relationship with the infant mortality rate, whereas, carbon dioxide emissions have a direct relationship with the sanitation facility in a country". [11] state "Exposure to pollutants such as airborne participate matter and ozone has been associated with increases in mortality and hospital admissions due to respiratory and cardiovascular disease". [12] found that air pollution and greenhouse gas emissions have strong and negative effect on the birth weight in Pakistan. Likewise [13] report that "Tropospheric ozone and black carbon (BC), a component of fine particulate matter (PM ≤ 2.5 μm in aerodynamic diameter; PM2.5), are associated with premature mortality and they disrupt global and regional climate".

This study differs from previous literature at least on three fronts; first it employs CO_2 emission as proxy for climate change. Many of the previous studies use climatic variables like precipitation and temperature to see their impacts on mortality rate. However it is well established the fact that rise in temperature is a result of greenhouse effect and carbon dioxide is the major emitter among greenhouse gases. Therefore we try to infer if exist a link between the CO_2 emission and infant mortality. Secondly, besides heat waves, some social and economic indicators like remittances, inflation and trade play a crucial role in explaining the unequal effect of extreme events on mortality in vulnerable communities [14,10,15] which has not been properly addressed by the previous studies and are included in this study. Thirdly we use infant mortality rather than mortality rate as infants in the household setup of developing countries are more at risk to climatic change. The rest of the paper proceeds as follows: Section 2 gives a brief literature review; section 3 provides detail of the variables with their source. In section 4, empirical methodology is explained while in section 5 results are reported with detailed discussion. The last section, 6, concludes with some policy recommendations.

2. LITERATURE REVIEW

Climate change is likely to have serious and long-term consequences for public health. Previous literature identifies numerous health problems that climate change can inflict on human for example change in vector biology of infectious diseases [16]. Further these impacts of climate change do not affect all regions and communities equally [17,18].

The debate on the determinants of infant mortality has been extensive explored in the scientific literature [19] and according to [20] infant mortality is affected by some socio economic variable in addition to climate change variables. The extreme events like heat waves can bring cardiovascular diseases [21] and high temperature cause high rainfalls affecting the environmental conditions for the proliferation of malaria and diarrhea [22]. Furthermore, the effects of climatic variables have different effect on child characteristics, for instance, [23] report female children with lower order in siblings are more vulnerable therefore the mitigation policies should focus on child characteristics. [24,25] conclude that extreme heat waves have caused hundreds of deaths across USA, Europe and Canada over the last 30 years. Several climate scenarios point towards that extreme event will become more frequent and intense by the end of 21st century with their long lasting effects [26]. These include higher population density, more risk to aging population and less air conditioning [27,28]. A study by [29] show that in the heat wave, excess emergency department visits increased in California in 2006, and across the state, excess hospitalization were reported as compared to the same period in previous year.

The Intergovernmental Panel on Climate Change fourth Assessment report provided specific information for South Asian region concerning the nature of future impacts. Some of the future impacts include; in hot regions like Pakistan, "as a result of increased atmospheric CO_2 concentrations, water-use efficiency for some types of plants would decline as yields decrease due to heat stress. Therefore, net cereal production in South Asian countries is projected to decline at least between 4% to 10% by the end of this century under the most conservative climate" (see Chapter 5 of the fourth Assessment report from IPCC). [10] found infant mortality and industrialization are indirectly linked while carbon dioxide emissions can directly affect sanitation facility in a country. [11] report that airborne participate matter and ozone increase the mortality and hospital admissions. [12] found that in Pakistan birth weight is negatively associated with carbon dioxide emissions while [13] state that black carbon are associated with premature mortality.

3. DATA AND VARIABLES

To establish any reliable link between infant mortality and climate change high frequency data is required due to the non-linear relationship between the variables. If the target is a single country then the data may be available or constructed/collected for the variables of interest. However, the data at greater frequency for these variables is not available to us at least for Pakistan, India, Sri Lanka and Bangladesh. Therefore we use CO_2 emissions per capita as proxy for precipitation and temperature rise as the latter are result of CO_2 emissions and the data on CO_2 is available from a common source i.e., the world development indicators that is a publication of World Bank. Rather than measuring CO_2 emissions in metric tonnes the per capita, emissions are more representative as it takes population into account. The advantage of taking data from the same source, due to same definition of the variables across entities, makes results more comparable and reliable. Further panel data is more informative and help in making cross-country comparisons.

Our dependent variable is infant mortality (children under the age of 5) which is the number of deaths per one thousand people per annum. Trade is the total of export and imports as a ratio of Gross Domestic Product (GDP). Agriculture has a significant share in the export of these countries therefore it can affect the income of the rural population through income channel. Inflation is also a very crucial variable that can impact the purchasing power of the household and change its expenditure plan. Consumer Price Index (CPI) is the widely known proxy for inflation in empirical literature. Remittances are the back bone of rural economy, because many emigrants are from rural origin and go out, in these countries, to earning the bread for their families. Therefore it has strong impacts on consumption choices of the household. Instead of using total population grow, we use in our model, rural population growth that is more relevant in our context as it is mainly a rural phenomenon. All our data comes from world development indicators.

We choice sample on the basis of agriculture share of GDP in the South Asian countries. However we exclude Nepal from the sample as it has very few information on the variables of interest. The time span of the data is from 1978 to 2010. Therefore 132 observations are available for the analysis.

4. ECONOMETRICS SCHEME

The empirical goal of the study is to estimate the relationship between per capita CO_2 emissions and the infant mortality rates in the panel of four South Asian countries. Initially, we estimate the log of number of infants per 1000 people per annum by the following equation:

$$Linfant_{it} = \beta_1 LCO_{2_{it}} + \beta_2 Lremit_{it} + \beta_3 Ltrade_{it} + \beta_4 Linfl_{it} + \beta_5 Lrpg_{it} + \gamma_{it} + \alpha_{it} + \epsilon_{it} \quad (1)$$

Where "Linfant" is the log of number of infants per 1000 people per annum, "LCO_2" is the log of per capita carbon dioxide emissions, "Lremit" is the individual remittances received as a percent of GDP, "Ltrade" is trade as share of GDP, "Linfl" is the log of CPI and "Lrpg" is the log of population growth. (γ) is a set of time effects, (α) is a set of fixed effect across countries and β_1, β_2, β_3, β_4 and β_5 are analogous to the slope in linear regression equation and are also called regression coefficients. The subscript "i" is a country index while "t" is the year index. The purpose of using all variables in log form is to estimate elasticity from regression.

We estimated three distinct models; first one with pooled regressions, secondly with fixed effect and third one with Random effects. The purpose was to know how results change as the estimation technique changes despite knowing the fact that pooled regressions in panel data suppress information and random effect model is not applicable in this case as sample is drawn purposefully rather than randomly. Therefore the model here presented is a fixed effects model that was endorsed by Hausman test and represents the observed quantities in terms of explanatory variables that are treated as if the quantities were non-random.

5. RESULTS AND DISCUSSION

To start with, we provide the descriptive statistics of the variables in Table 1 that make available the preliminary information about the each variable used in the model.

The correlation matrix is reported in Table 2. It is evident from the correlations that any two variables correlation coefficient does not exceed 0.80, and indicate that there is no multicollinearity in the variables.

We start our discussion with the main variable of interest that is carbon dioxide emissions per capita. Estimation results are presented in Table 3. As expected, carbon emissions are positively linked with infant mortality ($p<0.01$). The coefficient is high, which shows the large magnitude of the impact. The results are in line with the global change scenarios that associated the high frequency of occurrence of extreme events to the increase of global carbon dioxide emissions. For example, [22] states that high

Table 1. Descriptive statistics of the variables

Variable	Obs	Mean	Std. dev.	Min	Max
Linfant	132	12.19363	2.12501	8.158516	14.84595
LCO_2	132	.8487374	.7404348	2.562178	.5105511
Ltrade	132	3.53127	.5404241	2.485629	4.484543
Lremit	132	1.256433	.685096	-.3149199	2.349377
Linfl	132	2.040175	.642945	-1.248378	3.24333
Lrpg	132	1.573076	.7257668	-1.594862	3.080174

Table 2. Correlation matrix

	Linfant	LCO_2	Ltrade	Lremit	Linfl
Linfant	1.0000				
LCO_2	0.2933	1.0000			
Ltrade	-0.8530	0.0300	1.0000		
Lremit	-0.6345	-0.0853	0.7100	1.0000	
Linfla	-0.1524	-0.0053	0.1213	-0.0853	1.0000

temperature cause high rainfalls that affect the environmental conditions of the proliferation of malaria and diarrhea. Likewise, [21] reports that the extreme events, like heat waves, can bring cardiovascular diseases. However the direct link between the carbon emissions and mortality is missing. The scientific production on the field of climatic modelling predicts that greenhouse gas concentrations will continue to rise, and Earth's average surface temperature will rise with them. It can be interpreted that carbon dioxide emissions indirectly wreak the livelihood of the people that deeply depend on agriculture, made them extremely vulnerable to climate change. Similar findings are reached by [10] who found infant mortality and industrialization are indirectly linked while carbon dioxide emissions can directly affect sanitation facility in a country. [11] report that airborne participate matter and ozone increase the mortality and hospital admissions. [12] found that in Pakistan birth weight is negatively associated with carbon dioxide emissions while [13] state that black carbon are associated with premature mortality.

Table 3. Dependent variable is Linfant (Fixed effect)

Independent variable	Coefficient	P-value
LCO_2	0.476	0.000
Lremit	-0.269	0.000
Linfl	-0.018	0.473
Ltrade	-0.006	0.000
Lrpg	0.137	0.004
Constant	-11.634	0.000

Now we turn to control variables that can affect the infant mortality. In case of inflation it was found that it affects negatively the infant mortality which is not in conformity of the previous literature that report the positive effect of prices on number of deaths. However, in our case the result is not statistically significant (p>0.10) which means that inflation has not been effective to influence household decision to change their consumption plan. One argument could be put forward to explain why inflation is ineffective. The agriculture household store grain and other crops for their use at the harvest season, therefore inflation that is mostly food inflation does not change the expenditure pattern of the household and they avoid the reduction of number of meals per day, however, our results are different from studies that report the positive impact of prices and food shortage on child mortality [14,28,15].

Trade association with child mortality is found to be negatively related and statistically significant (P<0.01) and this result is in line with previous empirical literature. The possible explanation is the heavily dependence of rural population on agriculture and the fact that South Asian exports are mainly agriculture, and an increase in exports leads to higher prices of agriculture output that benefit the agricultural communities. A number of studies support this finding, for example [30] found that increasing income from trade seems to improve health, and the other channel, could improve nutrition of mothers and child's [31].

Rural population growth also leads to an increase in the number of deaths (P<0.01) which is understandable and in line with the results of many studies that link population growth with mortality. The fast growth in population in rural areas overburdens household and restrict it choices and change spending patterns. Here population characteristics also mater as the females are supposed to be suffered more when income resources are distributed. [32] show that population growth stresses sanity and health care infrastructures that may increase child mortality in developing countries.

Remittances seem helpful in checking the number of child deaths (P<0.01). A large number of Immigrants is from rural background and send money to their families on regular basis from abroad. This money is mostly spent in increasing the living standard particularly dress and food. [33] found that remittances reduce child mortality particularly childrens of household that belong to upper class, while [34] report, a pro-poor impact of remittances.

When intercept is allowed to change, a different scenario emerges, which show that albeit carbon emissions impact child health negatively in all the countries, the magnitude of the variables are different. Infant health is more affected in Bangladesh followed by India, Pakistan and Sri Lanka.

6. CONCLUSION

The main objective of this study was to establish a relationship between infant mortality and carbon dioxide emissions in four South Asian countries namely: Pakistan, India, Sri Lanka and Bangladesh for the period of 1978-2010. The carbon emissions were used as a proxy for climate variables like temperature and precipitation, with the purpose to determine an

indirect link with the infant mortality. The sample selection was based on the phenomenon that the countries studied are agriculture based economies and the majority of the population has heavy reliance on agriculture which is extremely vulnerable to climate change that mostly emerges from greenhouse phenomena to which carbon dioxide is the major contributor. Trade, rural population growth, inflation and remittances were included in the model as control variables because empirical literature takes these variables as determinant of human health. On the basis of Hausman test we estimate only a fixed effect model that shows to be more robust.

Many of the results are in line with the mainstream health economics as with the actual scenarios of global warming that state that high carbon dioxide emissions increase the global temperature and produce tropospheric ozone that results in extreme pollution events. We found that carbon emissions are positively associated with number of infant deaths whereas trade and remittance help reduce mortality in the studied region. Inflation is negative correlated with infant mortality but statistically not significant. Rural population, as expected, seems to be more affected by the impacts of global warming, especially on the number of infant deaths. When measuring the intercept value of the proposed model, individually, it becomes clear that the effect of the carbon dioxide emissions is not equally distributed across the sample. The highest effect is found in Bangladesh followed by India, Pakistan and Sri Lanka.

Based on our findings we put forward some policy implications. First carbon emissions reduction is mandatory to reduce infant mortality despite the fact that global warming been a global phenomenon. In spite of that, the reduction of carbon dioxide emissions can bring down the number of child deaths in the long run. This can be achieved in a number of ways, for instance, moving the countries towards a greener economy, could be one of the options. Trade and remittance needs to be encouraged as rural household income decisions largely depend on these two factors: Inflation and rural population growth that should be checked to avoid the reduction in the number of per day meals of the poor rural families.

We interpret the finding of our model suggestive of an insight that carbon dioxide emissions affects directly the infant health, but this study lacks support of a strong theoretical model. Therefore, results can be taken with care before framing any policy. The study sets two dimensions for future research that could be an improvement over our study. First simultaneous equation model could be used to determine indirect relationship between carbon dioxide emissions and infant mortality in a more concrete way. The second is to get high resolution data on the carbon dioxide emissions or temperature trends along with mortality data on district or state/province level, to deeply analyze the issue.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Holst RD, Neal HS. Food-water--energy nexus: GMS challenges of growth for 2020 and beyond, report prepared for the ADB Sponsored International Conference: GMS 2020: Balancing Economic Growth and Environmental Sustainability Bangkok, Thailand; 2012.
Available:http://www.gms-eoc.org/uploads/resources/125/attachment/Proceedings%20International%20Conference%20on%20GMS%202020.pdf
(Accessed: august 2015)
2. Chatterjee B, Khadka M. (Eds). Climate change and food security in south Asia: CUTS international, Jaipur Printers Private Limited, Japur; 2011.
Available:http://re.indiaenvironmentportal.org.in/files/file/Climate_Change_and_Food_Security_in_South_Asia.pdf
(Accessed: august 2015)
3. Deschenes D, Greenstone M. Climate change, mortality, and adaptation: evidence from annual fluctuations in Weather in the U.S., MIT Joint Program on the Science and Policy of Global Change, Report No. 153, Cambridge; 2007.
Available:http://web.mit.edu/globalchange/www/MITJPSPGC_Rpt153.pdf
(Accessed: august 2015)
4. Burgess R, Deschenes O, Donaldson D, Greenstone M. Weather and Health in India; 2011.
Available:www.tilburguniversity.edu/upload/3db6cd07-abb7-416e-ac4a-5e8b58024cc0_burgess.pdf
(Accessed: august 2015)

5. IPCC (Intergovernmental Panel on Climate Change). Climate Change 2007. The Physical Science Basis. The Intergovernmental Panel on Climate Change. Cambridge; 2007a. UK: Cambridge University Press. Available:http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg1_report_the_physical_science_basis.htm (Accessed: august 2015)
6. IPCC (Intergovernmental Panel on Climate Change). Climate Change 2007: Impacts, Adaptation, and Vulnerability. Intergovernmental Panel on Climate Change. Cambridge, UK: Cambridge University Press; 2007b. Available:https://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_report_impacts_adaptation_and_vulnerability.htm (Accessed: august 2015)
7. Smoyer KE, Rainham DC, Hewko JN. Heat-stress-related mortality in five cities in Southern Ontario: 1980-1996. Int. J of Biometeorology. 2000;44:190-197.
8. Stern N. The Stern Review Report: The Economics of Climate Change. London; 2006. Available:HMTreasury,http://www.wwf.se/source.php/1169157/Stern%20Report_Exec%20Summary.pdf (Accessed: August 2015)
9. Jorgenson AK, Clark B. The relationship between national-level carbon dioxide emissions and population size: An assessment of regional and temporal variation. 1960–2005. PLoS ONE. 2013;8(2):e57107. DOI: 10.1371/journal.pone.0057107.
10. Qureshi IM, Rasli A, Awan A, Jian M, Ali G, Faridullah, Alam A, Sajjad F, Zaman K. Environment and air pollution: Health services bequeath to grotesque menace. Environ Sci Pollut Res; 2014. DOI 10.1007/s11356-014-3584-2.
11. Brunekreef B, Holgate ST. Air pollution and health. Lancet. 2002;360(9341):1233–1242.
12. Akhmat G, Zaman K, Shukui T, Sajjad F, Khan MA, Khan MZ. The challenges of reducing greenhouse gas emissions and air pollution through energy sources: Evidence from a panel of developed countries. Environ Sci Pollut Res. 2014b; 21(12):7425–7435.
13. Aneberg CS, Schwartz J, Shindell W, Amann M, Faluvegi G, Klimont Z, Janssens-Maenhout G, Pozzoli L, Van Dingenen R, Vignati E, Emberson L, Muller ZN, West JJ, Williams M, Demkine V, Hicks KW, Kuylenstierna J, Raes F, Ramanathan V. Environmental Health Perspectives. 2012;120(6).
14. Cogneau D, Jedwab R. Family Income and Child Outcomes: The 1990 Cocoa Price Shock in Cote d'Ivoire. Document de Travail DT/2008-05. Paris; 2008. DIAL, Available:https://ideas.repec.org/p/dia/wpaper/dt200805.html (Accessed: August 2015)
15. Strauss J, Beegle K, Dwiyanto K, Pattinasarany AD, Sikoki B, Sukamdi F & Witoelar. Economic Crisis Impacts on Children after Three Years: Evidence from the Indonesia Family Life Survey, Mimeo. East Lansing: Michigan State University; 2002. Available:http://www.rand.org/labor/FLS/IFLS/papers.html (Accessed: august 2015).
16. Frumkin H, Hess J, Luber G, Malilay J, Mc Geehin M. Climate change: the public health response. Amer J of Pub Hlth. 2008;98:435-445.
17. Patz J, Campbell-Lendrum D, Holloway T, Foley JA. Impact of regional climate change on human health. Nature. 2005; 438:310-317.
18. Patz JA, McGeehin MA, Bernard SM, Ebi KL, Epstein PR, Grambsch A, Gubler D, Reither P, Romieu I, Rose J, Samet J, Trtanj J. The potential health impacts of climate variability and change for the United States. Executive summary of the report of the health sector of the U.S. national assessment. J. of Environ Hlth. 2000;64(2):20-28.
19. Barufi A, Haddad E, Paez A. Infant mortality in Brazil, 1980-2000: A spatial panel data analysis. BMC Pub Hlth. 2012; 12:81.
20. UNICEF. Causes of Child Mortality; 2007. Available:http://www.unicef.org/progressforchildren/2007n6/index_41802.htm (Viewed 15 November 2012)
21. Braga ALF, Antonella Z, Schwartz J. The effects of weather on respiratory and cardiovascular deaths in 12 U.S. cities. Environ Health Persp. 2002;110(9):859–863.
22. Parham P, Michael E. Modeling the effects of weather and climate change on malaria transmission. Environ Hlth Persp. 2010; 118(5):620-626.

23. Anttila-Hughes JK, Hsiang SM. Destruction, disinvestment, and death: economic and human losses following environmental disaster. Working paper, Columbia University; 2012. Available:http://www.younglives.org.uk/files/others/inequalities-conference-papers/anttila-hughes-hsiang-economichumanlossesfollowingenvironmentaldisaster (Accessed: august 2015)
24. Kaiser R, Rubin CH, Henderson AK, Wolfe MI, Kieszak S, Parrott CL, Adcock M. Heat-related death and mental illness during the 1999 Cincinnati heat wave. Amer. J of Foren Med and Path. 2007; 22:303-307.
25. Naughton MP, Henderson A, Mirabelli MC, Kaiser R, Wilhelm JL, Kieszak SM, Rubin CH, McGeehin MA. Heat-related mortality during a 1999 heat wave in Chicago. Amer. J. of Prev. Med. 2002;22:221-227.
26. Meehl GA, Tebaldi C. More intense, more frequent, and longer lasting heat waves in the 21st century. Science. 2004;305:994-997.
27. McGeehin MA, Mirabelli M. The potential impacts of climate variability and change on temperature-related morbidity and mortality in the United States. Environ Hlth Persp. 2001;9:185-189 (Supplement 2).
28. Rukumnuaykit P. Crisis and child health outcomes: The Impacts of Economic and Drought/Smoke Crises on Infant Mortality and Birth weight in Indonesia. Mimeo. East Lansing: Michigan State University; 2003. Available:http://www.rand.org/labor/FLS/IFLS/papers.html (Accessed: august 2015)
29. Knowlton K, Rotkin-Ellman M, King G, Margolis HG, Smith D, Solomon G, Trent R, English P. The 2006 California Heat Wave: Impacts on Hospitalizations and Emergency Department Visits. Environ Hlth Persp. 2009;117(1):61–67.
30. Pritchett L, Summers LH. Wealthier is healthier. The J. of Hum Res. 1996;841–868.
31. Fogel R. The relevance of Malthus for the study of mortality today: long-run influences on health, mortality, labor force participation, and population growth. NBER Working Paper, 0054; 1994. Available:http://www.nber.org/papers/h0054.pdf (Accessed: august 2015)
32. Thomas D, Lavy V, Strauss J. Public policy and anthropometric outcomes in the Cote d'Ivoire. J of Pub Econ. 1996;61:155-192.
33. Chauvet L, Gubart F, Somps MS. Aid, Remittances, medical brain drain and child mortality: Evidence using inter and intra-country data. The J of Dev Stud. 2012;49(6):801-818.
34. Chauvet L, Mesple-Somps S. Impact des financements internationaux sur les inégalités des pays en développement. Revue Économique. 2007;58(3):735–744.

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