



Final Paper- Inferential Statistics

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KEYWORDS

Research Question:

What is the effect of per capita income, per capita health expenditure, female education and the percentage share of rural population on Infant Mortality Rate?

"The infant mortality rate is the probability (expressed as a rate per 1,000 live births) of a child born in a specified year dying before reaching the age of one if subject to current age-specific mortality rates."¹ For years it has been regarded as a very sensitive indicator of a nation's overall population health. It is immensely useful for comparing the population's health overtime or between the populations at a single point in time. This paper explores the impact of socio-economic and demographic factors like per capita income, per capita health expenditure, female education and residential status of population on Infant Mortality rate (IMR).

This paper addresses the issue of public health because it is immensely important for a sustainable economic growth of a nation as health impacts the productive capacities of the population and hence the 'human capital'² of a country. I have chosen IMR as an indicator of public health because it reflects the inter-play of myriad factors like economic development, general living conditions, quality of life, social well-being, rates of illness, quality of environment and the health policies of a country.³ Given the fact that child and maternal health care is one of the most important public health issues in developing countries the United Nations has recognized IMR as one of its Millennium Development Goals as result of which it is being accorded high priority in the health policies of government, domestic and international NGOs and United Nations. Therefore, it becomes imperative to explore the factors which effect IMR. Those factors are not just medical but, in fact they span across a range of domains like social, cultural, religious, political and economic.

Off late, IMR has also been criticized as a narrow measure of public health focusing only a very small segment of population but still as compared to more comprehensive measures of public health like Disability Adjusted Life Expectancy (DALE) it is a simpler measure which can extremely important for resource poor countries i.e. the developing and LDCs (Least Developed Countries) which lack the capital and infrastructural resources to employ measures like DALE (Reidpath and Allotey, 2003).⁴

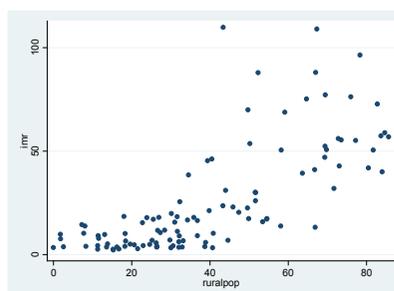
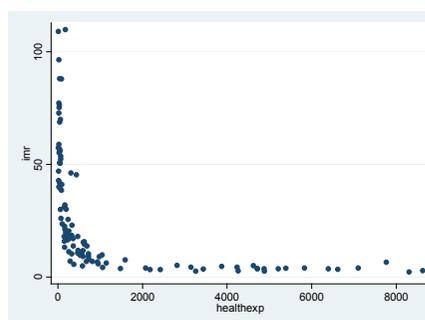
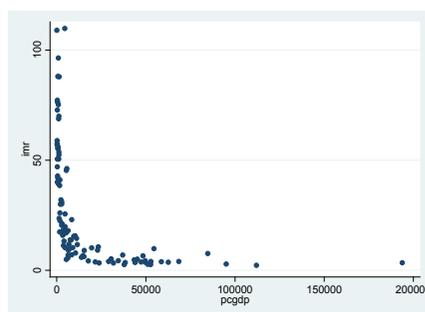
Empirical Model:

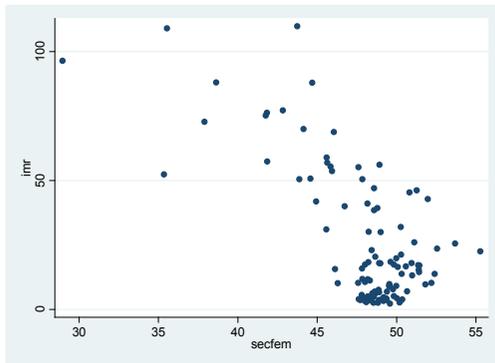
This paper wants to examine the impact of per capita income, per capita health expenditure, percentage share of rural population and female literacy on Infant Mortality Rate. The conventional theory of development economics suggest that:

The IMR has a strong negative relation with per capita income i.e. with the increase in per capita income the IMR declines, because with higher per capita income people can spend more on child and maternal health and in general on health care.

The IMR has strong negative relation with per capita expenditure on health i.e. with increase in per capita health expenditure IMR declines.

The IMR has strong positive relation with residential status of the population. The countries with higher percentage of rural population have high infant mortality rates particularly in developing countries because of the health care infrastructure facilities. Additionally, because of low levels of literacy, lack of awareness and scientific temperament in rural areas, people prefer traditional systems of birth delivery and child care which are not safe and result in high infant mortality rates. The figures below depict the relation between IMR and the aforementioned socio-economic variables.





Literature Review: The theories of development economics suggest that IMR has negatively related to per capita income. Tresserras, Canela ,Alvares, Sentis and Salleras (1992) have observed negative association between IMR and per capita income for 103 nations between 1960 and 1982.⁵Theoretical model on development economics suggest that there is strong negative relation between the IMR and per capita health expenditure. Issa and Ouattara (2005) have analyzed the data collected from 160 countries and shown that there is strong negative relation between IMR and per capita health expenditure. They have proved that IMR has declined dramatically in developed countries in the last century and the same trend has been observed in developing countries since 1945, though the situation in developing countries is less encouraging as compared to the developed nations. Among several socio-economic factors they have identified per capita income, expenditure on health and the level of education as responsible for the decline in IMR. Furthermore, they argue that public expenditure on health is more important in the early phases of development while as a nation develops private expenditure becomes more effective as compared to public expenditure.⁶ Similarly, in study conducted by Anyanwu and Erhijakpor (2009) in 47 African nations proved that increase in per capita as well as government health expenditures have statistically significant negative effect on IMR and Under 5 Mortality Rates.⁷

Similarly, another explanatory variable in this paper i.e. percentage of rural population is also negatively related to IMR. In India the IMR in rural areas was 66 per 1000 live births while in urban areas it was 38 per 1000 live births (Census of India 2011).⁸

Another variable in this paper i.e. the status of a country as post-conflict or not has been found to be positively correlated with IMR. O'Hare and Southall analyzed the data from 42 sub-Saharan countries and found that Under 5 Mortality Rate in nations with recent conflict is 197/1000 whereas in countries without recent conflict is 137/1000. In the case of Maternal Mortality Rate also they found the same trend. They argue that governments spend more on defense and less on health and education if there has been a recent conflict.⁹

IMR has strong positive relation with female education. This paper includes female secondary education as one of the explanatory variables. The female education along with per capita income, per capita health expenditure and percentage share of rural population is one of the important socio-economic determinants of IMR. Raney and Subbarao (1992) explored the strength of female secondary education and argue that infant mortality is more elastic with respect to female secondary education than to a family planning and health programs.¹⁰ Institute for Health Metrics and Evaluation has identified the education for women as single biggest factor in reducing the rate of death among children younger than five.

Data: This paper includes the following variables:

Year	Variable	Measurement Units	Variable Name
2008	Infant Mortality Rate(IMR)	Number of infants dying per 1000 live births in a year	imr
2008	GDP per capita	Current US dollar	pcgdp
2008	Health Expenditure per capita	Current US dollar	healthexp
2008	Rural Population	Percentage of total population	ruralpop
2008	Secondary Education, Pupils (% females)	Percentage of total students(male and female) at secondary education level in a given year	secfem

This paper uses the cross-sectional data for the year 2008 for randomly selected 109 countries. The data for this paper has been obtained from "World Development Indicators" of the World Bank data base.¹² In the case of female education, I have chosen percentage of females in secondary education as the explanatory variable because the data on literacy rates of female youth i.e. (ages15-24) is not available. Besides, this paper does not include many social, cultural and religious factors effecting IMR because of the lack of the availability of data. However, aforementioned variables of this paper are those which have been so far accepted as very important socio-economic determinants of IMR.

Regression Model:

Dependent Variable: imr

Explanatory variables: pcgdp, healthexp, ruralpop, secfem

In this paper, I will use OLS regression technique to regress 'imr' on the 'pcgdp', 'healthexp', 'ruralpop' and 'secfem'.

Null Hypothesis or H₀: There is no relation between imr and the independent variables.

Alternate Hypothesis or H₁: There is a strong correlation between the imr and pcgdp, healthexp, ruralpop and secfem.

Regression Equation:

$$\text{Logimr} = \beta_0 + \beta_1 \text{logpcgdp} + \beta_2 \text{loghealthexp} + \beta_3 \text{ruralpop} + \beta_4 \text{secfem} + \text{error term}$$

Where;

β_0 = Intercept

β_1 = Co-efficient of pcgdp

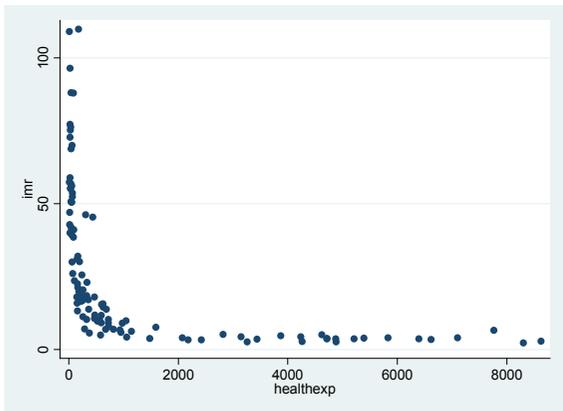
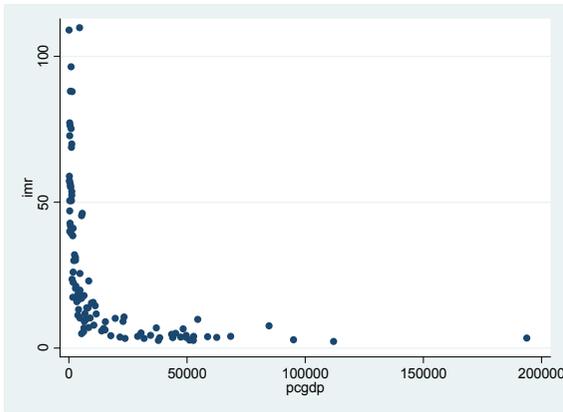
β_2 = Co-efficient of healthexp

β_3 = Co-efficient of ruralpop

β_4 = Co-efficient of secfem

In this regression analysis, in the light of the theoretical evidence and the literature review I expect the co-efficient of pcgdp to be negative, co-efficient of healthexp to be negative, co-efficient of ruralpop to be positive and the co-efficient of secfem to be negative.

In this regression analysis I will use the log of pcgdp and healthexp as their scatterplots with imr show that there is no linear relationship between imr and these two variables as it can be seen in the figures below:



stats	imr	pcgdp	health~p	ruralpop	secfem
mean	25.62569	17942.81	1331.822	39.82124	47.98828
p50	15.8	5405.101	326.2351	34.485	48.62683
min	2.2	198.4958	13.50398	0	28.97094
max	109.7	193892.3	8626.247	85.606	55.27218
sd	25.98342	28153.4	2098.361	22.88289	3.726392
variance	675.1382	7.93e+08	4403117	523.6269	13.88599
skewness	1.364623	3.119206	1.880522	.3580006	-2.233939
kurtosis	4.133322	16.68475	5.514217	2.126265	10.2459

Variable	Obs	Mean	Std. Dev.	Min	Max
imr	109	25.62569	25.98342	2.2	109.7
pcgdp	109	17942.81	28153.4	198.4958	193892.3
healthexp	109	1331.822	2098.361	13.50398	8626.247
ruralpop	109	39.82124	22.88289	0	85.606
secfem	109	47.98828	3.726392	28.97094	55.27218

Co-relation Matrix:

	imr	pcgdp	health~p	ruralpop	secfem
imr	1.0000				
pcgdp	-0.4666	1.0000			
healthexp	-0.4874	0.8472	1.0000		
ruralpop	0.7338	-0.5711	-0.5255	1.0000	
secfem	-0.6935	0.1439	0.1470	-0.4906	1.0000

Given below is the table of **summary statistics** of the key variables of this paper:

REFERENCES

1) Tresserras, R., Canela J., Alvarez J., Sentis J., and Salleras L., "Infant Mortality, Per Capita Income, and Adult Illiteracy: An Ecological Approach" (1992) | 2) Issa, H and Ouattara, B., "The Effect of Private and Public Health Expenditure on Infant Mortality Rates: does the level of development matters?" (2005) | 3) Anyanwu, John C and Erhijakpor, Andrew E.O; "Health expenditures and Health Outcomes in Africa" (2009), African Development review | 4) O'Hare, Bernadette A. M., Southhall, David P, "First do no harm: the impact of recent armed conflict on maternal and child health in sub-Saharan Africa" (2007) | | 5) Raney, Laura; Subbarao, Kalanidhi, "Social Gains from Female Education: a cross-national study" (1992), Policy Research Working paper Series, World Bank | | | 6) Census of India 2011 |