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Effect of Socio-economic Inequality in Health on Economic Growth in India

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Summary: By constructing a cross-state panel data of fifteen major states of India for the period of 1983 to 2011, we examine the effects of inequality in health on economic growth in India. Health inequality is measured in terms of – Gini of per capita calorie intake (PCCI) as well as inequality in under-five child mortality; whereas economic growth is measured in terms of growth in per capita net state domestic product (PCNSDP). Our regression results indicate that a 10% decrease in health inequality when measured in terms of Gini of PCCI and under-five child mortality (after controlling for fertility rate, life expectancy, state and time fixed-effects and a number of other relevant factors) results in a 2.3% and 1.6%, respectively, increase in PCNSDP. Moreover our results also indicate that a 10% decline in under-Five child mortality experienced by the illiterate mothers is expected to increase productivity by 4.7% in India.

Introduction

The evidence on effects of inequality in health on economic growth and development is limited in literature. Though there are a number of studies examining the positive effects of health on productivity and earnings, studies investigating negative effects of inequality in health on productivity and earnings are extremely rare. Examination of negative effect of health inequality on productivity and economic growth is important for two reasons – first, literature suggests (Thomas and Strauss, 1997) that labor productivity rises with health but at a diminishing rate, so average productivity in a society with highly unequal distribution of health will be lower than the average productivity in a society with lesser inequality in distribution of health (Grimm 2011);[1] and second, there is ample evidence that middle and lower income countries suffer from severe inequalities in health, which might be a behind the lower

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[1] For a detailed discussion and the theoretical model behind this argument, please refer to Grimm (2011).

productivity and lower levels of economic growth in these countries. If higher inequalities in health are indeed correlated with lower productivity and economic growth in lower and middle income countries (as shown by Grimm, 2011) then by targeting the inequalities in health, productivity and economic growth in these countries can be increased.

Measuring socio-economic health inequality by child mortality gradient over mothers' education, Grimm (2011) found negative effect of health inequality on economic growth in lower and middle income countries. On the other hand, Jack & Lewis (2009) did not find any significant effect between average health and economic growth in an economy with high degree of health inequality. However, there is no systematic and detailed analysis on how inequality in health affects productivity and economic growth in India, a country which suffers from huge inequalities as far as health in considered (Balarajan et al. 2011). India is also associated with enormous inter-state variation in health outcomes and economic growth which is increasing over time. Except Deolalikar (1988) which examines the relationship between nutrition and labour productivity in rural parts of southern India, there is almost no evidence on effect of health on economic growth in India. Given this context, we investigate the relationship between inequality in heath and productivity (as well as economic growth) in India.

Data

We construct a cross-state panel data (taken from different sources) covering fifteen major states of India over the period 1983 to 2011.

Also, we measure health inequality by Gini coefficient of per capita calorie intake (PCCI) for the fifteen states which are obtained from the nationally representative consumer expenditure rounds (1983, 1987, 1993, 1999, 2004 and 2011) of National Sample Surveys (NSS). Since the association between health inequality and PSNDP may be sensitive to the measure of health inequality, in order to check for robustness of the effect of health inequality on economic growth we also measure health inequality by under-five child mortality rates disaggregated by

mothers' education groups (in a sense to capture socio-economic inequality in health). That is, we use the ratio of the under-five mortality rates experienced by mothers with no formal education and mothers with at least primary education. The under-five child mortality based measure has been calculated for the period 1983 to 2006 from the pooled complete women birth history of National Family Health Survey (NFHS) 1 (1993-94), NFHS2 (1999-00) and NFHS3 (2005-06).

We measure economic output (or income) or productivity by per capita net state domestic product (PCNSDP) in constant 2004-05 Indian Rupees (Indian currency). We also include probability of survival between age 15 to 60 years (obtained from Sample Registration System [SRS], total fertility rate (TFR) (obtained from SRS), average years of schooling (from NSS), percentage of people living in urban areas (from NSS), percentage population of Scheduled Castes/Tribes (from NSS) and percentage of religious minority (from NSS) as control variables. We also control for state and time fixed-effects. The control for state random or alternatively state fixed-effects as well as time-shocks and many other variables that might be correlated with both health inequality and economic output/PCNSDP, is to reduce the problem of omitted variable bias

Overall, for examining the effect of health inequality (in terms of Gini coefficient of per capita calorie intake) on per capita net state domestic product (PCNSDP), [India, 1983-2011], we have 90 state-year observations. Similarly, for examining the effect of health inequality (in terms of ratio of Under-Five child mortality experienced by illiterate mothers to that of primary educated mothers) on per capita net state domestic product (PCNSDP), [India, 1983-2006], we have 255 state-year observations.

In addition we also checked the effect of health poverty measured by Under-Fiver child mortality experienced by the illiterate women on PCNSDP.

Methods and Findings

The bi-variate scatter graph in Figure 1 shows the negative relation (β= -1.3914 R^2=0.1997) between health inequality and PCNSDP.

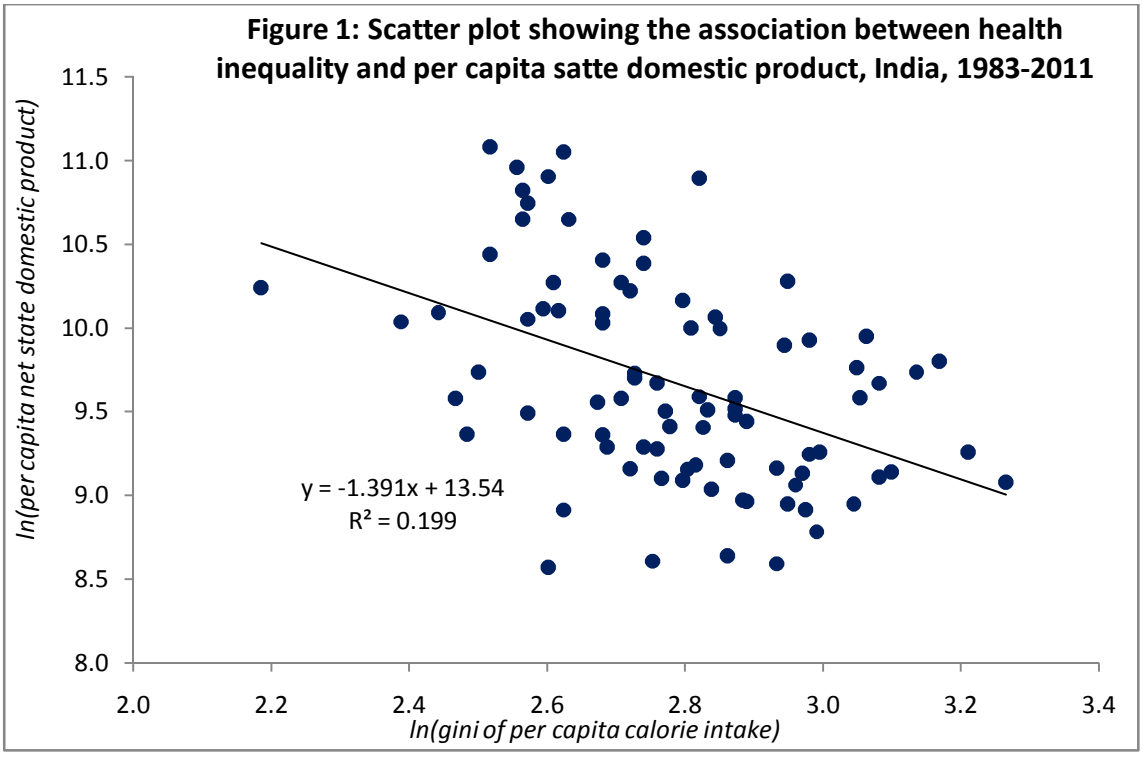
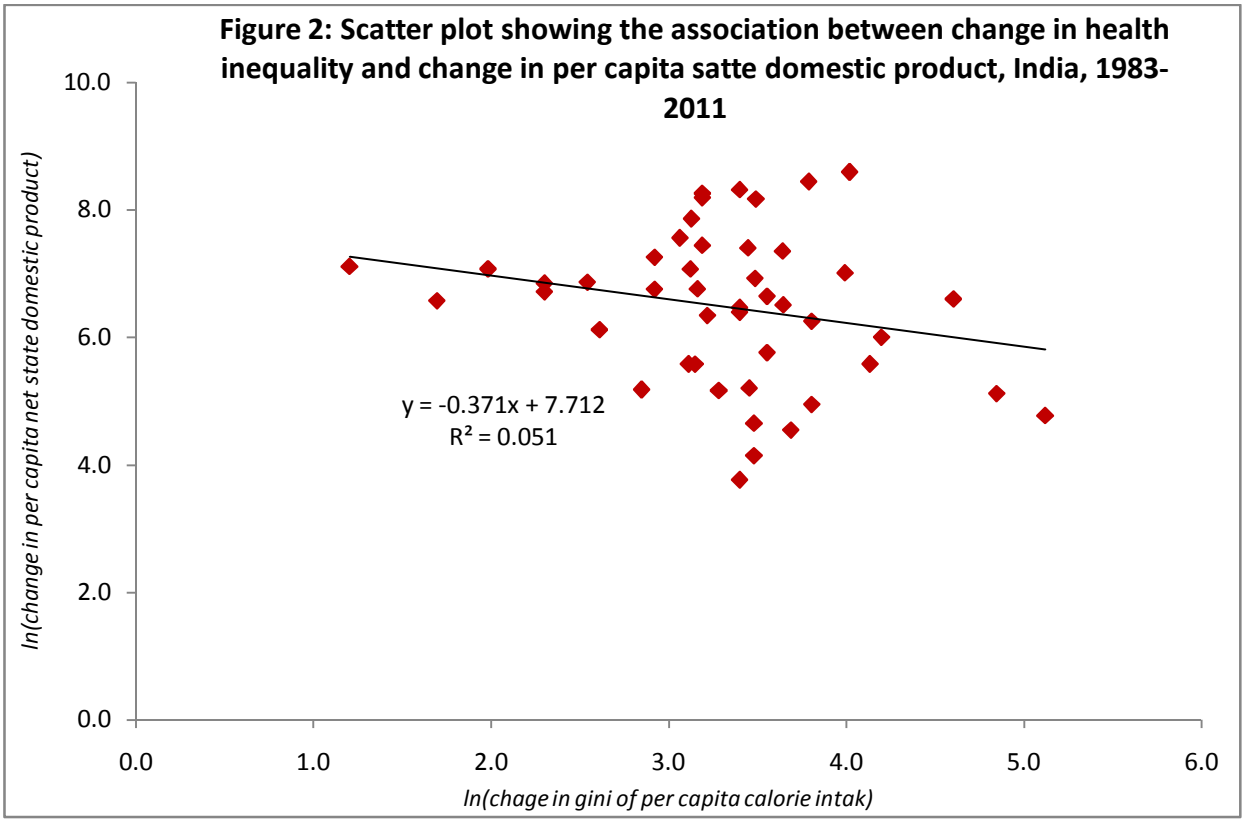


Figure 2 shows the bi-variate association between change in health inequality and change in PCNSDP. Change-in-change graph shows that decrease in health inequality results in the increase in PCNSDP between two time periods. In quantitative terms a 10% decline in health inequality will result in a 4% points increase in PCNSDP between two points of time.



Adjusted effect of health inequality, measured by the PCCI Gini, on PCNSDP is shown in Table 1. It can be seen from the table that the Ordinary Least Squares (OLS) regression based health inequality (PCCI Gini) elasticity of PCNSDP is -0.402 (CI: -0.655, -0.150). Time and state random effect adjusted Generalized Least Squares (GLS) regression gives the elasticity estimate of -0.165 (CI: -0.329, -0.002). Health inequality elasticity of PCNSDP from the fixed effect regression is -0.225 (CI: -0.480, 0.030). Final adjusted elasticity (-0.225) implies that a 10% decrease in health inequality will result in a 2.3% increase in PCNSDP.

Table 1: Effect of health inequality (Gini coefficient of per capita calorie intake) on per capita net state domestic product (PCNSDP), India, 1983-2011

	OLS	*GLS*	*FE(within)*
Natural log of Gini coefficient of per capita calorie intake	-0.402***	-0.165**	-0.225*
	(-0.655,-0.150)	(-0.329,-0.002)	(-0.480,0.030)
Natural log of probability of survival between age 15 to 60 year	-0.159	0.258	1.331
	(-1.631,1.313)	(-1.087,1.602)	(-1.139,3.801)
Natural log of total fertility rate (TFR)	-0.146	-0.357**	-0.552*
	(-0.465,0.173)	(-0.679,-0.036)	(-1.146,0.041)
Natural log of average years of schooling, person aged 15-65 years	1.158***	1.044***	0.842***
	(0.824,1.493)	(0.734,1.353)	(0.272,1.412)
Natural log of % population living in urban area	0.306***	0.223**	0.721**
	(0.120,0.491)	(0.050,0.397)	(0.113,1.329)
Natural log of % Scheduled Castes/Tribes	0.073	-0.014	-0.623**
	(-0.205,0.350)	(-0.274,0.245)	(-1.231,-0.015)
Natural log of % religious minority	-0.174***	-0.127**	0.264
	(-0.283,-0.066)	(-0.225,-0.029)	(-0.155,0.682)
Constant	6.729***	8.121***	8.281***
	(5.040,8.417)	(6.491,9.751)	(4.751,11.812)
Time effect		Yes	Yes
State effect		RE	FE
Total state-year panel	N=90	N=90	N=90

** p≤0.10, ** p≤0.05, *** p≤0.01; 95% confidence interval (CI) in parenthesis.*
OLS: Ordinary least square regression; GLS: Generalized least square random effect regression; FE(within):Fixed effect regression.

Table 2 shows the effect of Under-Five child mortality based health inequality on PCNSDP in India. Fixed effect regression result shows that although Under-Five child mortality based health inequality elasticity (-0.160) of PCNSDP is less than the previous model (-0.225) but level of significance has increased. Fixed effect coefficient shows that a 10% decline in health inequality will result in a 1.6% increase in PCNSDP.

One of the problems is such kind of estimations is that of reverse causality (i.e. the effect of income on health inequality). To address the problem of reverse causality, we use reverse causality adjusted instrumental variable fixed effect regression (IVFE). The instrument we chose is the one year lagged value of the measure of health inequality, which is highly correlated with

the corresponding measure of health inequality but not correlated with the PCNSDP. It can be noted from the Table that the β-coefficient increases in the reverse causality adjusted instrumental variable fixed effect regression (IVFE) than the simple fixed effects model. Health inequality elasticity of PCNSDP in the IVFE model is -0.190 (CI: -0.367,-0.014), which implies that one unit reduction in health inequality will result in 0.19 point raise in productivity and PCNSDP.

Table2: Effect of health inequality (ratio of Under-Five child mortality experienced by illiterate mothers to that of primary school completed mothers) on per capita net state domestic product (PCNSDP), India, 1983-2006

	OLS	***GLS***	***FE(within)***	***IVFE(within)***
Natural log of health inequality(Based on Under-Five mortality)	-0.395*** (-0.578,-0.212)	-0.321*** (-0.498,-0.145)	-0.160** (-0.298,-0.023)	-0.190** (-0.367,-0.014)
Natural log of probability of survival between age 15 to 60 year	-0.078 (-0.908,0.753)	1.932*** (1.125,2.739)	2.321*** (1.247,3.395)	2.320*** (1.251,3.389)
Natural log of total fertility rate (TFR)	-0.340*** (-0.493,-0.187)	-0.627*** (-0.770,-0.483)	-1.054*** (-1.309,-0.799)	-1.059*** (-1.314,-0.804)
Natural log of average years of schooling, person aged 15-65 years	0.965*** (0.807,1.123)	0.505*** (0.381,0.630)	0.366*** (0.149,0.583)	0.360*** (0.142,0.577)
Natural log of % population living in urban area	0.301*** (0.210,0.393)	0.094** (0.005,0.182)	0.115 (-0.069,0.300)	0.114 (-0.070,0.298)
Natural log of % Scheduled Castes/Tribes	0.127** (0.029,0.226)	0.018 (-0.044,0.080)	0.027 (-0.066,0.120)	0.026 (-0.066,0.119)
Natural log of % religious minority	-0.107*** (-0.152,-0.063)	-0.027** (-0.053,-0.002)	0.008 (-0.031,0.046)	0.007 (-0.032,0.046)
Constant	7.867*** (7.124,8.610)	10.150*** (9.571,10.729)	10.576*** (9.678,11.474)	10.621*** (9.712,11.530)
Time effect		Yes	Yes	Yes
State effect		RE	FE	FE
Total state-year panel	N=255	N=255	N=255	N=255

Note:-

** p≤0.10, ** p≤0.05, *** p≤0.01; 95% confidence interval (CI) in parenthesis.*

Under-identification test (Anderson canon. corr. LM statistic (Chi2(1) P-va)l:149 (0.00)

Weak identification test (Cragg-Donald Wald F statistic):307

Sargan statistic (over-identification test of all instruments) (equation exactly identified): 0.00.

OLS: Ordinary least square regression; GLS: Generalized least square random effect regression; FE(within):Fixed effect regression; IVFE(within): Instrumental variable fixed effect regression.

The health poverty elasticity of PCNSDP is shown in Table 3. The time and state fixed effect regression coefficient, -0.471 (CI: -0.586,-0.425), implies that a 10% decline in under-five child mortality experienced by the illiterate mothers is expected to boost PCNSDP or economic output by 4.7% in India. As we control the reverse causality in the IVFE model, health poverty elasticity of PCNSDP increases further.

Table3: Effect of health poverty (under-five child mortality experienced by illiterate mothers) on per capita net state domestic product (PCNSDP), India, 1983-2006

	OLS	***GLS***	***FE(within)***	***IVFE(within)***
Natural log of Under-Five child mortality born to illiterate mother	-0.500*** (-0.666,-0.333)	-0.608*** (-0.799,-0.417)	-0.471*** (-0.586,-0.357)	-0.563*** (-0.700,-0.425)
Natural log of probability of survival between age 15 to 60 year	-1.483*** (-2.449,-0.517)	0.63 (-0.284,1.543)	1.291** (0.299,2.283)	1.091** (0.086,2.097)
Natural log of total fertility rate (TFR)	-0.07 (-0.227,0.087)	-0.258*** (-0.432,-0.084)	-0.699*** (-0.939,-0.458)	-0.635*** (-0.882,-0.389)
Natural log of average years of schooling, person aged 15-65 years	0.821*** (0.660,0.982)	0.366*** (0.232,0.499)	0.301*** (0.107,0.495)	0.282*** (0.088,0.476)
Natural log of % population living in urban area	0.353*** (0.263,0.443)	0.107** (0.021,0.192)	0.049 (-0.117,0.215)	0.035 (-0.131,0.201)
Natural log of % Scheduled Castes/Tribes	0.172*** (0.077,0.266)	0.029 (-0.032,0.089)	0.007 (-0.076,0.090)	0.003 (-0.081,0.086)
Natural log of % religious minority	-0.115*** (-0.158,-0.072)	-0.026** (-0.050,-0.003)	0.004 (-0.030,0.039)	0.003 (-0.032,0.038)
Constant	5.815*** (4.938,6.692)	8.057*** (7.238,8.877)	9.208*** (8.380,10.036)	8.989*** (8.141,9.837)
Time effect		Yes	Yes	Yes
Country effect		RE	FE	FE
Total state-year panel	N=255	N=255	N=255	N=255

Note:-

** p≤0.10, ** p≤0.05, *** p≤0.01; 95% confidence interval (CI) in parenthesis.*

Under-identification test (Anderson canon. corr. LM statistic (Chi2(1) P-va)l:148(0.00)

Weak identification test (Cragg-Donald Wald F statistic):301

Sargan statistic (over-identification test of all instruments) (equation exactlyidentified): 0.00

OLS: Ordinary least square regression; GLS: Generalized least square random effect regression; FE(within):Fixed effect regression; IVFE(within): Instrumental variable fixed effect regression.

Conclusion

This paper perhaps for the first time analyzes the effects of health inequality on economic growth in India. Health inequality is measured by – first, Gini coefficient of per capita calorie intake; and second, as the gradient in under-five child mortality over mothers' schooling categories which is used as a proxy for socio-economic disparity in health. Our results indicate that a 10% decrease in health inequality when measured in terms of Gini of PCCI and under-five child mortality (after controlling for fertility rate, life expectancy, state and time fixed-effects and a number of other relevant factors) results in a 2.3% and 1.6%, respectively, increase in economic output. Moreover our results also indicate that a 10% decline in under-Five child mortality experienced by the illiterate mothers is expected to increase economic output by 4.7% in India. The results hold whether we control for fixed or random-effects or whether health inequality is instrumented using instrumental variable.

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