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Human Capital vs. Physical Capital: A Cross-Country Analysis of Human Development Strategies

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ABSTRACT

This study estimates a small simultaneous equation model using panel data from sixty-four countries for the years 1996 and 2004. The model is estimated by various techniques—OLS, TSLS, dummy variable approach introducing variation at the regional level, and fixed and random effect approaches introducing variation at the individual country level. The objective is to identify the importance of basic needs in human development strategies in Asia, Africa, and the rest of the world (ROW). The results show that income per capita has priority over basic needs expenditure in development strategies of all regions despite being quantitatively different. However, the importance of basic needs expenditure cannot be denied in terms of capabilities development (improvement in health) that ultimately increases productivity.

JEL classification: J24, E22, P24

Keywords: Human Capital, Physical Capital, Income Per Capita, Basic Needs Expenditures, Human Development

1. INTRODUCTION

Issues related to human development are as old as those of economic development. But they have not been acknowledged before 1960, when millions of people were found to be living without basic needs—food, clothing, health, education, shelter, safe drinking water and sanitation facilities.[1] Since then the policies for human development have been widely debated.

Countries are different in their history, culture, resource endowment and political institutions. Hence, they opt for different set of policies—the main instruments to generate or eliminate the problem.[2] Some countries have adopted for growth-oriented policies, whereas others have focused on the policies to provide public social services and reached at different level of human development. Since, human capital expenditure interact with income generating economic sector expenditure, therefore, this is not clear how resources allocated to one sector are prioritised over the other from human development point of view i.e., a rupee spent directly on basic needs (public provision for human capital) is better than a rupee spent directly on income raising (physical investment which indirectly influences basic needs) or not.

A simultaneous equation model developed by Ferroni and Kanbur (1990) incorporates the interaction between public expenditure on basic needs and income raising activities. This model has been adopted in this study to explore the priority between investment in human capital and investment in physical capital in human development strategies. The model is estimated using panel data for 64 countries dispersed over different regions of the world, namely Asia, Africa, and the rest of the world (ROW) (largely include middle and high income countries) for the years 1996 and 2004. Various version of the model have been estimated. First, it is estimated with complete data set without making a distinction between the regions. Second dummies are introduced for Asia and Africa with base category ROW. Last, fixed effect and random effect approaches have been used to estimate model to reveal the difference in conclusion (if any) appears due to estimation methods.

The next section discusses Global Development Scenario. The Section 3 presents model and discusses data sources. The results are discussed in the Section 4. Concluding the paper, some policies are recommended in the last section.

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[1]The concept of Basic needs, Growth and Welfare is widely discussed during 1980s and 1990s. See Goldstein (1985), Richard (1980), Streeton (1980), Annad and Ravallion (1993), Henmer, *et al.* (2003) etc.

[2]Birdsall (2008) also identified that weak markets and poor government policies are key factors in making inequality a problem in developing countries.

2. GLOBAL DEVELOPMENT SCENARIO[3]

During 1990-2005, a period of implementation of structural adjustment program, the developing countries pursued economic policies to correct imbalances in their economies and bring about improvement in the country's overall economic conditions. This section briefly present over view of the global economy through graphical and tabulation presentation using data from World Development Indicators [World Bank (2006)]. The socio-economic indicators such as growth, investment, literacy rate, infant mortality rate are discussed in the following sub sections.

Fig. 1. Growth Performance by Group of Countries

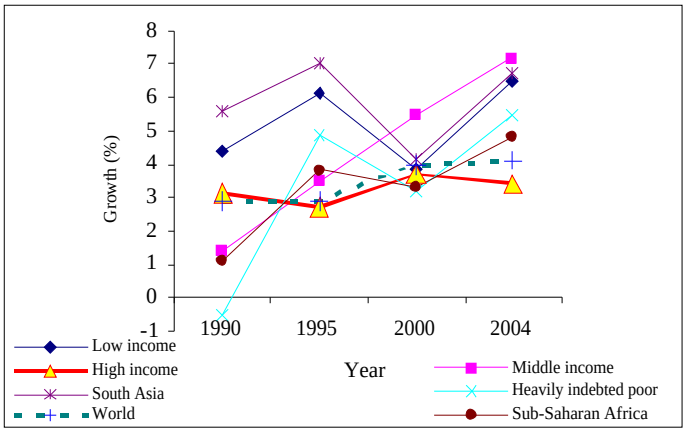
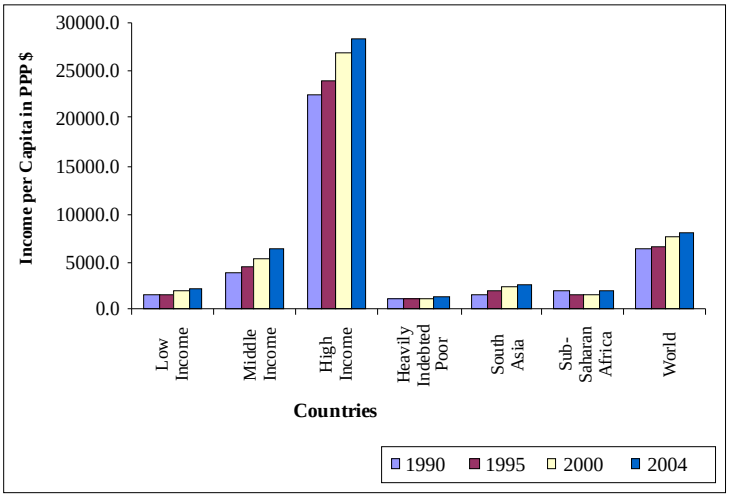


Fig. 2. Income per Capita



[3]The tables and figures are based on the data from World Development Indicators, 2006.

The Figure 1 shows that pattern of growth in the world economy is determined by the growth in high-income countries (Figure 1). In middle-income economies, growth accelerates over the entire period. However, in South Asia and Africa growth rate of GDP fluctuates the same way as growth fluctuates in low income and heavily indebted countries, because majority of low income and heavily indebted countries are located in Asia and Africa. Figure 2 shows that the gap between income per capita of high-income countries and all other group of countries namely middle income, low income, South Asia, Sub Saharan Africa, and highly indebted countries is very large. The income per capita of high-income country is about 3 times higher than average per capita income in the world. The lowest per capita income observed from Figure 2 is for highly indebted countries, which is 6 times lower than the world per capita income and 20 times lower than high-income countries.

Growth performance of any country is dependent on government policies to allocate resources for different purposes, consumption and investment. At the aggregate level, government consumption and investment as percentage of GDP are presented in Figures 3 and 4, respectively. The Figures show smooth pattern of consumption and investment over the entire. They fluctuate in a similar manner, if consumption share is high it remains high, and if it is low it remains low for all group of countries over the entire period.

Fig. 3. Government Consumption Expenditure as Percentage of GDP

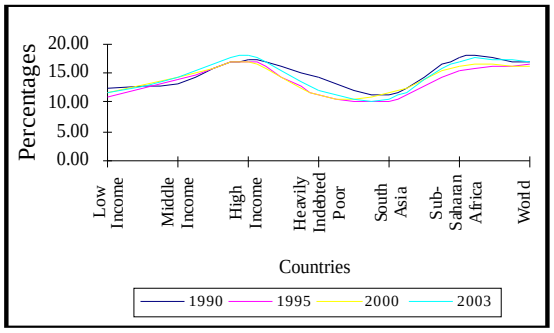
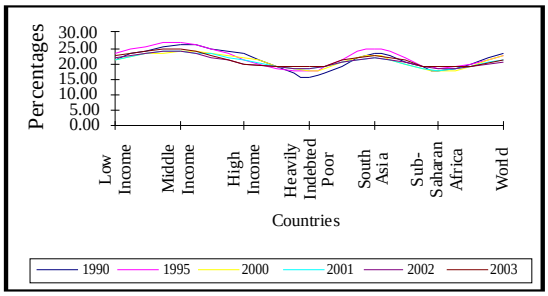


Fig. 4. Gross Fixed Capital Formation as Percentage of GDP



The Figure 4 shows that investment shares in GDP are higher for South Asia than Africa. Conversely, the share of consumption of Sub-Saharan Africa is higher than South Asia. This pattern can be observed in all periods. Higher current consumption level has led lowers saving that ultimately reduce investment and decelerate growth process. The proponents of this approach argue that the poor would only be better off in terms of basic needs satisfaction through the higher income, which can be achieved by higher level of investment. While others argue that direct satisfaction of basic needs—through public provision of social services—benefit more to the poor and increase level of human development as well as productivity.

Figure 5 shows a positive association between growth of GDP and investment, higher the investment the higher would be the GDP. Figure 6 shows a negative association between GDP growth and infant mortality rate, higher the GDP per capita the lower would be IMR—a composite indicator of capabilities development. This indicates improvement in health/decline in infant mortality rate increases productivity.

Fig. 5. GDP Growth and GFCF as Percentage of GDP

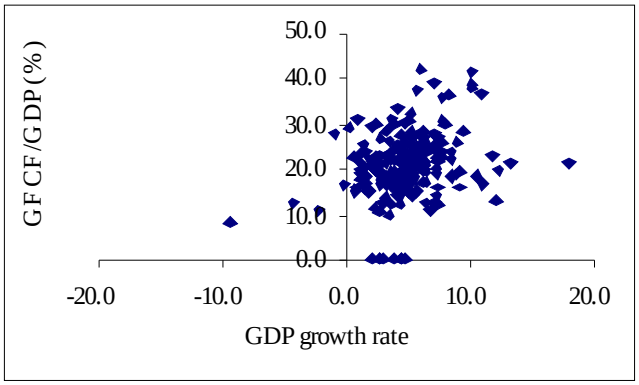
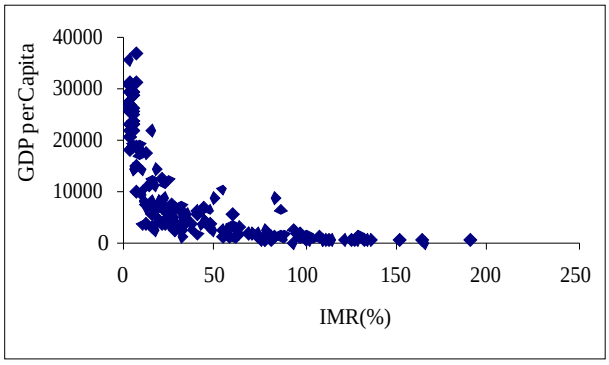


Fig. 6. GDP per Capita and Infant Mortality Rate



A capability indicator—literacy rate (LR) of population of 15 years and above show improvement in all regions over time. It was lowest in South Asia in 1990, 47.1 percent that has increased by 12 percentage points in 14 years lower than the increase in low income countries, where adult literacy rate has increased by 13 percentage points (Table 1).

Table 1

Literacy Rate (%)

	Literacy Rate	
	1990	2004
Low Income	48.58	61.71
Middle Income	80.80	90.49
High Income	100.00	100.00
Heavily Indebted Poor Countries (HIPC)	50.23	62.19
South Asia	47.09	59.52
Sub-Saharan Africa	50.63	–

Source: World Development Indicators (2006).

A comparison across the region shows that literacy rate is by and far the lowest in the South Asia and retain its relative position after 14 years (Table 1).

Health Expenditure as percentage of GDP is lowest for South Asia (lower than in heavily indebted countries and highest for high-income countries (Figure 7). Contrary to education and health indicators, the largest increase in use of sanitation facilities among the developing countries is in South Asia over the base year (see Figure 8). The percentage of households using sanitation facilities and safe drinking water has increased over the last twelve years in all regions (Figures 8 and 9).

Fig. 7. Health Expenditure as Percentage of GDP

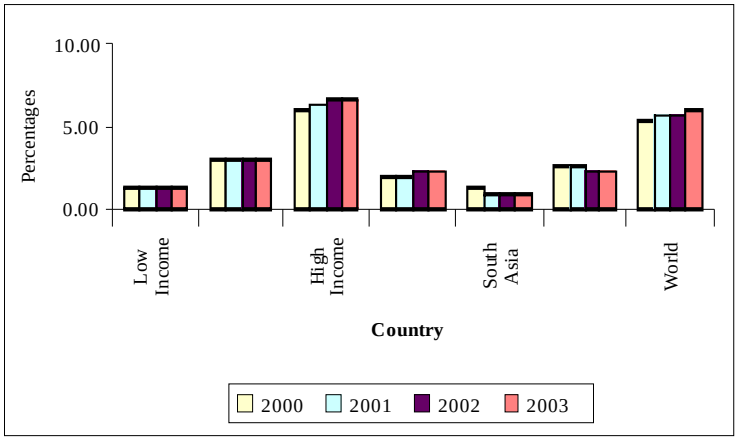
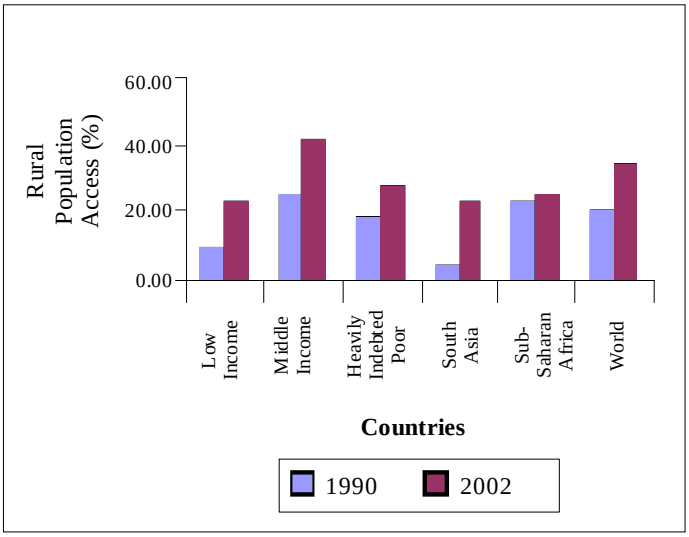


Fig. 8. Sanitation Facilities



The composite indicator of all theses facilities—education, health, sanitation and availability of clean water—is built in infant mortality rate (IMR). In heavily indebted poor countries (HIPC), IMR is highest among the regions; 113.2 deaths per 1000 live births (Table 2). Sub-Saharan Africa also has very high IMR, 110.6 per 1000 live births in 1990, which is coming down too slowly. It seems difficult that these countries will achieve MDG target by 2015. The high-income countries have lowest IMR, 9 infant deaths per 1000 live births in 1990, which has reduced by about 30 percent during 1990-2004. IMR improve in Asia by 20 percentage points over 14 years, while improvement in other regions is slow (Table 2).

Table 2

Infant Mortality Rate

	1990	1995	2000	2004
Low Income	93.92	89.44	83.76	79.45
Middle Income	43.22	39.69	34.67	30.02
High Income	9.34	7.35	6.45	6.12
Heavily Indebted Poor Countries (HIPC)	113.18	108.84	103.40	99.99
South Asia	86.30	79.54	72.38	66.41
Sub-Saharan Africa	110.63	108.78	103.42	100.47
World	63.88	61.74	57.64	54.09

Source: World Development Indicators 2006.

Table 3 shows that income poverty has reduced over time in Asia but has increased in Africa either it is measured at poverty line $ a day or $ 2 a day.[4] Incidence of poverty was higher in Asia than in Africa in 1981, i.e., 51.5 percent and 41.6 percent, respectively. The table also shows that proportion of poor has declined in South Asia from 51.5 percent in 1981 to 31.1 percent in 2002, when measured at $1.0 a day, and it reduced from 89.1 percent to 77.8 percent when measured at $2 a day. Contrarily, in Africa, poverty has increased from 41.6 percent to 44.0 percent at $ a day and from 73.3 percent to 74.9 percent at $2 a day over the same period.

Table 3

Poverty Incidence—Head Count Ratio (%)

	Poverty Headcount Ratio at $1 a Day (PPP) (% of Population)		
Series Name	Year	South Asia	Africa
	1981	51.5	41.6
Poverty Headcount Ratio at $1 a day (PPP) (% of Population)	1990	41.3	44.6
Poverty Headcount Ratio at $1 a day (PPP) (% of Population)	2002	31.1	44.0
	Poverty Headcount Ratio at $2 a Day (PPP) (% of Population)		
	1981	89.1	73.3
Poverty Headcount Ratio at $2 a day (PPP) (% of Population)	1990	85.5	75.0
Poverty Headcount Ratio at $2 a day (PPP) (% of Population)	2002	77.8	74.9

Source: World Development Indicators (2006).

3. MODEL

A small basic needs policy model is developed to determine the priority of basic needs in human development strategy. The model is developed by Ferroni and Ravi (1990). Basic needs—food, education, health, shelter, sanitation and clean water facilities are the factors, which directly raise the standard of living of the poor and the basic needs achievements are considered as inputs into income generation.

Let capabilities development or human capital[5] (B) is a function of direct provision of basic needs (education and health) measured by public expenditure on education and health (E) and income (Y). E and Y are explanatory variables defined on per capita basis to overcome the problem of country size. The equation is as follows:

$$B = \alpha_0 + \alpha_E * E_{PC} + \alpha_Y * Y_{PC} + \mu \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

[4]The poverty estimates may be under estimated as Ravallion, Chen, and Sangraula (2008) indicates that new purchasing power parities for the poorest countries has demanded for a new international poverty line equivalent to one dollar a day. They suggest a new poverty line of 1.25 dollar a day for 2005 (equivalent to $1.0 a day in 1996 US prices. This is based on mean of the line found in fifteen poorest countries. This is the level above which the poverty line tends to rise.

[5]Capabilities development and basic needs achievements are interchangeably used in the paper.

Among basic needs indicators—infant mortality rate (IMR), literacy rate (LR), life expectancy (LE) – IMR is considered the best indicator for capabilities development. It is a composite indicator of at least four basic needs described above. Infants are prone to the availability of the clean water facilities. It has also been considered as an outcome variable of nutrition, health and education and highly correlated with adult mortality rate and life expectancy. Therefore, IMR is used to measure the satisfaction of basic needs in a country.

Country's income is a function of country's basic needs achievements or investment in human capital and productive expenditure or investment in physical (I). Capability indicator—IMR, determines the level of human capital. Both—IMR and I—are used as a predictor of a country's economic performance and the following equation determines their role in income generation.

$$Y_{pc} = \beta_0 + \beta_B * B + \beta_I * I_{pc} + \mu_2 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

For given total resources available for investment and social expenditure, the policy instrument available to us is to alter the composition of expenditure: investment[6] or public provision of social services.

In presence of financial constraint, financial resources (FR) available for physical investment (I) and expenditure on social sectors (E)—education and health (4)

$$FR = E + I \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

The choice between – E and I – determines the role of each of them in income generation. The contribution of capabilities (B) and income per capita (Y) to standard of living is specified as follows

$$W = \gamma_0 + \gamma_B * B + \gamma_Y * Y_{PC} + \mu_3 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

Where,

Y = Income per capita
B = MR—an Indicator used to measure level of capabilities
I = gross fixed capital formation per capita
E = Public Expenditure on basic needs per capita—Education and Health
FR = Financial Resources
W = Standard of living measured by human development—HDI
u = Error term
pc = per capita

[6]Growth strategy refers to economic policies and institutional arrangements [Rodrik (2004)]. We assume that public policy also affect private investment. The constraint here indicates total resources available for accumulation and public expenditure on basic needs such as health and education.

Solving Equations 1 and 3 gives the value of *B* and *Y* in reduced form equations:

$$B^* = \{(\alpha_0 + \alpha_Y\beta_0) + \alpha_E * E_{pc} + \alpha_Y\beta_I * I_{pc}\}/(1-\alpha_Y\beta_B) \quad \ldots \quad \ldots \quad (5)$$

$$Y_{PC}* = \{(\beta_0 + \beta_B\alpha_0) + \beta_B\alpha_E * E_{PC} + \beta_I I_{PC})\}/(1-\alpha_Y\beta_B) \quad \ldots \quad \ldots \quad (6)$$

Substitution the optimal values of B* and Y* in Equation 4 determine the true level of welfare:

$$W* = \frac{\gamma_o(1-\alpha_Y\beta_B) + \gamma_B(\alpha_0 + \alpha_Y\beta_0) + \gamma_Y(\beta_0 + \alpha_0\beta_B)\} + \{(\alpha_E\gamma_B + \alpha_E\beta_B\gamma_Y) * E_{pc} + (\alpha_Y\beta_I\gamma_Y + \beta_I\gamma_Y) * I_{PC}\}}{(1-\alpha_Y\beta_B)} + u \quad (7)$$

The restructuring of government expenditure-the choice between *E* and *I* may be answered in the following way.

$$\alpha_E(\gamma_B + \gamma_Y\beta_B) < \beta_I(\gamma_Y + \gamma_B\alpha_Y) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

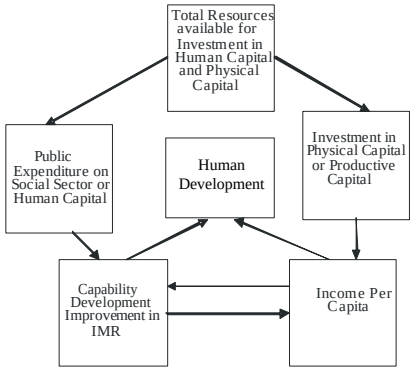
or $\alpha_E(\gamma_B + \gamma_Y\beta_B) > \beta_I(\gamma_Y + \gamma_B\alpha_Y)$

The terms on left hand side and right hand side are coefficients of variables in the equations mentioned above. If a country prefers basic needs achievements then $\gamma_Y = 0$ and the choice depend on the direct and indirect effects respectively.

$\alpha_E > a_Y ß_I$ or
$\alpha_E < a_Y ß_I$

Direct effect comes through public expenditure on basic needs (health and education) and indirect effect comes from income, which increases command over goods and services including basic needs. Human development is measured by taking into account three elements of human life namely health, knowledge, and living standard. HDI is used to measure the level of human development. All these relations are presented graphically in Flow Chart below.

Flow Chart 1. Income, Expenditure on Social Sector and Human Development



The model is block recursive, where first two equations (Equations 1 and 2) in the model are simultaneous equations with two predetermined variables. The estimated values of the IMR from first equation and income per capita from second equations are used as input in the third equation to explore the relative importance of the two in human development strategy of a country. The relationship has been explored in various ways. The endogeniety of variables is checked using Hausman test.

First model is estimated without taking into account the differences across the regions or at the country level. Then dummy variables, additive and multiplicative or interactive dummies are introduced sequentially. Unlike cross section models, with a panel model it is possible to control for the country specific, time invariant characteristics through the use of country specific or region specific fixed effects and random effect by incorporating variation across the countries through random variable. We have used these approaches to estimate reduced form equation of HDI and used Hausman test to select appropriate model.

First intercept dummy and then intercept and slope dummies have been introduced which take into account structural differences between regions. Last, we allow for country specific fixed effect and random effects by introducing random variable that captures country specific differences. The model is estimated using balanced panel data set for 64 countries for the years, 1996 and 2004.

4. DATA

The data have been taken from Word Development Indicators (2006) and Summer and Huston version 6 and Human Development Reports (Various Issues). Data is composed of N=128 with 64 countries. This type of data is called panel data. The data is balanced as each variable for each country is observed twice. There is an advantage of using panel data over a single time series data or cross-country data for one year. With a panel model, it is possible to control for the country specific, time invariant characteristics with country specific intercepts or fixed effects and random effect by incorporating variation across the countries through random variable.

The data include 11 countries from South Asia [5 low income and 6 medium income countries], 18 countries from Africa [14 low income and 4 medium income countries], and rest of the world include [low income (2), middle income (22), high income (11)]. The data show that Asia and Africa consist of low-income countries and rest of the world (ROW) can be categorised as group of high-income countries.

Infant mortality rate is the death rate per 1000 live births. GDP per capita is in PPP$ (purchasing power parity dollar) constant at 2000 prices. Resources constrain (FR) consist of financial resources available for investment (Private+Public) and social expenditure composed of expenditure on health and education in per capita terms. All the variables are in logarithm form in the regression except HDI.

5. RESULTS

5.1. Correlation Coefficient

First a matrix of correlation coefficients is calculated for 1996, 2004 and for the entire period using data from World Development Indicators. The correlation coefficients matrix shows that indicator of satisfaction of basic needs—IMR is highly correlated with income per capita, –0.65. The correlations are higher in1996 than 2004 i.e., the correlation coefficient between IMR and income per capita reduces from –0.69 in 1996 to –0.66 in 2002 (Table 4). This confirms the relationship between the two variables—IMR and GDP per capita—depicted in Figure 5, which shows that the graph becomes steeper at higher level of income [low IMR in high income countries indicate that countries already using more productive labour]. Table 4 shows that negative relationship exists between IMR and accumulation of physical capital.

Table 4

Correlation Coefficient Matrix

Correlation of Infant Mortality Rate (IMR)with	1996-2004	1996	2004	1996 vs. 2004
Income per Capita	–0.67	–0.69	–0.66	–0.66
Gross Fixed Capital Formation/Gross Domestic Product	–0.26	–0.32	–0.19	–0.34
Gross Fixed Capita Formation	–0.27	–0.35	–0.17	–0.36

Figure 1 shows that all group of countries have higher growth in 2004 than 1990. The correlation between IMR in 2004 with investment in 1996 is higher than the correlation with current value of investment. This outcome confirm Hicks (1979) argument that the poor will be better off in the long run in terms of basic needs satisfaction through the higher income realised by higher investment.

5.2. Regression Results

In the literature, two approaches are widely discussed for the estimation with panel data, fixed effect approach and random effect approach. The model has been estimated under the assumptions made for intercept, the slope coefficients and the error term. Before estimation, Hausman test[7] has been used to test endogeniety of infant mortality rate and income per capita. It has rejected null hypotheses that IMR is exogenous. In case of income per capita, it does not reject null hypotheses. Therefore, Equation 1 has been estimated with OLS and Equation 2 with two stage least square techniques using exogenous variables as instruments.

[7]For detail of Hausman test see Mukherjee, White, and Wuyts (1998).

5.2.1. ***Dummy Variable Approach***

(a) First we assume that the intercept and slope coefficient are constant across time and countries and error term captures differences (if any significant difference exist). The results of Equation 1 suggest direction of government move is toward productive expenditure as the coefficient of income per capita is very significant and the coefficient of public expenditure on social services (basic needs expenditure) is not significantly different from zero, –0.73 and –0.14 with *t*-statistics 5.7 and 1.4, respectively. Contrary to Anand and Ravallion (1993), indirect effects of income operating through investment in income earning opportunities out weigh the direct effect of social expenditure. Hence, results of the Equation 1 support the policies to income growth for higher achievements in terms of capabilities (Table 5). In Equation 2, both productivity effect from higher capability (improvement in IMR) and productive expenditure (INV) have significant impact on income generation. This is simply a comparison of marginal productivity between expenditure on education and health and expenditure on productive capital. The results indicate that a unit of expenditure diverted from productive capital to social sector has opportunity cost β_I in terms of income forgone. Nevertheless, it leads to improvement in capabilities, which in turn leads to increase in income. Therefore, we cannot deny the importance of either basic needs expenditure or productive expenditure in human development. The result shows that productive expenditure is more significant and has higher value in absolute term than the coefficient of IMR (productivity of labour). Both of these equations indicate the priority of productive expenditure over basic needs expenditure. Third equation evaluate relative importance of IMR or improvement in capabilities and Y_{pc} or increase in income via increase in productive capital in measuring human development—an indicator of standard of living. The results indicate that human development increases with capabilities development, but income per capita has no impact on it indicating direct route to increase standard of living measured by human development.[8] However, the choice of rout to human development strategy of a country is determined by all the slope parameters of three equations i.e., a combination of productivity and productive expenditures or direct and indirect effects. Substituting the values of estimated parameters from three equations in Equation 8, left hand side of equation 8 become zero with ($\alpha_E = 0$). The results indicate that basic needs has productivity effect as well as feed back effect via income to basic needs as $\beta_B = -0.5$ and $\alpha_Y = -0.73$ are significantly different from zero. Equation 8 reduces to $0 < \beta_I \gamma_Y = (0 < 0.04)$, which implies that investment in physical capital has priority over basic needs expenditure in human development strategy at the global level. However, importance of basic needs cannot be denied. The results show that satisfaction of

[8]The difference between results from Equation 3 and Equation 4 for human development may be due to following reasons. IMR is result of many factors, which have not been included in the analysis due to lack of comparable data availability.

Table 5

Results of the Basic Needs Policy Model

Assumptions	Model I: Intercept and Slope are Same			Model II: Fixed Effect or Least Square Dummy Variable (LSDV) Approach — Intercept Differ by region—Asia, Africa, ROW			Model III: Fixed Effect or Least Square Dummy Variable (LSDV) Approach — Both Intercept and Slope Differ			Model IV: Allows difference for all Individual Countries — Fixed Effect	Model V: Allows difference for all Individual Countries — Random Effect
Dependent Variable	Equation-1 LIMR	Equation-2 LY_{pc}	Equation-3 HDI	Equation-1 LIMR	Equation-2 LY_{pc}	Equation-3 HDI	Equation-1 LIMR	Equation-2 LY_{pc}	Equation-3 HDI	HDI	HDI
C	10.34 (18.5)**	6.5 (9.7)**	0.58 (0.92)	9.13 (13.7)**	6.09 (4.7)**	–0.79 (–1.93)*	10.07 (13.7)**	7.95 (7.31)	0.54 (1.6)		–0.02 (–5.02)
LIMR		–0.48 (–6.5)**	–0.11 (2.1)**		–0.31 (–2.96)**	0.01 (0.23)		–0.61 (–5.6)**	–0.08 (–2.5)**		
LY_{pc}	–0.73 (–5.72)**		0.06 (1.1)	–0.55 (–3.8)**		0.17 (4.96)**	–0.56 (–3.6)**		0.05 (1.79)*		
LEpc	–0.14 (–1.43)			–0.21 (–1.96)**			–0.33 (–2.7)**			0.05 (1.04)	0.03 (1.40)
LIpc		0.51 (8.2)**			0.53 (4.04)**			0.37 (3.47)**		0.11 (3.35)**	0.12 (6.47)**
Intercept Dummy and Slope Dummy											
D_{ASIA}				0.1 (0.81)	–0.65 (–3.56)**	0.06 (2.8)**	4.3 (2.2)**	–1.7 (–1.0)	–0.4 (–0.6)		
D_{AFR}				0.37 (3.3)**	–0.52 (–1.4)	–0.02 (–0.89)	–2.4 (–2.2)**	–4.47 (–3.3)**	0.77 (2.5)**		
DYasia							–0.88 (–2.24)**		0.05 (0.77)		
DIMRasia								0.28 (1.61)	–0.01 (–0.27)		
DIasia								0.09 (0.58)			
DEasia							0.57 (2.04)**				
DYafr							0.11 (0.43)		–0.2 (–1.0)		
DIMRafr								0.48 (2.93)**	–0.16 (–4.3)**		
DIafr								0.41 (3.4)**			
DEafr							0.36 (2.77)**				
R2	0.84	0.95	0.8	0.85	0.93	0.87	0.897	0.96	0.88	0.896	0.897
F	326.1	1227	251.5	177.9	406.1	206.2	139.9	346.8	112.6	Chi2 = 7.34	
Policy Orientation		Growth			Growth			Asia and Africa—Growth		Growth	Growth

Note: Figure in the parentheses are t-statistics. ** Significant at 5 percent. * Significant at 10 percent.
Intercept Dummies : D_{ASIA} = 1 for Asia otherwise 0, D_{AFR} = 1 for Africa otherwise 0 , Multiplicative Dummies: for income per capita: DYasia for Asia and DYafr for Africa, For IMR : DIMRasia, DIMRafr, **For** Investment per Capita = DIasia, DIafr, For Public Expenditure on Education and Health = DEasia, DEafr, afr = Africa.

basic needs has productivity increase effect leading to increase in income that effect feed back to IMR (satisfaction of basic needs) in Equation 1.

These results at the global level may not apply to different regions or different countries. Because assumption of that the intercept and slope are identical for all regions is too restrictive that may distort the picture of these relationship across the regions. Therefore, the model is re estimated under the assumptions (i) intercept differs, and (ii) intercept and slope differ by regions. The intercept dummies and intercept and slope dummies are introduced in all the three equations to distinguish the effect at the regional level and the results are discussed in the following sections b and c.

(b) The Slop Coefficients are Constant but Intercept Varies by Regions

The same model is estimated after incorporating intercept dummies for Asia and Africa. The model assumes that intercept does not vary over time but it does across the regions assuming ROW is base category. The results obtained here differ from the results obtained in section (a)—the base case. Income and basic needs expenditure have significant impact on IMR. However, the value of the coefficient of income per capita reduces from 0.73 to 0.55 in absolute term and the effect of the basic needs expenditure on IMR increases from 0 to 0.21 percent. In Equation 2, direction of change and significance remains the same but coefficients differ quantitatively by small amount. In Equation 3, introduction of variation across the regions through intercept dummies reverse the out come. The results show that IMR does not affect HDI, but one percent increase in income per capita increase human development by 0.17 percent that is higher than the effect of IMR on HDI in first model.

In Equation 1, intercept dummy is significant for Africa but not for Asia that indicates that intercept is same for Asia and ROW but Africa differs from rest of the world. The difference is small, by 0.37 points over the base category of 9.13. These differences in the intercepts indicate Africa has unique features that differ from ROW. The results of Equations 2 and 3 indicate that Asia differs from rest of the World. Restricted F-test shows that restricted form of estimation of equations (without intercept dummies for regional characteristics) is not valid. We should introduce binary variables to distinguish region specific differences. With little difference between the slope coefficients in unrestricted equation and restricted equations, conclusion remains the same that indirect route—via expenditure on productive capital to increase income to human development—has priority in human development strategies.

(c) All Coefficients (Intercept as well as Slope) Vary by Region

At the third stage, model is estimated by assuming that intercepts and slopes are different for different regions, Asia, Africa and ROW.[9] Here, additive as

[9]Alternatively, we have estimated the model for different regions, namely, Asia, Africa and ROW and results and brief discussion is reported in Appendix I.

well as multiplicative or interactive dummies are introduced for all variables on the right hand side for both Asia and Africa. The model assumes that relationships are different from each other for Asia, Africa, and ROW and can be estimated separately.[10] We assume that ROW is a base category.

First, results are discussed for the base category, the countries other than Asian and African. In Equation 1, the coefficient of income per capita reduces from 0.73 to 0.56 in absolute term but basic needs expenditure has become significant. The coefficient of government expenditure on basic needs (education and health) changed to (–0.33) from 0 in model 1 and from (–0.21) in model 2. This indicates regional differences, which remains hidden in the absence of intercept and interactive dummies. In the second equation the coefficient of IMR (capability) increases but the coefficient of physical capital reduces in absolute terms, from (–0.48 to –0.61) and (0.51 to 0.37) respectively. We may conclude that in this group of countries, increase in physical capital contribute more than human capital to income [as they already have high human capital (Low IMR). The results for equation three differ from the results of earlier two version of the model. The results of Equation 3 indicate that income per capita and IMR are significant at 5 percent and 10 percent, respectively. Whereas in the earlier two models only one variable is significant, IMR in the first model and income per capita in second model. Introduction of structural differences between the regions through slope dummies, change the earlier results. Both variables, IMR and income per capita, affect HDI significantly. In the absence of dummy variables for regions, regional differences remain hidden, which must be taken into account before drawing any policy implication.

In all the three equations, intercept differs for Africa. The sign of intercept dummy in Equation 1 for Africa changes from positive to negative. This is expected due to following reasons. First, intercept for ROW increases from 9.13 in model 2 to 10.1 in model three. Due to negative sign the function shift down ward for Africa. The slope coefficients for each region are calculated from Table 5 and reported in Table 6. The results indicate that all intercept and slope coefficients differ from ROW, but no structural difference is found in Equations 2 and 3 from ROW. For Africa, intercept differs from ROW in all the three equations. The slopes coefficients for Africa also differ from ROW for basic needs expenditure in equation one. In equation two structural differences are more prominent as all the three parameters intercept as well as slope differs from ROW. In Equation 3 impact of capabilities development on HDI is higher by 0.16 points. The relationship is further explored by estimating model independently for each region.[11] The results show that basic needs expenditures have no impact on IMR in Africa (see Box 3 in Appendix I).

[10]The model is estimated for Asia, Africa and ROW and results are briefly discussed in Appendix I.

[11]The same model is estimated for three regions independent of each other (see results in Appendix I).

Table 6

Slope Coefficient across the Regions

Equation 1(LIMR)	LY_{PC}	LE_{PC}	LHDI	LY_{PC}	LIMR
ROW	–0.56	–0.33	**ROW**	0.05	–0.08
Asia	–1.44	0.24	**Asia**	0.05	–0.08
Africa	–0.56	0.03	**Africa**	0.05	–0.24
LY_{PC}	**LIMR**	**LI_{PC}**			
ROW	–0.61	0.37			
Asia	–0.61	0.37			
Africa	–0.13	0.78			

The results indicate that elasticities of productivity and expenditure on productive capital with respect to income are same for Asia and ROW but not for Africa (see Table 6). This is simply a comparison of expenditure on education and health and expenditure on productive capital. The slope coefficient for productivity (capabilities) is higher for ROW than Africa, From Box 3 in Appendix I, it shows that the coefficient of IMR (productivity is insignificant also. The contribution of productive capital is higher for Africa (see Table 6). These results indicate structural differences among the regions.

In Equations 3 and 4 for HDI, intercept and interactive dummy variables for Asia are not significant. Therefore, Asia and ROW have similar relationship (Table 6). However, this relationship differs for Africa as intercept and multiplicative dummy for Africa are significant at five percent level.

F-test using restricted and unrestricted R-square indicate that relationship differ by region for Equations 1 and 3. However, in case of Equation 2, hypothesis is not rejected. The calculations based on Equation 8 show, despite difference in the relationship among variables in Africa and Asia from ROW, the conclusion remains the same that indirect effect on human development through higher income is larger for all the three regions, Asia, Africa and ROW. These differences are not same for Asia and Africa, and the relationship has been further explored in Appendix I by estimating model for three regions, Asia, Africa and ROW separately.

In the next section, differences at the individual country level have been incorporated in the model and estimate reduced form equation of HDI—Equation 7—using fixed effect and random effect approach.

(d) Fixed Effect Approach Assuming Variation across all Individual Countries

The Equation 7 for HDI is estimated in reduced form by taking into account differences across all individual countries (Fixed Effect). Results are reported in Table 5. The results show that coefficient of public expenditure on basic needs is insignificant but the coefficient for productive capital is very significant. The result

that expenditure on productive capital has significant effect on human development still remains valid, when we allow variation at the individual country level.

5.2.2. *Random Effect Approach*

Fixed effect approach to estimate model is easy to apply but it can be expensive in terms of degree of freedom, if we do not have a large number of cross sectional units. Random effect approach (or error component model-ECM) overcome this problem. The effect of unobservable factors is introduced through error term. A comparison of the coefficients of government expenditure on social sector and productive capital shows that the value of the coefficient of productive capital is significant as well as greater than the coefficient of basic needs expenditure. This implies that route to satisfaction of basic needs is indirect. In ECM we control for individual country specific characteristics. The conclusion that growth oriented policies has priority in human development strategies remains valid. Ravallion (1997) also admits that sustained improvements in welfare are best brought by increasing income. On the other hand, Dollar and Krray shows that spending on basic services is not pro poor, therefore, it does not have significant effect on human development [Henmer, *et al.* (2003)].

Hausman[12] test is used for the selection between RE and FE.[13] The test is performed on the coefficients of explanatory variables only [excluding mean value of random variable in random effect model and intercepts in FE]. Chi^2-statistics reject fixed effect model. That implies that variation exist at the individual country level.

5.3. Decomposition Analysis

If we look at the socio economic indicators, Pakistan lags far behind not only from developed world, but also within region—Asia (Table 7).

Table 7

Pakistan's Position against the Average of Selected Countries

Variables	Mean of Sample	Pakistan	Difference from Mean
Full Sample			
Income Per Capita	8700.6	1947.6	–6753.0
Government Expenditure on Basic Needs—Health and Education	864.9	62.8	–802.2
Gross Fixed Capital Formation per Capita	1926.5	353.0	–1573.5
Human Development Index	0.7	0.4	–0.3
Infant Mortality Rate	41.9	87.6	45.7
Asia			
Income Per Capita	5278.5	1947.6	–3330.9
Government Expenditure on Basic Needs—Health and Education	308.2	62.8	–245.4
Gross Fixed Capital Formation per Capita	1605.8	353.0	–1252.8
Human Development Index	0.7	0.4	–0.3
Infant Mortality Rate	45.4	87.6	42.2

[12]The test checks a more efficient model against a less efficient.

[13]We dropped the values of country specific intercept from fixed effect and mean value and the variation around it by country from the table.

The Table 7 shows that Pakistan's income per capita is less than the world average by 6753 in PPP dollar. However, difference reduces to half when Pakistan income per capita is compared with average income per capita in Asia. The per capita expenditure on social sector in Pakistan is 1/12th of the world and 1/4th of the average in Asia. Similarly, capital formation is one-fifth and one-third of the level in the world and in Asia respectively. Average level of IMR is same in the world and in Asia but it is higher in Pakistan. Human development is low in Pakistan compared to in the World and Asia.

The decomposition analysis identifies relative contribution of various factors for high IMR, low income per capita and human development. A decomposition analysis[14] can be defined as follows.

$$Z_P - \overline{Z_i} = \beta_{1i} * (X_{P1} - \overline{X}_{i1}) + \beta_{2i} * (X_{P2} - \overline{X_{i2}}) + \varepsilon \qquad \ldots \qquad \ldots \qquad (9)$$

Where

Z = Variable on left hand side (LHS)
X = variables on right hand side (RHS)
$\overline{Z}$ = mean value of Z
$\overline{X}$ = mean value of X
P = Pakistan
i = Asia, World

X's can be increased to k number of variables on right hand side. The results in Table 8 shows how much difference in IMR is explained by income per capita and government expenditure on social sector(health and education), how much variation in income per capita over mean value is explained by productivity and productive capital. Finally, the contribution of income per capita and capability development (lower IMR) to difference in HD is calculated based on Equation 9.

Table 8

Decomposition of Effects by Factors

Full Sample			Asia		
Decomposition of Factors on IMR			Decomposition of Factors on IMR		
IMR	LYPC	LEXP	IMR	Income per Capita	Government Expenditure on Social Sector
0.74	1.09	0.63	0.66	1.46	–0.38
Decomposition of Factors on Income per Capita			Decomposition of Factors on Income per Capita		
Ypc	LIMR	LINV	Ypc	lIMR	lINV
–1.50	–0.35	–0.87	–1.00	–0.35	–0.45
Decomposition of Factors on HDI			Decomposition of Factors on HDI		
HDI	LIMR	LYPC	HDI	LIMR	LYPC
–0.30	–0.05	–0.15	–0.27	–0.02	–0.16

[14]Shehzad (2003).

The results show that in all equations, the contribution of income per capita and productive capital is larger than other variables. The results also show that to achieve the level of average prevailing in the world, Pakistan should increase investment more than expenditure on health and education to the average level in the world.

6. CONCLUSION

The countries are different in their history, culture, resource endowment and political institutions. Hence, they face a different set of problems, opportunities and constraints. They adopt different set of policies to allocate resources for different purposes and arrive at different level of development. The government must choice between different types of expenditures to achieve higher human development, higher capabilities, and higher income.

The paper explores the priority of productive expenditure (accumulation of physical capital) and basic needs spending (expenditure on social sector) in human development strategies of the countries. However, it is difficult to assess because of the complex chains of linkages. The study estimates a basic needs policy model [Ferroni and Kanbur (1990)] of three equations to understand these linkages at the macro level. The model is a type of block recursive.

The results show that the effect on basic needs satisfaction is indirect at the global level—the higher income per capita leads to higher level of capabilities. The higher level of capabilities lead to higher level of per capita income. Although both improvement in IMR and income per capita positively affect human development, but income per capita play superior role over basic needs expenditure at the global level.

Dummy variable approach (additive as well as multiplicative dummy) for various regions, Asia, Africa and ROW, shows that results differ by regions, but main conclusion remains the same that productive expenditure is prioritised in human development strategies. The model is also estimated separately for each region, Asia, Africa and ROW. Although the variation across the regions exists in terms of quantitative impact and significance of the variables but conclusion remains the same. The same conclusion also holds when variation for individual countries is allowed by estimating model by fixed effect and random effect approaches. Random effect approach is selected on the basis of Hausman test. The results show that variation in human development strategies exist across individual countries.

The overall results show that route to human development goes from growth oriented policies to capabilities development that ultimately increases income and led to improve IMR. Therefore, income as well as public expenditure on social sector is necessary for human development despite income has priority in development strategies. Decomposition analysis shows that Pakistan need to increase expenditure on productive capital (investment) than on education and health to achieve the level prevailing in the region as well as in the world.

The conclusion drawn above is tentative given that model is static and lags in impact of certain variables are not considered in this study. So far, econometric estimation consists of model without and with regional dummies, fixed effect, and random effects approaches estimated by OLS and TSLS methods. The results of the study provide a basis to achieve the goal of human welfare through growth oriented policies. Hence, institutions are important to determine the level of achievements. Further research would explore the role of institutions. It is also necessary to explore pattern of growth necessary for poverty reduction. In addition, variables such as IMR and Welfare are results of many factors, which have not been included in the analysis due to lack of comparable data availability.

APPENDIX I

The model is re estimated separately for three regions namely Asia, Africa, and ROW. The results are presented in Boxes 2, 3, and 4. The aggregate results for the world are same which are discussed in the main text and reproduced here in Box 1 for comparison. The results show that route to human development goes from growth oriented policies to capabilities development that ultimately increases income, which lead to improving IMR for all regions, but the importance of IMR cannot be denied in terms of capabilities development or improvement in health status that ultimately increase productivity (see Boxes 2–3).

The results show that in Asia, the effect of income per capita on IMR is three times higher than the impact in Africa, (–1.46 and –0.46) [Box 2 and 3]. Contrarily, the effect of expenditure on productive capital on income—elasticity on income per capita with respect to productive capital—is higher for Africa than Asia: 0.79 and 30, respectively. Improvement in health indicator—IMR—leading to increase in labor productivity has no influence income in Africa but has significant impact in Asia. The results show that one percent decline in IMR in Asia increase income per capita by 0.53 percent. Basic needs indicator—IMR—has no impact on HD for both regions, Asia and Africa. Though expenditure on productive capital in Africa has higher income generating impact but this income does not translate into higher human development. Contrarily, in Asia, expenditure on productive capital and productivity increase (improvement in IMR) bring significant impact for human development.

The third group of country is largely dominated by medium and high income countries. The results show that improvement in IMR improves productivity that lead to increase in income per capita by 0.56 percent due to decline in IMR by one percent. On the other hand, one percent increase in investment increase income per capita by 0.42 percent. Further calculations show, that main conclusion remains the same for all regions i.e., income per capita has priority in human development strategies.

Box 1. Development Strategy and Human Development—All countries

Eq No.	Dependent Variable	Variable on Right Side	Coefficients	Value	*t*-statistics	R2	F	N
1	IMR	E	α_E	–0.14	–1.43	0.84	326.1	128
		Y_{pc}	α_Y	–0.73	–5.72			
2	Ypc	IMR	β_B	–0.48	–6.5	0.95	1227	128
		I	β_I	0.51	8.2			
3a	HDI	IMR	γ_B	–0.31	–3.0	0.83	3507.9	128
		Y_{pc}	γ_Y	0.53	4.04			
3b	HDIF	IMR	γ_B	–0.11	2.1	0.80	251.5	128
		Y_{pc}	γ_Y	0.06	1.1			

Priority in human development strategy determined by

EQ8 — $\alpha_E(\gamma_B + \gamma_Y\beta_B) >< \beta_I(\gamma_Y + \gamma_B\alpha_Y)$

The equations 1–3a indicate that $\alpha_E = 0$

EQ8 reduces to = 0 < 0.08

The equations 1–3b indicate that $\gamma_Y = 0$ and $\alpha_E = 0$

EQ8 reduces to = 0 < 0.04

⇒ Accumulation of physical capital has priority in government strategy for human development.

Box 2. Development Strategy and Human Development in Asia

Eq No.	Dependent Variable	Variable on Right Side	Coefficients	Value	t-statistics	R2	F	N
1	IMR	E	α_E	0.24	1.15	0.89	86.55	22
		Y_{pc}	α_Y	–1.46	–4.85			
2	Ypc	IMR	β_B	–0.53	2.23	0.95	189.8	22
		I	β_I	0.30	–3.40			
3a	HDI	IMR	γ_B	–0.16	–1.82	0.82	49.60	22
		Y_{pc}	γ_Y	0.02	0.22			
3b	HDIF	IMR	γ_B	–0.03	–0.60	0.80	42.9	22
		Y_{pc}	γ_Y	0.16	2.44			

Priority in human development strategy determined by

EQ8 — $\alpha_E(\gamma_B + \gamma_Y\beta_B) >< \beta_I(\gamma_Y + \gamma_B\alpha_Y)$

The equations 1–3a indicate that $\alpha_B =$ and $\gamma_B =$

EQ8 reduces to $0 > \beta_I\gamma_Y or 0 < \beta_I\gamma_Y$ = –0.04 < 0.08

The equations 1–3b indicate that $\alpha_B =$ and $\gamma y =$

EQ8 reduces to –0.03 < 0.06

⇒ Accumulation of physical capital has priority in government strategy for human development.

Box 3. Development Strategy and Human Development in Africa

Eq No.	Dependent Variable	Variable on Right Side	Coefficients	Value	t-statistics	R2	F	N
1	IMR	E	α_E	0.03	0.22	0.59	26.25	36
		Y_{pc}	α_Y	–0.46	–2.40			
2	Ypc	IMR	β_B	–0.10	–0.69	0.95	302.3	36
		I	β_I	0.79	12.87			
3a	HDI	IMR	γ_B	-0.17	-3.78	0.69	39.8	36
		Y_{pc}	γ_Y	0.05	2.06			
3b	HDIF	IMR	γ_B	-0.15	-0.79	0.56	23.4	36
		Y_{pc}	γ_Y	0.07	0.81			

Priority in human development strategy determined by

EQ8 — $\alpha_E(\gamma_B + \gamma_Y\beta_B) >< \beta_I(\gamma_Y + \gamma_B\alpha_Y)$

The equations 1–3a indicate that $\gamma_B =$ and $\beta_B =$

EQ8 reduces to = –0. 01 < 0.10

The equations 1–3a indicate that $\gamma_B = 0$, $\beta_B = 0$, and $\gamma_y = 0$, $\gamma_B = 0$,

EQ8 reduces to –0.005<0.11.

⇒ Accumulation of physical capital has priority in government strategy for human development.

Box 4. Development Strategy and Human Development for Medium and High income Countries

Eq No.	Dependent Variable	Variable on Right Side	Coefficients	Value	t-statistics	R2	F	N
1	IMR	E	α_E	–0.33	–2.55	0.84	187.2	70
		Y_{pc}	α_Y	–0.58	–3.38			
2	Ypc	IMR	β_B	–0.56	–5.21	0.92	439.4	70
		I	β_I	0.42	4.03			
3a	HDI	IMR	γ_B	–0.02	–1.18	0.7	115.6	70
		Y_{pc}	γ_Y	0.10	5.11			
3b	HDI	IMR	γ_B	–0.04	–1.41	0.78	120.0	70
		Y_{pc}	γ_Y	0.08	2.74			

Priority in human development strategy determined by

EQ8 — $\alpha_E(\gamma_B + \gamma_Y\beta_B) >< \beta_I(\gamma_Y + \gamma_B\alpha_Y)$

The equations 1–3a and 3b indicate that $\gamma_B = 0$

EQ8 reduces to $0 > \beta_I\gamma_Y or 0 < \beta_I\gamma_Y$ = 0 .03 < 0.05

⇒ Accumulation of physical capital has priority in government strategy for human development.

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