Human Capital Advanced Investment and Its Effects on Economic Growth

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Abstract: *This paper created the Human Capital Relatively Advanced Investment (HCRAI) index to compare human capital investment in China and other countries. The HCRAI comprises life expectancy and average length of schooling adjusted for GDP per capita to measure the degree to which a country has invested in human capital in the early stage. Our study found that in 2014, China ranked much higher on the HCRAI index than on GDP per capita. The fact that China was far ahead of the United States on the HCRAI ranking suggests that China had invested more in human capital. Since the 1970s, China's HCRAI ranking has experienced an inverted U-shaped curve, increasing at first and ranking first in the world in 1980 before declining in a later stage. That is to say, China has invested somewhat less on human capital in relative terms in the post-reform era. International data comparison showed that the HCRAI index may largely explain a country's long-term economic growth rate, justifying the continuity in China's six-decade development before and after reform and opening up in 1978. By replacing the existing absolute indicators with relative indicators, this paper measures the level of human care in China, reflecting the concept of fairness. The international comparison and long-term evolution of the HCRAI index offer a new perspective for the new normal of China's economy and supply-side structural reforms. China's declining HCRAI ranking over the past three decades indicates the importance of a more inclusive and sustainable development path that puts human first.*

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1. Introduction

After four decades of reform and opening up, China has emerged as the second largest economy and the largest exporter with the highest manufacturing output in the world. For a large country of over 1.4 billion people, such an achievement is nothing short of a miracle. Yet behind the brilliant economic data, social problems, such as corruption, uneven wealth distribution and the loss of upward mobility, loom large, posing threats to social security and human development in the long run. In the face of uneven development and social inequities in the transition stage, China has embraced the concept of "putting human first," recognizing that all-round human development is pivotal to the socialist approach to development (Zhang, 2010).

Since reform and opening up in 1978, China's economic growth has long been driven by material input and capital accumulation. Yet in recent years, more prominence has been given to human care and

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human capital. China's rise from a poor and precarious country to the world's second largest economy could not have been possible without a long-term commitment to human development. This paper contends that China's rapid development over the years is underpinned by relatively advanced human capital input.

We define "relatively advanced human capital investment" as the level of human capital input ahead of a country's development stage.[1] It requires a country to broadly share the benefits of development among its people, address the basic needs of vulnerable groups, and entitle the vast majority of social members to their basic rights to survival and development while recognizing their different contributions to society. That is to say, a country should devote a greater proportion of limited resources to human capital to benefit the vast majority of people.

Human capital investment makes a big difference in a country's long-term economic growth (Li, *et al*., 2010; Barro and Sala-I-Martin, 1992; Lucas, 1989; Romer and Paul, 1986; Acemoglu and Johnson, 2007). Regretfully, none of the existing metrics captures the relativity in extent of importance attached to human capital investment. Human capital is reflected as a stock under the income and cost approaches. It is often denoted by such proxy variables as the average length of school and literacy rate. As a more subjective concept, however, human care must be reflected by a multitude of dimensions instead of a single absolute value.

Published by the Sustainable Governance Indicators (SGI) project,[2] the Bertelsmann Stiftung on social justice (BS) database offers a common evaluation system for a country's level of human care on five dimensions, including poverty prevention, educational equality, labor market inclusiveness, social cohesion and equality, and intergenerational fairness. Most international comparative studies have relied on these indicators for measuring human development in various countries (Merkel and Heiko, 2009; Kauder and Potrafke, 2015; Bertelsmann, 2011). Helmy (2013) refined and edited Bertelsmann's data to estimate social justice in 40 developing countries. Despite their standardization treatment of data and selection of a certain percentage of data (mostly in %), the social justice index remains an absolute indicator that takes no account of a country's level of development as reflected by GDP.

In analyzing the economic growth of transition economies, Tridico (2010) measured inequality by literacy, public expenditure, and life expectancy. Similar to Tridico, the United Nations Human Development Index (HDI) is another common system for measuring a country's level of human development. The HDI consists of three indicators, including a long and healthy life, being knowledgeable (2/3 for adult literacy rate and 1/3 for the enrolment ratio), and a decent standard of living (gross national income per capita). Giving each dimension an equal weight, the HDI is an aggregation of weighted absolute indicator values.

In measuring human care, all the indicators are concerned with absolute values, but cannot fully reflect the level of importance a country attaches to human capital investment, not to mention human development. They are more like proxy variables of absolute human capital investment. Absolute indicators are more appropriate for evaluating advanced economies. With higher gross national income and sound social systems, the developed world naturally boasts better education and longer life expectancies. Yet despite these gaps, developing countries may attach no less importance to human care and human capital compared with developed countries.[3] Unlike existing measurement systems, this paper is concerned with the extent to which a country attaches importance to human capital investment and not just the absolute level of human capital. As a relative indicator, the human capital relatively

[1] In this paper, "human capital relatively advanced investment" is a relative concept. The term "relatively advanced" means that a country has invested more in human capital relative to other countries in the same stage of economic development. The detailed definition and measurement of this concept will be elaborated in Section 2.2.

[2] SGI database: http://www.sgi-network.org.

[3] In this paper, "country" may refer to not only the government of a country, but its people, firms and social organizations.

advanced investment (HCRAI) goes beyond the concept of human capital. A developing country that devotes a greater proportion of its limited resources to fostering human capital can be deemed as a country that attaches greater importance to human capital investment. If a country's human capital investment exceeds the average level of other countries in the same development stage, it is be regarded as relatively advanced in human capital investment.

In this sense, the issue that whether a country is relatively advanced in its human capital investment is dependent on its national conditions. As the Chinese saying goes, "a son's filial piety should be measured by his sincerity and not just his deeds." Similarly, the HCRAI index measures the degree to which a country strives to care for ordinary people in terms of the proportion, rather than sheer size, of resources invested in human capital.[4] That is to say, a country is relatively advanced in human capital investment when it attaches greater importance to human care and social justice.

This paper attempts to create relative indicators to compare China's HCRAI index with those of other countries to reflect a real picture of China's human capital investment. Our findings help assess China's economic potentials for overcoming the "middle-income trap" and maintaining rapid growth, refute accusations made by some Western countries that China had paid little attention to human development, and reveal change in China's human capital investment as policy-making reference for China's "people first" strategy and transition of growth drivers in the new stage.

2. Human Capital Relatively Advanced Investment (HCRAI) Index

Based on the above considerations, this paper attempts to create a new set of indicators to measure how much importance a country has attached to human care and human capital investment relative to its level of economic development. This paper selects life expectancy and school life expectancy from primary to tertiary stages of education to arrive at the human capital relatively advanced investment (HCRAI) based on data from the World Bank's World Development Indicators (WDI) database, the UNDP Human Development Report database, and the UNESCO's UIS database.

First, we established GDP per capita's regression relationship with life expectancy and school life expectancy. With GDP per capita as an independent variable, we performed a regression analysis of life expectancy and school life expectancy, and arrived at the fitted values of life expectancy and school life expectancy through the regression equation.

Growth in life expectancy and school life expectancy decreases with the rise of GDP per capita (Gou, 2011; Chen and Wei, 2010; Liu and Jian, 2011). Hence, this paper creates a regression model of the natural logarithm of GDP per capita in relation to life expectancy and school life expectancy, as shown in equation (1).[5] Figure 1 and Figure 2 are scatter diagrams of each country's GDP per capita in relation to life expectancy and school life expectancy. As can be seen from the distribution of sample points, the logarithmic form is an appropriate choice for the regression model.

$$\begin{cases} \exp edu_i = \alpha + \beta \ln GDP_i + \varepsilon_i \\ \exp life_i = \varphi + \lambda \ln GDP_i + \mu_i \end{cases} \quad (1)$$

Where $expedu_i$ and $explife_i$ respectively denote school life expectancy and life expectancy at birth, respectively, lnGDP is the natural logarithm of GDP per capita, and i is country. Through equation

[4] Notably, the difference between absolute and relative indicators discussed in this paper is not whether they reflect a country's level of development but whether they are adjusted for a country's level of development (such as GDP per capita) to form indicators to compare the development concepts of countries in the same stage of development. Relative indicators measure the relative importance attached by a country to human capital investment during a specific stage of development; absolute indicators measure the level of human capital stock (absolute value) attained by a country at a certain point in time. In Section 2, this paper will explain in detail the creation of relative indicators.

[5] In comparing the goodness of fit R^2 of various non-linear models, it can be found that the logarithmic function model has the highest R^2, indicating a good fit. More importantly, the logarithmic function is characterized by first derivative greater than zero and second derivative smaller than zero. As GDP per capita grows, life expectancy at birth will increase but at a slowing pace.

(1), we may obtain the fitted values E($expedu_i$) and E($explife_i$) of $expedu_i$ and $explife_i$, and measure the degree of a country's relatively advanced human capital investment by the difference between actual and fitted values. For a country that attaches greater importance to human capital, the actual values should be much higher than average fitted values, and vice versa. With the Human Capital Relatively Advanced Investment (HCRAI) index, we standardized the differences of school life expectancy and life expectancy at birth to arrive at S[$expedu$-E($expedu_i$)] and S[$explife$-E($explife$)], whose weighted aggregation gives us each country's HCRAI index. As a basic dimension of human care, survival is given a 70% weight, and education is given a 30% weight.[6] The HCRAI is calculated with equation (2):[7]

$$HCRAI_i = 0.3S[\exp edu_i - \mathrm{E}(\exp edu_i)] + 0.7S[\exp life_i - \mathrm{E}(\exp life_i)] \quad (2)$$

Unlike existing studies, this paper creates relative values to replace absolute values. By calculating the differences with the fitted values of life expectancy at birth or school life expectancy versus GDP per capita, this paper obtained itemized data of the HCRAI index. In this manner, a country's life expectancy at birth or school life expectancy are compared with the average levels of countries in a similar development stage, i.e. GDP per capita. This approach avoids the individual heterogeneity of countries in different development stages. After decades of socio-economic development, advanced economies naturally boast better healthcare and education compared with emerging economies. Life expectancy and years of schooling are correlated with economic development. Yet the importance a country attaches to education and healthcare should be reflected in the percentage of resources devoted to these endeavors. Instead of comparing the absolute results, this paper is more concerned with how a country distributes its resources to promote human capital. That is to say, despite poorer healthcare and education, a small

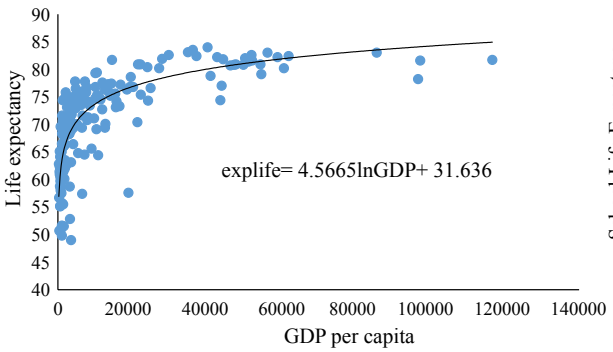

Figure 1: Life Expectancy vs. GDP per Capita for Various Countries in 2014

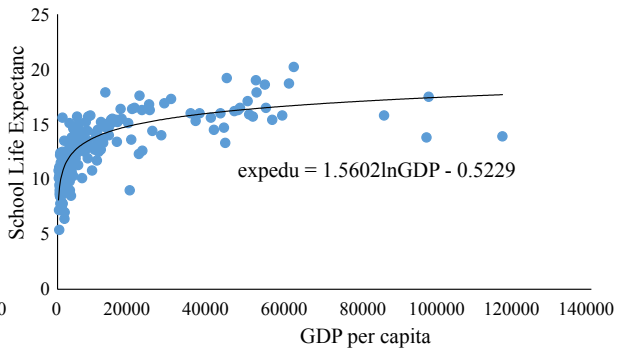

Figure 2: School Life Expectancy vs. GDP per Capita for Various Countries in 2014

[6] The HCRAI index is created in two scenarios with health and education given 60% and 40% weights and each given a 50% weight, respectively. In comparison, we believe that (i) China's ranking showed a consistent inverted U-shaped trend, increasing at first before declining in the late stage; (ii) China's ranking consistently outperformed major economies including the US and the UK in both scenarios; (iii) the HCRAI's correlation coefficient is highly significant at various weights. Take 2014 for instance, the correlation coefficient is 0.993 and 0.971 at 7:3 and 6:4 weight ratios for life expectancy and school life expectancy, respectively, and is highly significant. The conclusions thus obtained are not contingent upon the choice of weight. That is to say, the result of the HCRAI index's calculation is robust.

[7] In creating the HCRAI index, we also considered calculating the ratios between actual and fitted values, i.e. $HCRAI_i = 0.3\frac{\exp edu_i}{\mathrm{E}(\exp edu_i)} + 0.7\frac{\exp life_i}{\mathrm{E}(\exp life_i)}$. Yet the ratio method was scrapped since it may reduce the score and ranking of developed countries with the highest GDP per capita. This problem can be effectively avoided with the difference method. Also, we estimated the HCRAI index's correlation coefficient under the two methods, respectively, which is fairly high. Take 2014 for instance, the correlation coefficient is 0.977 and highly significant (P= 0.000). The two methods led to highly similar index results, indicating the robustness of this index and research results that are not subject to any specific method.

economy can be deemed as relatively advanced in human capital investment if it commits a fairly big percentage of available economic resources to healthcare and education. With the HCRAI index, this paper reflects a better picture of how much importance countries have attached to human capital.

Referencing the HCRAI index, this paper measures the levels of health and education by life expectancy and school life expectancy as proxy variables for social members' rights to survival and development, respectively. Based on each country's development stage, health and education indicators are processed into relative indicators to reflect the extent to which each country has worked to protect their people's rights to survive and development. That is to say, a higher HCRAI index means greater importance that a country attaches to protecting their people's rights to survival and development relative to other countries in the same development stage. An increase in this index, however, requires the vast majority of people in the country to experience an equal or faster growth in life expectancy and school life expectancy relative to the country's economic development.

3. National HCRAI Scores and Comparative Analysis

The HCRAI score of each country, calculated based on equation (2), can be used to examine the level of importance attached by the country to human care and human capital investment, as shown in Table 1. Regarding the results of HCRAI calculation, two issues need to be clarified. Firstly, this paper provides relative indicators based on each country's economic development stage, but the scores are not related to GDP per capita. As shown in the correlation test, there is no correlation between the HCRAI index and GDP per capita (ρ=-0.066, P= 0.384 for the year 2014). It can be concluded that some developed countries scored low not because of their GDP per capita. Secondly, this paper examines the level of correlation between life expectancy and school life expectancy, which are both identified as core indicators of the HCRAI and the HDI indexes. Hence, we performed an analysis and found that the two indicators are correlated with each other (ρ=-0.323, P=0.000 for the year 2014). This correlation verifies the scientific basis of the HCRAI index. Difference in a country's HCRAI and HDI rankings suggests the HCRAI's contribution. The HCRAI's correlation with GDP per capita and HDI is shown in Figures 3 and 4, respectively. As shown in the data and rankings of Table 1, the HCRAI index created in this paper offers the following contributions:

In 2014, China ranked 62nd among 174 countries and the HCRAI index, followed by the US (128th), the UK (107th), Germany (102nd), Canada (101st), and France (81st). On March 10, 2016, 12 Western countries led by the US issued a joint statement at the United Nations Human Rights Council blaming China's human rights record.[8] Similar accusations have been made frequently since the 1990s.

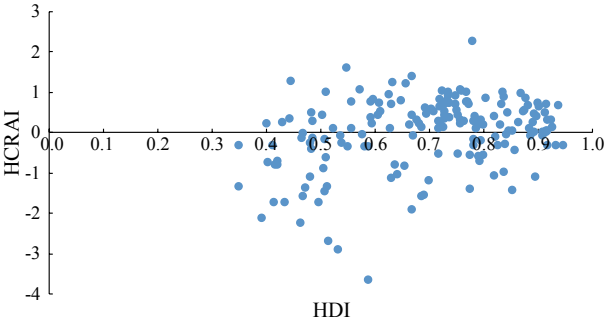

Figure 3: Correlation between HCRAI and GDP per Capita

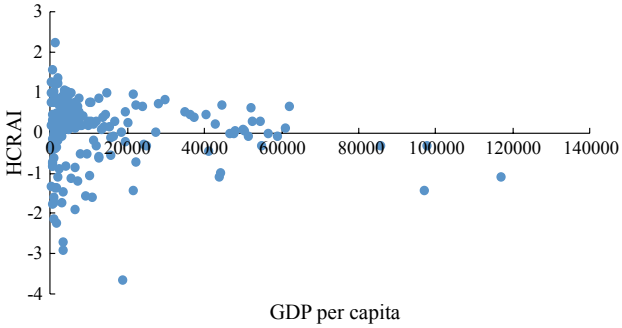

Figure 4: Correlation between HCRAI and HDI

[8] "China Refutes 'Joint Statement on Human Rights' by 12 Countries", Global Times, March 12, 2016, Issue 3849, Page 3.

Table 1: HCRAI Indexes of G20 Member Countries

Country	Life expectancy (years)	School life expectancy (years)	Per capita GDP (USD)	HCRAI	Ranking
Argentina	76.3	17.9	12510	0.861	19
S. Korea	81.9	16.9	27970	0.735	30
Australia	82.4	20.2	61925	0.661	39
Italy	83.1	16	34909	0.545	46
India	68	11.7	1582	0.503	50
Japan	83.5	15.3	36194	0.446	55
China	75.8	13.1	7590	0.409	62
Mexico	76.8	13.1	10017	0.297	72
Turkey	75.3	14.5	10515	0.289	75
France	82.2	16	42733	0.239	81
Brazil	74.5	15.2	11384	0.229	84
Indonesia	68.9	13	3492	0.139	92
Canada	82	15.9	50235	0.048	101
Germany	80.9	16.5	47822	0.045	102
UK	80.7	16.2	46332	-0.006	107
Saudi Arabia	74.3	16.3	24161	-0.285	123
US	79.1	16.5	54629	-0.323	128
Russia	70.1	14.7	12736	-0.565	139
South Africa	57.4	13.6	6483	-1.898	169

Notes: Countries on this list are G20 member states (except the EU). Data in this table is 2014 data.
Source: UNDP's HDI database and the World Bank's WDI database.

Yet the HCRAI ranking shows a clear evidence that China was not behind Western countries in terms of human capital investment such as healthcare and education. On the contrary, China has attached more importance to human care in relative terms. As mentioned in Section 2, a greater emphasis on human care does not mean more spending on health and education. In absolute terms, China fell behind all Western countries. As shown in Table 1, China's life expectancy and school life expectancy are both below the levels of Western advanced economies in the G20. However, the absolute values cannot reveal a full picture about how much importance a country attaches to human capital investment. Compared with Western countries preoccupied with economic efficiency, China has devoted a greater percentage of its limited available resources to healthcare and education as two aspects of people's survival and development, which explains why China ranked higher than Western countries on the HCRAI index.

The HCRAI index is not a ranking of absolute values, and thus differs sharply from the Human Development Index (HDI). Major advanced economies may not rank high on the HCRAI index, which departs from our subjective impression. As shown in Figure 5, except for Australia and Iceland, all the wealthiest countries (GDP per capita above 50,000 US dollars in 2014) underperformed on the HCRAI index relative to their HDI rankings. Even Scandinavian countries with widely acclaimed welfare and social protection ranked in the lower half of this table. With advanced health and education systems, these countries boast far longer life expectancies and years of schooling compared with other countries and ranked high on the HDI. Yet their human capital investment as a share of GDP may not be the highest in the world. For advanced economies, it takes relatively smaller percentage of GDP worth of spending on health and education to sustain higher life expectancy and school life expectancy. A much

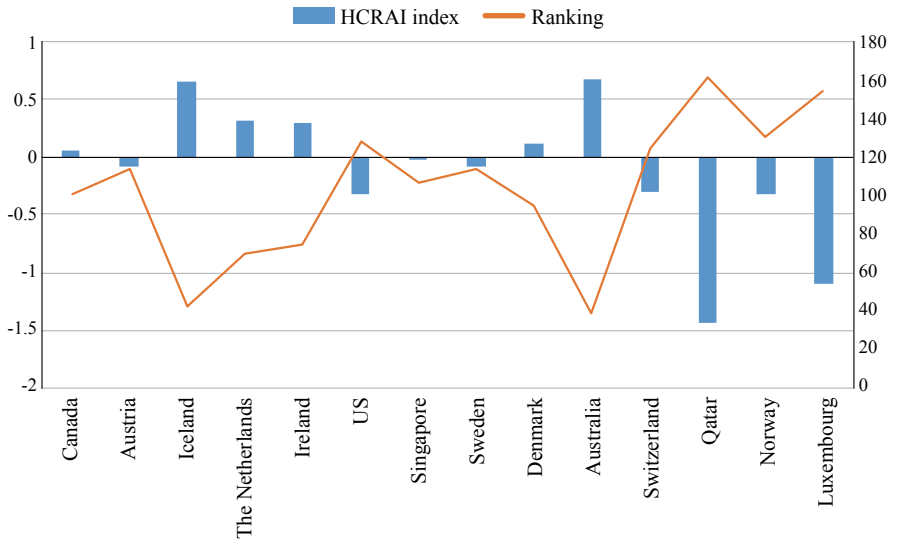

Figure 5: HCRAI Results of Countries with per Capita GDP above 50,000 USD

Table 2: HCRAI Rankings of Oil Exporting Countries

Country	Life expectancy at birth (year)	School life expectancy (year)	Per capita GDP (USD)	HCRAI	Ranking
Tunisia	74.8	14.6	4,421	1.018	9
Iran	75.4	15.1	5,443	1.000	13
Ecuador	75.9	14.2	6,346	0.775	25
Algeria	74.8	14	5,484	0.720	32
Egypt	71.1	13.5	3,199	0.608	44
Indonesia	68.9	13	3,492	0.139	92
Libya	71.6	14	6,573	0.116	93
Saudi Arabia	74.3	16.3	24,161	-0.285	123
Bahrain	76.6	14.4	24,855	-0.323	129
Iraq	69.4	10.1	6,420	-0.843	148
UAE	77	13.3	43,963	-0.972	150
Kuwait	74.4	14.7	43,594	-1.080	152
Qatar	78.2	13.8	96,732	-1.430	161
Gabon	64.4	12.5	10,772	-1.582	164
Nigeria	52.8	9	3,203	-2.696	172

Notes: Countries on this list are member or former member states of OPEC. Data in the table are 2014 data and calculation results.

bigger share of GDP, however, was spent on economic efficiency. Such countries lead the world in terms of life expectancy and education largely as a result of their higher levels of economic development.

Similarly, major oil-exporting countries also ranked low on the HCRAI index. As shown in Table 2, except for Tunisia, Ecuador, Algeria and Egypt, all other countries ranked relatively low and even at the bottom on this list. Unlike Western countries, oil-exporting countries not only scored poorly on the HCRAI index but underperformed on absolute indicators as well, including health and education.

The abundance of oil resources in these countries has eclipsed their shortfall of human capital, which undermines their long-term economic potentials.

Compared with Western capitalist economic powers, countries influenced by socialism ranked high on this list. Table 3 shows the HCRAI rankings of socialist countries and countries previously in the socialist camp. Given the difference of sample size, we have divided the rankings of countries by the total sample size of countries in the previous year. Among 25 sample countries in 2014, for instance, 17 countries ranked among the top 50% in the world. With data of 1990 following the political disturbance in Eastern Europe, 11 out of 13 sample countries ranked among the top 50% in the world. With the then collapse of the camp, these countries saw their rankings decline. Figure 6 shows the rankings of countries influenced by socialist systems. In 2014, most of these countries saw their rankings decline over 1990, which reflects how changing economic systems and policy-making could affect human capital development.

Table 3: HCRAI Rankings of Socialist and Former Socialist Countries

	Ranking ratios										
Country	1970	1978	1980	1985	1990	1995	2000	2005	2010	2013	2014
China	0.130	0.014	0.012	0.047	0.032	0.057	0.105	0.069	0.132	0.286	0.356
Laos				0.929	0.532	0.793	0.571	0.431	0.698	0.747	0.626
Cuba		0.041	0.024	0.059	0.096	0.103	0.076	0.017	0.009	0.044	
Vietnam					0.011						0.017
Albania				0.035	0.021	0.023	0.067	0.129	0.038	0.011	0.098
Amenia							0.048	0.095			0.178
Belarus					0.074	0.126			0.538	0.484	0.511
Croatia						0.448	0.590	0.534	0.509		0.362
Czech Republic					0.394	0.402	0.314	0.526	0.500	0.396	0.282
Ethiopia						0.920	0.800	0.491	0.425		0.397
Georgia						0.011	0.029	0.043		0.055	0.040
Hungary						0.517	0.429	0.612	0.613	0.560	0.517
Kazakhstan					0.245		0.295			0.890	0.805
Kyrgyzstan					0.043	0.046	0.010	0.009	0.028	0.033	0.034
Lithuania						0.276	0.200	0.457	0.557	0.670	0.632
Mongolia					0.628	0.655	0.286	0.207	0.415		0.391
Montenegro								0.224	0.179		0.115
Mozambique						0.954	0.924	0.914	0.915	0.934	0.833
Romania						0.448	0.590	0.534	0.509		0.362
Russian Federation					0.404	0.701		0.819		0.879	0.799
Slovakia						0.391	0.486	0.629	0.726	0.703	0.592
Slovenia						0.644	0.543	0.379	0.274	0.154	0.236
Tajikistan						0.080	0.019	0.026	0.047	0.088	0.092
Turkmenistan											0.937
Ukraine					0.149		0.057	0.155	0.160	0.220	0.103
Uzbekistan					0.053		0.086	0.034	0.208		0.420
Yemen Republic								0.707	0.858		

Note: Numbers in this table are the ratios between each country's ranking and the total number of sample countries in the same year.

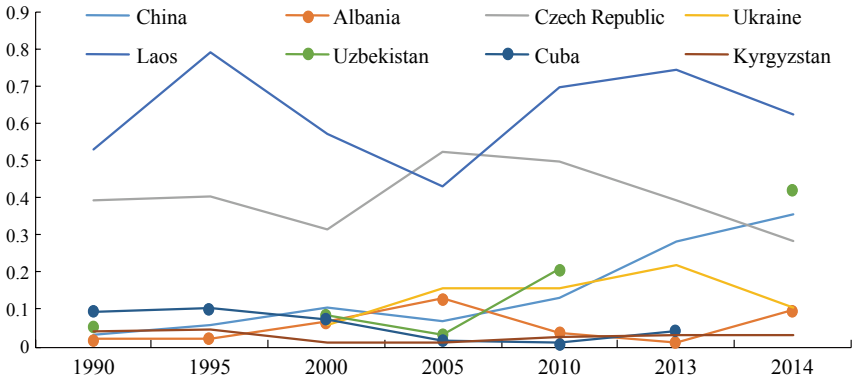

Figure 6: HCRAI Rankings of Socialist and Former Socialist Countries

These findings point to the differences between socialist and capitalist systems. While efficiency-driven capitalism came into existence during the Industrial Revolution, mass manufacturing led to workers' movements demanding their rights (Sun, 2013). Socialist political parties have laid the foundation for welfare states in Europe. More public spending and better social protection have in turn helped foster human capital in welfare states. Yet under the capitalist system, efficiency always takes priority over social welfare, and public welfare is an expediency for capital accumulation (Diao, 2007). The socialist system, in contrast, gives a greater priority to fair income distribution and social justice (Wu, 2008).

China's HCRAI ranking shows an inverted U-shaped trend.[9] As shown in Figure 7, the Chinese government has devoted a significant portion of limited resources to human capital investment before reform and opening up in 1978. After the founding of the People's Republic of China in 1949, the Chinese government swiftly established a nationwide public health system and disease control network from scratch, thus effectively containing endemics and improving women and children's access to healthcare across cities and the countryside (Li, 2011). At the local level, the rural cooperative medical system has effectively curbed communicable diseases in the countryside and delivered primary healthcare services to farmers (Cao, 2006). Acclaimed by the WHO as a unique example for developing countries to deliver health services to the poor despite a health spending gap, "bare-feet doctors" provided much-needed medical services to the masses in remote and less accessible rural areas. Life expectancy has increased substantially since 1949.

On the front of education, fiscal centralization for all its defects ensured funding for education (Yang, 2006). Educational authorities encouraged the masses to run private schools. In the countryside, primary schools of various sorts mushroomed, such as those that recruited part-time pupils who also did farm work or sent teachers to pupils' homes, itinerant schools, "horseback schools" and "boat schools," and agricultural middle schools were opened. A variety of flexible schooling modes have boosted China's educational development (Qu and Fan, 2011) and vastly increased access to education. With extremely limited fiscal and economic resources, China has significantly increased people's life expectancy and school life expectancy, as manifested in its rising HCRAI ranking.

The inflection point occurred in 1980. Since then, China's HCRAI ranking has been on the decrease, especially in more recent years. China's HCRAI index, among the highest in the world at the beginning of reform and opening up in 1978, has gradually converged to the world average level. This inverted U-shaped trajectory coincides with China's new economic policy after the 1980s, when economic development took center stage on government agenda. In four decades, China's economic aggregate and

[9] After excluding countries with populations below 5 million, China's HCRAI ranking still demonstrated a highly consistent inverted U-shaped trend.

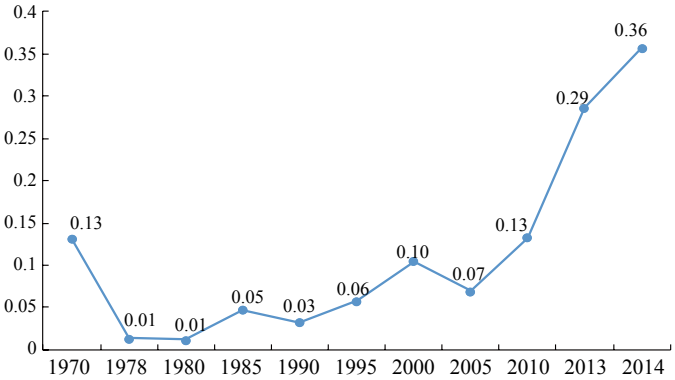

Figure 7: Change in China's HCRAI Ranking

overall national strengths, including strengths in technology and defense, have increased tremendously. Living standards in China as a large country of over 1.4 billion people have been elevated from subsistence to moderate prosperity in all respects.

As Comrade Deng Xiaoping noted, China's rapid economic development would present unprecedented challenges and dilemmas. While recognizing the achievements of reform and opening up, we must address imbalances emerging from the course of economic development, including environmental degradation, corruption, social injustice, resource scarcity, technological inferiority, wealth gaps, social credibility lack, and political reforms lagging behind (Fang and Yang, 2014). As efficiency took priority over human care, China's HCRAI ranking declined chiefly as a result of diminishing advantage in school life expectancy.

As shown in Figure 8, growth in school life expectancy outpaced economic growth in the pre-reform era. In the reform era, however, growth in school life expectancy has slowed. In recent years, school life expectancy in China has dipped below the level of countries with similar GDP per capita. Insufficient investment in education, especially in the primary and intermediate stages, has caused China's HCRAI ranking to slide. The consequences of human capital underinvestment alarmed China's policymakers. At the turn of the new millennium, the Chinese government vowed to "put people first." The Report to the 18th CPC National Congress called for "people-centered development." The "putting people first" principle was reflected throughout the 13th Five-Year Plan period. Socio-economic development should be predicated upon and serve human development.

It should be noted that our conclusions do not negate China's four-decade achievements since reform and opening up in 1978. China's declining HCRAI ranking does not mean a reduction in human capital investment. Rather, it reflects a shift of priority from human capital investment to material capital accumulation as economic development dominated China's policy agenda then. To be sure, giving priority to efficiency was a correct policy response to China's then primary social contradiction. As the economy expanded, even a smaller share of economic resources would be a much greater investment in human capital in absolute terms. Utmost priority to human capital investment regardless of development stage may not yield the best outcome.

Among socialist and former socialist countries listed in Table 3, Cuba and Vietnam have ranked high on the HCRAI index since 1990. Obviously, both countries underperformed China in socio-economic development. People in China have apparently benefited much more from improving living standards than their peers did in Cuba and Vietnam.[10] Without development, it makes little sense to

[10] In 2014, Vietnam's GDP per capita was 2,052.29 US dollars, and in 2013, Cuba's GDP per capita was 6,789.85 US dollars, both of which were below China's in the same years.

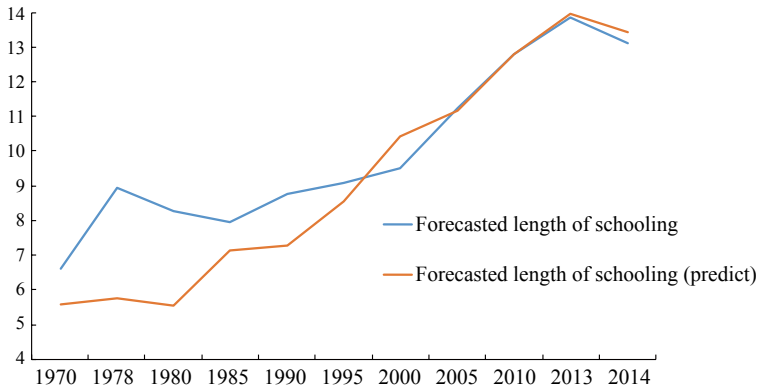

Figure 8: Actual and Forecasted Length of Schooling in China

compare development concepts. The principle of putting people first may achieve intended results only when development occurs. A country in secular economic stagnation can hardly expect to see any improvement in health and education.

4. HCRAI Index and Long-Term Economic Growth

We believe that in the pre-reform era (1949-1978), China had invested a significant share of its limited resources in human capital. The question is whether such a development approach has influenced China's economic takeoff in the reform era. As shown in Table 1, countries may fall into three categories based on their HCRAI score: (i) Most high-ranking countries were less developed or emerging in the 1980s and outperformed economically in the following one to three decades, comprising the majority of "emerging economies"; (ii) advanced economies from Europe and North America constituted the middle range on the HCRAI list of 1978, and experienced steady development in the following decades; (iii) countries at the bottom of the list were mostly less developed, and according to our information, many of them suffered negative growth in two or three decades after 1980. Detailed data is shown in Table 5.

4.1 Model Creation and Data Selection

In light of the above discoveries on China's four-decade economic success factors since 1978, this paper tested the HCRAI index's contribution to long-term economic growth under the following model:

$$Growth_{it} = \alpha + \beta_0 HCRAI_i + \beta_1 Control_i + \varepsilon \quad (3)$$

Where, *Growth* is growth rate, *HCRAI* is each country's HCRAI score in 1978, and Control is control variable. *i* is country, *t* is time, and t=10, 20 and 30.[11] Referencing the cross-section regression studies on cross-national economic growth by Summers and Heston (1988) and Barro and Sala-i-Martin (1992), control variables include actual government investment and labor growth. Referencing Summers and Heston (1991), actual government investment is measured by the ratio between actual domestic investment (private and public investment) in 1978 and real GDP; referencing Mankiw *et al*. (1992), labor growth is measured by working population (aged between 15 and 64)

[11] Referencing the approaches of Sala-I-Martin *et al* (2004) for the selection of long-term economic growth indicators, this paper employed the average growth rates of GDP per capita over the period of 1980-1990, 1980-2000 and 1980-2010 as the explained variable for long-term economic growth. Referencing Barro and Sala-i-Martin (1992, 2010), Islam (1998) and Mankiw *et al*. (1992), this paper also employed GDP per capita growth rates for the periods of 1980-1990, 1980-2000 and 1980-2010 to measure long-term economic growth for a robustness test. We believe that long-term economic growth is more or less stable, i.e. the selection of annual average and actual growth rates does not affect empirical results in any significant way, and regression results have verified the rationality in this paper's selection of long-term economic growth variables.

Table 4: Countries' HCRAI Indexes in 1978 and Growth Performance in the Subsequent Three Decades

Country	HCRAI index in 1978	Growth rate in the following decade	Growth rate in the following two decades	Growth rate in the following three decades	Country	HCRAI index in 1978	Growth rate in the following decade	Growth rate in the following two decades	Growth rate in the following three decades
China	2.447	0.021	0.019	0.018	Sweden	0.090	0.021	0.019	0.018
Tonga	2.146	0.024	0.028	0.021	Norway	0.075	0.024	0.028	0.021
Cuba	1.383	0.023	0.023	0.016	Denmark	0.069	0.023	0.023	0.016
Panama	1.321	0.019	0.023	0.018	Netherlands	0.068	0.019	0.023	0.018
Philippines	1.180	0.030	0.024	0.020	Finland	0.007	0.030	0.024	0.020
Cyprus	1.104	0.026	0.024	0.018	US	-0.068	0.026	0.024	0.018
Malta	1.014	0.008	0.003	-0.018	Zimbabwe	-0.081	0.008	0.003	-0.018
Thailand	0.973	0.021	0.019	0.014	France	-0.093	0.021	0.019	0.014
Chile	0.968	-0.019	-0.009	-0.001	Venezuela	-0.167	-0.019	-0.009	-0.001
Jordan	0.915	0.021	0.020	0.017	Belgium	-0.191	0.021	0.020	0.017
Mauritius	0.856				Uganda	-0.260			
Columbia	0.769	-0.023	-0.016	0.005	Zambia	-0.268	-0.023	-0.016	0.005
Indonesia	0.746	0.022	0.013	0.010	Iraq	-0.273	0.022	0.013	0.010
Argentina	0.728	0.026	0.026	0.026	Nepal	-0.302	0.026	0.026	0.026
Syria	0.676	-0.007	0.001	0.008	Honduras	-0.356	-0.007	0.001	0.008
Israel	0.675	0.027	0.020	0.026	Morocco	-0.379	0.027	0.020	0.026
Portugal	0.666	-0.021	-0.056	-0.032	D.R. Congo	-0.438	-0.021	-0.056	-0.032
Kenya	0.632	-0.017	-0.014	-0.007	Central African Republic	-0.471	-0.017	-0.014	-0.007
Egypt	0.627	-0.016	-0.011	0.010	Rwanda	-0.505	-0.016	-0.011	0.010
S. Korea	0.621	-0.018	0.000	0.003	Guatemala	-0.511	-0.018	0.000	0.003
Spain	0.574	0.050	0.043	0.033	Luxembourg	-0.598	0.050	0.043	0.033
Lesotho	0.557	-0.023	-0.002	0.005	Malawi	-0.603	-0.023	-0.002	0.005
Mexico	0.483	0.034	0.027	0.026	Turkey	-0.633	0.034	0.027	0.026
India	0.398	0.002	0.008	0.007	Benin	-0.779	0.002	0.008	0.007
Pakistan	0.363				Kuwait	-0.830			
Greece	0.319	-0.132	-0.067	-0.050	Liberia	-1.237	-0.132	-0.067	-0.050
Botswana	0.291	-0.005	-0.001	0.004	Senegal	-1.258	-0.005	-0.001	0.004
Ireland	0.290	0.010	0.018	0.021	Burkina Faso	-1.266	0.010	0.018	0.021
Japan	0.273	-0.039	-0.022	0.006	Nigeria	-1.315	-0.039	-0.022	0.006
Italy	0.268	-0.034	-0.021	-0.016	Cote d'Ivoire	-1.392	-0.034	-0.021	-0.016
Kiribati	0.264				Afghanistan	-1.447			
UK	0.215	-0.056	-0.030	-0.041	UAE	-1.515	-0.056	-0.030	-0.041
Iceland	0.196	-0.010	-0.009	-0.009	Gabon	-1.535	-0.010	-0.009	-0.009
Solomon Islands	0.182	-0.017	-0.023	-0.006	Sierra Leone	-1.583	-0.017	-0.023	-0.006
Togo	0.161	0.008	0.011	0.016	Mali	-1.589	0.008	0.011	0.016
Tunisia	0.129	0.046	0.035	0.024	Oman	-1.783	0.046	0.035	0.024
Salvador	0.092	-0.032	-0.024	-0.013	Niger	-2.089	-0.032	-0.024	-0.013

Notes: Growth rate data is from the World Bank's World Development Indicators (WDI) database. Base period for growth rate is 1980, growth rate in the following decade is growth rate from 1980 to 1990, and so on and so forth.Growth rates are calculated in constant price US dollar with 2010 as base period. Countries are ranked in the descending order by their HCRAI scores in 1978.

growth over the period 1977-1978.

Referencing Mankiw *et al*. (1992) and Barro and Lee (2001), human capital is substituted into regression and measured by the 1978 value of the human capital index in the Penn World Table estimated by Summers and Heston. Referencing Barro and Sala-i-Martin (2010) and Acemoglu and Daron (2002), we considered the effects of political systems, including legal environment and democracy, on long-term economic growth. Legal environment rating is based on information from the International Country Risk Guide, which contains 12 indicators such as government stability, socio-economic conditions, and investment profile. This paper selects the law and order indicator of 1984 to measure a country's rule of law. Democracy variable is the subjective indicator provided by the Freedom House, which includes two dimensions of political rights and civil liberties. This paper selects the weighted average of two indicators in 1978 to measure a country's level of liberty.[12] Referencing Barro and Sala-i-Martin (2010), this paper measures a country's international openness by the ratio of its total import and export volume and GDP in 1978 and a country's fertility rate by the average number of births for each woman.

4.2 Regression and Result Analysis

Based on the variables selected in the above section, we examine the HCRAI's effects on long-term economic growth with regression results shown in Table 6.

As can be learned from the results of Table 6, HCRAI scores exert positive effects on long-term economic growth. Higher HCRAI score means relatively advanced human capital investment, i.e. more attention to human care and greater long-term economic growth potentials. Given the positive economic growth effects of relatively advanced human capital investment, a society must attach importance to people's all-round development as a prerequisite for sustainable development.

Among the control variables in Table 6, investment rate has a negative effect on economic growth in the subsequent decade. That is to say, one-time investment may boost growth in the short run but the effect turns negative in the long run (Liu, 2002). Measured by fertility rate, population growth exerts a negative effect on long-term economic growth. The negative regression result indicates that a larger population size is more adverse to economic growth. In the current stage, academics have yet to agree on the economic growth effects of population growth. Pessimists argued that an excessive demographic burden would cause too much strain on a country's resources and lead to growth in poverty (Du *et al*., 2005). Optimists considered that population growth could stimulate demand and investment (Gui, 2008), and bring about demographic dividends essential for economic growth and innovation (Zuo, 2012). Some believed that population growth had no significant effect on economic growth (Li, 2009; Yang, 2009).

Since this paper only examines population size without introducing such factors as demographic structure and human capital, we cannot conclude that population growth necessarily leads to a negative effect on economic growth, which is not our key concern. Here, our message is that compared with the positive long-term economic growth effects of relatively advanced human capital investment, demographic burden could be detrimental to long-term economic performance. In addition, the initial level of economic development has a negative impact on long-term economic growth rate, which is consistent with the conditional convergence put forth by Barro (1991) and Mankiw *et al*. (1992). They believed that with other variables held constant, a higher economic growth rate would correspond to lower initial levels of economic performance. Other control variables in Table 6 are insignificant, which suggest that: (i) Compared with national environment variables such as the rule of law, democracy and international interdependence, the HCRAI index and the human capital variable have more significantly positive effects on long-term economic growth; (ii) in our regression analysis, each control variable

[12] The earliest statistics for this indicator are dated 1984. Hence, this paper employed the indicator value of 1984 to measure each country's rule of law in 1978. This method makes some sense because the rule of law variable is relatively stable over time. Barro and Sala-i-Martin (2010) did the same.

Table 5: Regression Result of the Effects of HCRAI Scores in 1978 on Long-Term Economic Growth

	(1)	(2)	(3)	(4)	(5)	(6)
	10-year growth rate	20-year growth rate	30-year growth rate	10-year growth rate	20-year growth rate	30-year growth rate
HCRAI score	0.020***	0.017***	0.015***	0.009	0.009**	0.007**
	(0.004)	(0.003)	(0.002)	(0.005)	(0.004)	(0.003)
Labor growth				0.001	0.001	0.003
				(0.004)	(0.003)	(0.002)
Investment rate				-0.072**	-0.029	-0.014
				(0.033)	(0.025)	(0.019)
Rule of law				0.005	0.003	0.003
				(0.004)	(0.003)	(0.002)
Democracy				-0.025	-0.009	-0.005
				(0.022)	(0.016)	(0.013)
International openness				0.007	0.006	0.004
				(0.011)	(0.008)	(0.006)
Fertility rate				-0.009*	-0.008**	-0.009***
				(0.005)	(0.004)	(0.003)
GDP in 1978				-0.040***	-0.026**	-0.025***
				(0.014)	(0.011)	(0.008)
Human capital				-0.012	-0.011	-0.011
				(0.012)	(0.009)	(0.007)
Constant term	0.011***	0.014***	0.015***	0.251***	0.171***	0.152***
	(0.004)	(0.003)	(0.002)	(0.067)	(0.049)	(0.038)
Observations	68	68	68	49	49	49
R^2	0.242	0.308	0.345	0.451	0.498	0.604

Notes: ***, ** and * denote passing the 1%, 5% and 10% significance level tests. Numbers in parentheses are standard errors.

exerted significant effects on economic growth individually, but the HCRAI index's effect on long-term economic growth is apparently more significant; (iii) considering the lack of data availability and difficulties in the selection of instrumental variables, this paper focuses on whether relatively advanced human capital investment would put a damper on long-term economic growth. As shown in the empirical result, relatively advanced human capital investment would promote long-term growth more significantly compared with other factors such as material accumulation, investment and export-driven growth. In the short run, investment and export-driven economic growth is unsustainable, and investment and export-based economies should transition towards more rational growth patterns.

4.3 Implications for Sustainable Development in China

Based on our analysis, China's high HCRAI score in the pre-reform era is correlated with the nation's subsequent economic takeoff. To a large extent, China's rapid economic growth in the post-reform era can be attributed to relatively advanced human capital investment in the pre-reform period. Three-decade human capital investment before 1978 has paved the way for uninterrupted economic growth in the following three decades, demonstrating the continuity in China's six-decade development. Notably, government investment and foreign capital have also contributed to China's reform process. Government intervention has enabled rapid industrial development and great progress in scientific research, defense, and infrastructure construction. By taking an active part in international cooperation and competition, China has enhanced its overall national strength and competitiveness.

However, investment and export-driven economic growth has also posed grave challenges such as

overcapacity, environmental degradation, weakness in technology, distorted industrial structure, wealth gaps and other social contradictions. These problems force us to seek a new and more sustainable path of development. At the dawn of the 21st century, the concept of "putting people first" has appeared repeatedly in various official documents as China's policymakers have become increasingly aware that social stability and wealth accumulation will occur only when people's rights to development are respected. China must "put people first" if it is to overcome the "middle income trap."

Material capital accumulation and efficiency improvement are vital to short-term economic growth. Yet in the long run, economic development cannot sustain without adequate human care and human capital investment. Not all countries are capable of making relatively advanced human capital investment as the Chinese government did. In many countries, short-term interests often overrode long-term considerations. Unlike in the Western world where material accumulation preceded human development, China's relatively advanced human capital investment has unleashed tremendous and unremitting growth potentials in the reform era.

5. Conclusions

By creating the HCRAI index with each country's development level as benchmark, this paper performed vertical and horizontal comparisons for an objective assessment of each country's relatively advanced human capital investment. In conclusion, we have reached the following findings and policy recommendations:

On human capital investment relative to its GDP per capita, China outperformed numerous advanced economies including the UK and the US. It is natural for China as an emerging economy to encounter various social problems. As a late-mover, China lags far behind Western countries in terms of human capital stock. However, China has invested a more significant share of its limited resources in human capital development. People in China may not expect to live as long and receive as many years of schooling as their peers in advanced economies. Yet China attaches greater importance to people. Western metrics, on the contrary, have exaggerated China's gaps in absolute terms while neglecting the relative ratio of human capital investment. China should respond to such biased metrics as the WHO's member state health funding and distribution equality ranking,[13] and demonstrate China's efforts to promote social harmony.

This paper's conclusions have verified the continuity of China's development over the past six decades before and after 1978. Human capital investment in the three-decade pre-reform era has laid the groundwork for China's economic takeoff afterwards. Despite grave hardships after the founding of the People's Republic of China in 1949, China has made relentless efforts to improve education and healthcare, which is manifested in China's rising HCRAI ranking in the pre-reform era. China's remarkable economic achievements in the three-decade reform era could not have been achieved without human capital investment in the three-decade pre-reform era. As indicated in this paper, relatively advanced human capital investment has significantly positive effects on China's long-term economic growth. A country that attaches more importance to its people's well-being and development will benefit from more stable economic growth potentials in the long run. China's three-decade rapid economic growth after ranking first in the world on the HCRAI index in 1980 testifies the importance of "putting people first".

China's inverted U-shaped HCRAI ranking trend is a reminder that we must transform the pattern of our economic development to cope with rising economic and social challenges. For all its merits in uplifting China's economic aggregate, the efficiency first and GDP-centric development approach

[13] China ranked the bottom fourth among 191 WHO member states for health funding and distribution equality in 2000, and saw little improvement in its ranking in recent years.

has raised questions over China's growth potentials in the long run. To overcome the looming middle-income trap, China must foster new growth momentum. Our findings suggest that relatively advanced human capital investment significantly boosts economic growth sustainability. Under the "putting people first" principle, we must offer more protections for vulnerable groups, ensure the quality of rights for everyone, and safeguard social fairness, justice, harmony, and stability.

Human capital is vital to China's supply-side structural reforms. We must attach great importance to health and education as the HCRAI's two critical dimensions. China's inverted U-shaped HCRAI ranking indicates that its level of education was below the average of countries with similar GDP per capita. In the next stage of development, therefore, China should strive to enhance education and increase school life expectancy, focusing on elementary education. Access to compulsory education is highly uneven among regions, urban and rural areas and schools, so much so that vulnerable groups, especially in rural and remote areas, are deprived of fair access to education. Education in China is severely underfunded. Around the world, over 170 economies have implemented compulsory or free education. Even cash-strapped poor countries have been striving to increase access to free education. As the second largest economy, China already has the conditions for promoting 12-year compulsory education. Given education's important and effective role in human capital development, policymakers should put the nationwide implementation of 12-year compulsory education on the agenda, which is vital to increasing China's HCRAI, social justice, and economic potentials.

This paper has also revealed the differences between socialist and capitalist concepts of development and social justice. Capitalism prioritizes efficiency and economic interests over fairness. Capitalist fairness serves the interests of the bourgeois class. As demonstrated in this paper, advanced economies in the Western world scored low on the HCRAI index despite longer life expectancies and schooling. Fairness and human rights in capitalist countries are compromises made in exchange of efficiency. As in the words of Carl Marx and Frederik Engels, all ethics, in the final analysis, stem from socio-economic conditions of a given time, and serve the interests of a social class. In contrast, socialist fairness encompasses economic, political and cultural fairness, focusing on fair process and results. As shown in this paper, socialist countries devoted a greater share of their limited economic resources to human care and ranked high on the HCRAI index. Compared with capitalism, socialist systems give more prominence to fairness.

Under the Belt and Road Initiative (BRI), China should attach greater importance to countries with high HCRAI rankings as an indicator of long-term growth potentials. These countries, such as Nepal, Iran and Tajikistan, have invested in human capital ahead of their development stage, and should be identified as strategic partners considering their potentials for social progress and economic growth.

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