National IQ and Economic Development: A Study of Eighty-One Nations

Richard Lynn
University of Ulster
Tatu Vanhanen
University of Helsinki

The authors examine the hypothesis that the intelligence of the population is a major factor determining national differences in economic development. To test the hypothesis, national IQs were calculated for 81 nations and economic development measured by real Gross Domestic Product at Purchasing Power Parity for 1998. The correlation between the two is .733, indicating that 54 per cent of the variance in GDP is attributable to the IQs of the populations.

Since the eighteenth century social scientists have attempted to find solutions to the problem of why some nations have developed economically and become wealthy while others have stagnated economically and remained poor. In contemporary times there are huge differences in per capita income between the economically developed world of North America, Western Europe, Australasia and the Pacific Rim, and the economically underdeveloped world of South Asia, the Caribbean, much of Latin America, and Africa. This problem has been discussed by economists, political scientists, sociologists, psychologists, anthropologists and historians. These have advanced numerous theories of the causes of these disparities, including advantageous or disadvantages climates, the possession of natural resources, economic and political systems, and psychological attitudes and values such as the work ethic.

We do not attempt to review all the theories of the causes of the wealth and poverty of nations. This is a subject on which numerous books have been written and with which several journals are concerned, notably the Journal of Economic Growth, the Journal of Comparative Economics, Economic Development and Cultural Change, Development and Change, and Development Economics. Our purpose is to present a new theory that has not been advanced hitherto. This is that a major factor responsible for national disparities in economic development is the intelligence (IQ) of the populations.

Theoretical Background: IQ and Earnings among Individuals

There are strong theoretical reasons for the theory that the intelligence of national populations is likely to be a significant determinant of economic growth and development. The first of these is that it is well established that intelligence is a significant determinant of incomes among individuals. We believe it is reasonable to treat nations as aggregates of the individuals, so that nations with high average IQs can be expected to have high average earnings.

The major studies of the relationship between intelligence and earnings are summarized in Table 1. All of these studies are for the United States. The first entry in the table (Duncan,1968) presents data from the 1964 Current Population Survey carried out by the National Opinion Research Center (NORC) on a sample of white males aged 24-35. The second entry from Jencks (1972) is derived from a synthesis of the American research literature up to 1970. The third and fourth entries (Brown and Johnson,1995) are derived from a study of the relation between the IQ of males measured in early adulthood and earnings approximately 12 years later for samples of 24,819 whites and 4,008 blacks and reported correlations of .327 and .126, respectively. The fifth entry (Murray,1998) is derived from the National Longitudinal Study of Youth nationally representative American sample of 12,686 and finds a correlation of .37 between the IQ of males measured in adolescence and income approximately twelve years later, assessed in the late twenties to mid-thirties. It is apparent that the four results for whites are closely similar, all lying in the range between .31 and .37 and averaging .34. The one correlation for blacks of .13 is substantially lower but nevertheless statistically significant. The main reason for the lower correlation among blacks is possibly that greater numbers of intelligent blacks born into poverty do not obtain the educational credentials generally required for average to high earnings.

Table 1. Studies on the correlations between IQ and earnings among individuals

Correlation	*Reference*
.31	Duncan,1968
.35	Jencks,1972
.33	Brown & Reynolds,1975
.13	Brown & Reynolds,1975
.37	Murray, 1998

The effect of a correlation of approximately .34 between intelligence and earnings is to produce quite considerable differences in the earnings of high and low IQ groups. As Jencks (1972, p.222) noted, men inducted in the Korean War who had been tested and scored above the 80th percentile for intelligence, representing IQs of 110 and over, had personal incomes when they returned to civilian life 34 percent above the national average. Conversely, the military inductees who scored below the 20th percentile on intelligence, representing IQs of below 90, had personal incomes when they returned to civilian life approximately 34 per cent below the national average.

Those who have considered this question have concluded that IQ is a cause of income because IQ's are established quite early in childhood and predict incomes achieved in adulthood (e.g. Duncan, 1968; Duncan, Featherman and Duncan,1972; Jencks,1972; Jensen,1998). Furthermore, several studies have shown that intelligence assessed in childhood from the age of about 8 years and above is fairly stable over the life span and is correlated at about .7 to .8 with intelligence in adulthood (McCall,1977; Li,1975). The longest span of time over which a high stability of IQ has been demonstrated is 66 years. This was shown in a study by Deary et al. (2000) in which 101 children intelligence tested in 1932 at the age of eleven were tested again in 1998 at the age of 77. The correlation between the two scores was .77. Because intelligence is established in childhood, the causal sequence is likely to be from IQ to earnings because, obviously, earnings in adulthood cannot be a cause of IQ. While it might be argued that the socio-economic status of the family is the common cause of children's intelligence and subsequent earnings, it has been shown by Duncan, Featherman and Duncan (1972) and by Jencks (1979) that the positive relation between childhood IQ and adult income is present when parental socio-economic status is controlled. We therefore believe that those who have concluded that IQ and has a causal impact on earnings are correct.

The explanation for the positive association between IQ and income is that people with high IQs learn more rapidly and can solve problems more effectively than those with low IQs. Children and adolescents with high IQs can be trained to acquire more complex skills and work more proficiently than those with low IQs. This makes them more productive and able to earn higher incomes. An early study showing the positive effect of IQ on trainability was carried out during World War Two in the training of pilots for the American Air Force. Initially, the Air Force admitted those of all ability levels to its pilot

training program but soon discovered that significant numbers proved to be untrainable and this resulted in an unacceptably high failure rate. It then examined the effect of intelligence on success in the training program and found that 95 percent of those in the top 10 percent of intelligence successfully completed the training, while only 20 percent of those in the bottom 10 percent were able to complete (Matarazzo,1972). Further work by the American military has confirmed that it is difficult and often impossible to train inductees with low IQs. A series of reports on the experience of the military on this issue has been summarized by Gottfredson (1997, p.91): "All agree that these men were very costly and difficult to train, could not learn certain specialities, and performed at a lower average level once on a job. Many such men had to be sent to newly created special units for remedial training or recycled one or more times through basic or technical training". As a result of this experience the United States military no longer accepts recruits with IQs below 80.

There have been two major reviews of studies examining the relation between IQ and trainability for the acquisition of skills. The first consists of a meta-analysis by Hunter and Hunter (1984) of 425 studies which have used the General Aptitude Test Battery (GATB), a test of general intelligence, for the prediction of training success. They classified jobs into two categories of general and industrial. Their conclusion was that for all occupations, IQ predicts job training success at a correlation of .45. When jobs are classified according to their complexity, IQ correlates more highly at .56 to .58, than it does for jobs of low complexity, for which the correlations are between .23 and .40. The details of the correlations are shown in Table 2.

Table 2. Correlations between IQ and training success

Job Complexity	*Training*
High - general	.50
High - industrial	.65
Medium - general	.57
Low - general	.54

The second major review of the relation between intelligence and training success consists of data collected from American military training schools. All recruits to the American military are given an intelligence test, the AFQT (Armed Forces Qualification Test). They

are also sent to training schools. At the end of training, they are assessed for how well they have done on the course by tests assessing job performance, knowledge and skills. The results based on a sample of 472,539 military personnel have been analysed by Hunter and Hunter (1984), who present the correlations between IQ and training success for five types of training, namely Mechanical, Clerical, Electronic, General Technical and Combat. These correlations are shown in Table 3. It will be seen that all the correlations are substantial and lie between .45 and .67. The magnitude of the correlations depends on the cognitive complexity of the skills assessed. The highest correlation is for Electronics, which is the most cognitively demanding. The lowest is for Combat, which is the least cognitively demanding and for which success is heavily dependent on physical skills, but even for this the correlation of .45 is appreciable.

Table 3. Correlations between IQ and training success in the United States Military

Job Type	*Training Success*
Mechanical	.62
Clerical	.58
Electronic	.67
General Technical	.62
Combat	.43

IQ and Earnings among Populations

Because IQ is a determinant of earnings among individuals, it can be predicted that IQ should be a determinant of the earnings of populations. There is much evidence that this is the case. The major studies are summarized in Table 4. All the correlations in the table are statistically significant. The first of these studies by Sir Cyril Burt took as its population units the 29 boroughs of London. The second took as its population units the states of the U.S.A. The third, fourth and fifth took as their population units 13 regions of the British Isles, 90 departments of France, and 48 regions of Spain.

Table 4. Correlations between IQs and earnings among populations

Location	*Correlation*	*Reference*
London	.73	Burt, 1937
American states	.81	Davenport & Remmers, 1950
British Isles	.73	Lynn, 1979
France	.61	Lynn, 1980
Spain	.65	Lynn, 1981

The reason that IQ is highly correlated with per capita income across populations is that populations are aggregates of individuals. Because individuals with high IQs are able to secure high earnings, so populations with high IQs are likewise able to secure high earnings.

Method

We are now ready to consider whether there are national differences in intelligence which may contribute to per capita national incomes and to rates of economic growth that have led to differences in national incomes. We begin by presenting data for national IQs for 81 nations. We show that these are reliable and highly associated with national levels of educational attainment. We show next that national IQs are significantly associated with national rates of economic growth and per capita incomes during the second half of the twentieth century. We then consider some anomalies and exceptions to the general principle that national IQs are a significant determinant of economic growth and per capita incomes.

1. Calculation of National IQs

Most intelligence tests have been constructed in Britain and the United States and these tests have subsequently been administered to samples of the populations in many other countries throughout the world. From these studies we have found it possible to calculate the mean IQs of the populations of 81 nations. In making these calculations the mean IQ in Britain is set at 100 with a standard deviation of 15 and the mean IQs of other nations have been calculated in relation to this standard. We do not have space here to provide the details of how these calculations have been made. Those who wish to examine these are referred to Lynn and Vanhanen (2002). We should note that although the 81 nations for which national IQs have been calculated are not a random sample, they are a representative sample of the world's nations in so far as they include nations from all continents and from

Table 5

Data for National IQs, attainment in Math and Science, Real GDP per capita 1998, Residual GDP following regression analysis and Fitted GDP

Country	*IQ*	*Math*	*Science*	*GDP*	*Residual GDP*	*Fitted GDP*
Argentina	96	-	-	12,013	-2,094	14,107
Australia	98	525	540	22,452	7,307	15,145
Austria	102	-	-	23,166	5,945	17,221
Barbados	78	-	-	12,001	7,236	4,765
Belgium	100	558	535	23,223	7,040	16,183
Brazil	87	-	-	6,625	-2,811	9,436
Bulgaria	93	511	518	4,809	-7,741	12,550
Canada	97	531	533	23,582	8,956	14,626
China	100	-	-	3,105	-13,078	16,183
Colombia	89	-	-	6,006	-4,468	10,474
Congo (Brazz)	73	-	-	995	-1,175	2,170
Congo (Zaire)	65	-	-	822	2,804	-1,982
Croatia	90	-	-	6,749	-4,244	10,993
Cuba	85	-	-	3,967	-4,431	8,398
Czech Republic	97	520	539	12,362	-2,264	14,626
Denmark	98	-	-	24,218	9,073	15,145
Ecuador	80	-	-	3,003	-2,800	5,803
Egypt	83	-	-	3,041	-4,319	7,360

Table 5

Data for National IQs, attainment in Math and Science, Real GDP per capita 1998, Residual GDP following regression analysis and Fitted GDP

Equatorial Guinea	59	-	-	1,817	6,913	-5,096
Ethiopia	63	-	-	574	3,594	-3,020
Fiji	84	-	-	4,231	-3,648	7,879
Finland	97	520	535	20,847	6,221	14,626
France	98	-	-	21,175	6,030	15,145
Germany	102	-	-	22,169	4,948	17,221
Ghana	71	-	-	1,735	603	1,132
Greece	92	-	-	13,943	1,912	12,031
Guatemala	79	-	-	3,505	-1,779	5,284
Guinea	66	-	-	1,782	3,245	-1,463
Hong Kong	107	582	530	20,763	946	19,817
Hungary	99	532	552	10,232	-5,432	15,664
India	81	-	-	2,077	-4,245	6,322
Indonesia	89	403	435	2,651	-7,823	10,474
Iran	84	422	448	5,121	-2,758	7,879
Iraq	87	-	-	3,197	-6,239	9,436
Ireland	93	-	-	21,482	8,932	12,550
Israel	94	466	468	17,301	4,232	13,069
Italy	102	479	493	20,585	3,364	17,221
Jamaica	72	-	-	3,389	1,738	1,651
Japan	105	579	550	23,257	4,478	18,779

Kenya	72	-	-	980	-671	1,651
Korea, South	106	587	549	13,478	-5,820	19,298
Lebanon	86	-	-	4,326	-4,591	8,917
Malaysia	92	519	492	8,137	-3,894	12,031
Marshall Islands	84	-	-	3,000	-4,879	7,879
Mexico	87	-	-	7,704	-1,732	9,436
Morocco	85	337	323	3,305	-5,093	8,398
Nepal	78	-	-	1,157	-3,608	4,765
Netherlands	102	540	545	22,176	4,955	17,221
New Zealand	100	491	510	17,288	1,105	16,183
Nigeria	67	-	-	795	1,739	-944
Norway	98	-	-	26,342	11,197	15,145
Peru	90	-	-	4,282	-6,711	10,993
Philippines	86	345	345	3,555	-5,362	8,917
Poland	99	-	-	7,619	-8,045	15,664
Portugal	95	-	-	14,701	1,113	13,589
Puerto Rico	84	-	-	8,000	121	7,879
Qatar	78	-	-	20,987	16,222	4,765
Romania	94	472	474	5,648	-7,421	13,069
Russia	96	526	529	6,460	-7,647	14,107
Samoa (Western)	87	-	-	3,832	-5,604	9,436
Sierra Leone	64	-	-	458	2,959	-2,501
Singapore	103	604	568	24,210	6,470	17,740
Slovakia	96	534	535	9,699	4,408	14,107
Slovenia	95	530	533	14,293	705	13,588
South Africa	72	275	243	8,488	6,837	1,651
Spain	97	-	-	16,212	1,586	14,626

Table 5

Data for National IQs, attainment in Math and Science, Real GDP per capita 1998, Residual GDP following regression analysis and Fitted GDP

Sudan	72	-	-	1,394	-257	1,651
Suriname	89	-	-	5,161	-5,313	10,474
Sweden	101	-	-	20,659	3,957	16,702
Switzerland	101	-	-	25,512	8,810	16,702
Taiwan	104	585	569	13,000	-5,260	18,260
Tanzania	72	-	-	480	-1,171	1,651
Thailand	91	467	482	5,456	-6,056	11,512
Tonga	87	-	-	3,000	-6,436	9,436
Turkey	90	429	433	6,422	-4,571	10,993
Uganda	73	-	-	1,074	-1,096	2,170
U. Kingdom	100	496	538	20,336	4,153	16,183
United States	98	502	515	29,605	4,460	15,145
Uruguay	96	-	-	8,623	-5,484	14,107
Zambia	77	-	-	719	-3,527	4,246
Zimbabwe	66	-	-	2,669	4,132	-1,463

all levels of economic development including the "first world" of the economically developed market economies, the "second world" of the former communist economies of the Soviet Union, Eastern Europe and China, and the "third world" of economically developing and undeveloped economies of South and Southwest Asia, the Pacific Islands, Latin America, the Caribbean and Africa.

The data with which we are concerned are given in Table 5. This shows the IQs for the 81 counties, the mean scores of adolescents on tests of math and science in 30 of the countries obtained in the Third International Mathematics and Science Study of 1999, the per capita real GDP (Gross Domestic Product) in 1998, the "residual per capita GDP" (a measure of how much the actual GDP differs from the predicted GDP calculated from the regression of GDP on IQ: see further explanation below), and the "fitted per capita GDP" (the value of per capita GDP at the regression line: see further explanation below).

Looking first at the national IQs, we note that these fall into seven clusters. First, the 25 European nations have mean population IQs in the IQ range between 90 (in Croatia) and 102 (in Austria, Germany, Italy and The Netherlands). The median IQ for this group of nations is 98. Apart from Ireland (93), there is some trend for IQs to be higher in northern and western Europe, where the IQs are around 100, than in southern and eastern Europe, where the IQs tend to be in the low 90's, notably in Croatia (90), Greece (92), Bulgaria (93) and Romania (94). The depressed IQ in Ireland is attributable to a long history of selective emigration and to the low standard of living until the mid-1990's.

A second cluster consists of countries of North America and Australasia. The populations of mainly northern and western European origin have about the same IQs as those of their parent populations in Europe. The IQ of the 98 in the United States is slightly depressed because of the substantial numbers in the population of blacks and Hispanics, whose mean IQs are approximately 85 and 92, respectively (Herrnstein and Murray, 1994). The mean IQ of whites in the United States is 100 (Jensen and Reynolds, 1983), the same as that in Britain.

A third cluster consists of the five East Asian countries populated by Oriental peoples. In Hong Kong, Japan, South Korea and Singapore the mean IQs lie in the range of 104 in Taiwan to 107 in Hong Kong and are significantly higher than those in Europe. The IQ in the People's Republic of China is lower at 100. This is attributable to the economically backward state of the country and low living standards

which have impaired the development of intelligence to its full potential. If the rapid economic growth of the 1990's continues, it can be anticipated that the IQ in China will rise to about 105, the same level as the other Oriental peoples.

A fourth cluster consists of the nations of South and Southwest Asia running from Turkey through the Middle East to South East Asia. The IQs lie in the range between 78 in Napal and Qatar and 94 in Israel. The IQ in Israel is higher than in the remainder of this group of nations. The explanation is that Israel is an ethnically diverse nation with about equal numbers of Western (European) and Eastern (Asian) Jews. Western Jews have an IQ about points higher than Eastern Jews (Lieblich, Ninio and Kugelmass,1972; Zeidner,1987). The IQ of Eastern Jews in Israel is approximately 88 and is closely similar to that of neighboring South Asian populations like Turkey (90), Lebanon (86), Iraq (87) and Iran (84). The IQ of Western Jews in Israel is approximately 100, and about the same as that of other Northern and Western European populations, although Jews in the United States and Britain have substantially higher IQs averaging around 110 or even 115 (Herrnstein and Murray,1994; MacDonald,1994). Most Western Jews migrated to Israel during the second half of the twentieth century and have raised the intelligence level above that of other south Asian populations.

A fifth cluster consists of the countries of South East Asia and the Pacific Islands. The IQs fall in the narrow band between 84 and 89.

A sixth cluster consists of the Latin America and the Caribbean countries. The range of IQs is considerable from 65 in Jamaica to 96 in Argentina and Uruguay. The IQs appear to be determined by the racial and ethnic make-up of the populations. In Argentina and Uruguay the populations are very largely European at 85 per cent for Argentina and 86 per cent for Uruguay (Philip's,1996). The IQs of 96 are typically European. The countries with lower proportions of Europeans and greater proportions of Native Americans, Blacks and Mestizos have lower IQs. This applies to Brazil with its IQ of 87 (53 per cent European, 22 per cent Mulatto, 12 per cent Mestizo, 11 per cent black); Colombia with its IQ of 88 (Europeans 20 per cent, Mestizos 68 per cent, Native American Indian 7 per cent, blacks, 5 per cent); Mexico with its IQ of 87 (9 per cent European, 60 per cent Mestizo, 30 per cent Native American Indian); and Peru with its IQ of 90 (12 per cent white, Native American Indian, 47 per cent, Mestizos, 32 per cent). Countries with very low percentages of Europeans have still lower IQs. This applies to Guatemala with its IQ of 79 (3 per cent

white, 55 per cent Native American Indian, 42 per cent Mestizo); Barbados with its IQ of 78 (4 per cent European, 80 per cent black, 16 per cent Mulatto); and Jamaica with its IQ of 65 (3 per cent European, 3 per cent East Indian, 80 per cent black and 15 per cent Mulatto).

The seventh and final cluster consists of fifteen African countries. The two countries in North Africa, Egypt and Morocco, have higher mean IQs at 83 and 84, respectively, than any of the countries of sub-Saharan Africa. The explanation for this is that their populations are Caucasian and they are genetically part of the Caucasian family of peoples of Europe and South and Southwest Asia rather than to the African peoples south of the Sahara (Cavalli-Sforza, Menozzi and Piazza, 1996,p.78). The 13 countries of sub-Saharan Africa have IQs in the range between 63 and 78. The IQ is South Africa is estimated at 72. There have been a number of studies of the intelligence of these groups and their average IQs are whites: 94; blacks: 66; coloureds: 82; Indians: 83. The percentages of the four groups in the population are whites: 14 per cent; blacks: 75 per cent; coloreds: 9 per cent ; Indians: 2 per cent (Ramsay, 2000). Weighting the IQs of the four groups by their percentages in the population gives an IQ for South Africa of 72.

2. The Validity of National IQs

It has sometimes been argued that no valid comparisons can be made between IQs obtained from different nations. This is the problem of the "validity" of the national IQs presented in Table 6. One variant of this position is that intelligence tests are biased in favor of the white Americans and Europeans who construct them because they measure the cognitive skills taught or acquired incidentally in western cultures but not equally complex cognitive skills possessed by peoples of other cultures but not measured by western intelligence tests. For instance, it has been asserted by Kagan (1971,p.92) that "the IQ test is a seriously biased instrument that almost guarantees middle class white children higher scores than almost any other group of children ". The proposition that white Americans and Europeans "almost" inevitably perform better on the tests than other peoples has been shown to be incorrect by the accumulating evidence that the Japanese, Chinese and Koreans perform better on the tests than Americans and Europeans. It is not only in their own countries that these peoples achieve higher IQs than whites. Ethnic East Asians in the United States have a mean IQ of 104.4 in relation to a white IQ of 100 (Lynn, 1996).

Another variant of the position that intelligence tests do not provide valid measures of the mental abilities of different peoples has

been advanced by Diamond (1997,p.20). He contends that the stone age peoples of New Guinea are more intelligence than westerners even though they do not perform so well on intelligence tests: "New Guineans impressed me as being on the average more intelligent, more alert, more expressive, more interested in things and people around them than the average European or American...Of course New Guineans tend to perform poorly at tasks that westerners have been trained to perform since childhood and that New Guineans have not." What Diamond is in effect contending here is that intelligence tests do not provide valid measures of the intelligence of peoples outside economically developed western societies.

Another assertion that no valid comparisons can be made between IQs obtained in different societies has been made on the grounds that intelligence has different meanings in different cultures. This view has been advanced by Irvine and Berry (1988, p.6) who write that "Our mature judgment is that most attempts to use test scores as operational measures of the mental status of groups or populations have little claim to scientific validity". Contrary to the view, it has been shown by Reuning (1988) that even among such a primitive group as the Bushmen hunter-gatherers of the Kalahari desert ability tests are positively intercorrelated and have a general factor similar to the g found in western studies, that the Bushmen have the concept that some people are bright and others dull, corresponding to similar notions in economically developed countries, and that these concepts correlate well with scores on intelligence tests. It has also been shown in numerous other studies of peoples from a variety of different cultures that cognitive abilities have the same pattern of positive intercorrelation and a general factor identifiable as g as has been found in the populations of economically developed nations. This has been shown to be true in Turkey (Kagitcibasi and Savasir,1988), for Ugandans, Eskimos and Native American Indians (Hakstian and Vandenberg (1988), and for blacks as well as whites in South Africa (Kendall, Verster and Mollendorf,1988).

To examine the validity of the national IQs we present evidence for the attainment of adolescents for 30 of the nations in math and science obtained in the 1999 study of achievement. These data are set out in columns 2 and 3 of Table 6. Looking at these results, we see that educational attainment is closely associated with national IQs. Thus in math the countries with the highest attainment in math are Singapore (604), South Korea (587), Taiwan (585), Hong Kong (582) and Japan (579). The countries of north west Europe and with predominantly

north west European populations come next. Below these are the nations of south east Europe and west and south Asia. Finally, there is South Africa with by far the lowest score (275). The same correspondence between national IQs and educational attainment is present for science, for which the highest scores are obtained by school students in Singapore and Taiwan. The correlation between national IQ and attainment in math is .904 and between national IQ and attainment in science is .878.

This demonstration that national IQs are highly associated with educational attainment in math and science "validates" the IQs. It follows the long established methodology of the validation of intelligence tests among individuals by showing that they are positively correlated with measures of educational attainment. What these studies have shown is that intelligence tests measure something important and not simply the ability to perform well on the puzzles devised by psychologists. The same association is present across nations and shows that national IQs are measuring cognitive capacity as expressed also in the ability to master math and science. It shows that the national IQ figures are not biased in favor of white middle class American and British males and they are not measures of some trivial ability to do tests constructed by western psychologists.

Our major interest concerns the hypothesis that a country's economic success depends to a significant extent on the average intelligence of the population. We have adopted per capita national income as the best measure of countries economic success of countries. There are three measures of per capita national income. These are per capita Gross Domestic Product (GDP) expressed in 1990 US dollars, per capita Gross National Product (GNP) in US dollars and real Gross Domestic Product (GDP) per capita in US dollars. The last measure is calculated on the basis of the "purchasing power parity" (PPP) of the country's currency. It is intended "to make more accurate international comparisons of GDP and its components than those based on official exchange rates, which can be subject to considerable fluctuation" (Human Development Report 1997, p. 239). The three measures are quite highly correlated. We consider the third gives the most accurate measure of national per capita incomes. These are the data presented in the third column of Table 6. These data are taken from the United Nations Development Programme's (UNDP) *Human Development Reports*. The Pearson product-moment correlation coefficient between national IQs and real GDP is .733 and is highly statistically significant. The square of this correlation is .54 and indicates that 54 percent of the

variance in national per capita income can be explained in terms of the average IQ of the populations.

The fact that the relationship between national IQ and per capita income is not perfect means that some countries have higher per capita incomes than would be predicted from their populations' IQs, while other countries have lower IQs than would be predicted. We now use regression analysis to examine these anomalies to a perfect relation between national IQs and per capita incomes. Regression analysis shows the extent to which the average relationship between national IQ and per capita national income applies to individual countries and which countries deviate most from the average relationship (regression line). The analysis of deviant countries should help to indicate other factors that have affected a country's economic development independently from its level of national IQ.

The results of the regression analysis are shown in the fifth and sixth columns of Table 6. In the fifth column (Residual real GDP), a negative sign indicates that the country has a lower per capita national income than would be predicted from its populations' IQ, while a positive residual indicates that a country has a higher per capita income than would be predicted from its national IQ. The predicted values of real GDP per capita in 1998 (Fitted real GDP) are given in the sixth column. It should be noted that because of the linear regression line, predicted or fitted values are negative for all countries for which national IQ is 67 or less. Because per capita income cannot be negative for any country, positive correlations for those countries are unrealistically high (for example, 6,913 for Equatorial Guinea). Such positive residuals are technical consequences of the regression equation $Y = -37{,}716 + 519 * X$.

The deviations from the regression line are due to a large number of factors, but by examining the figures it is possible to discern the most important of these. The countries with the largest negative residuals are China, Bulgaria, Poland, Romania, Russia and Indonesia. The first five of these have had their economies impaired by socialism and communism, while Indonesia suffered particularly severely from the economic downturn in East Asia in the 1990's. Another country with a large negative residual is Iraq, whose economy has been impaired by defeat in the Gulf war and subsequent economic sanctions.

The countries with the largest positive residuals are Belgium, Canada, Denmark, Ireland, Norway, Singapore, Switzerland, the United States, Qatar, Barbados and South Africa. The first eight of these are free market economies which for various reasons have performed

exceptionally well economically. Norway has benefited from large oil revenues and Ireland from large European Economic Community subsidies. Qatar has gained from its huge oil earnings. Barbados and South Africa have performed better than predicted because their economies have been largely run by fairly small minorities of whites, who comprise 4 percent of the population of Barbados and 14 percent of the population of South Africa. It can be noted that this is also to some degree the case for Zimbabwe whose quite large positive residual is attributable to much of the economy being run by a small minority of whites.

Discussion

In this paper we have been concerned with an examination of the hypothesis that the intelligence of the populations is an important determinant of national per capita income. We have found that in this sample of 81 nations there is a correlation of .733 between national IQ and real per capita GDP in 1998 and we propose that this provides strong support for the hypothesis. The correlation explains 54 per percent of the variance in per capita income. The remaining 46 percent is attributable to a number of other factors. The most important of these is the extent to which countries have free market economies, which have helped to produce high per capita incomes, or have socialist economies, which have been responsible for low per capita incomes.

The reason that nations whose populations have high IQs have high per capita incomes (except in countries whose economies have been handicapped by socialism) is easy to understand. People with high IQs learn rapidly, work efficiently and can solve new problems. The principal reason that the free economies of the Pacific Rim (Japan, South Korea, Hong Kong, Taiwan and Singapore) have done so well economically in the decades following World War Two is that their populations have high IQs. The principal reason that the countries of sub-Saharan Africa and the Caribbean have done poorly economically is that their populations have low IQs.

For a number of reasons set out in Lynn (1991a, 1991b,1997) we believe that the national differences in IQs are largely genetically determined. Population geneticists have demonstrated that there are genetic differences between major geographical populations and races in numerous characteristics including skin and eye color, body shape, teeth, blood groups and susceptibility to genetic diseases (Cavalli-Sforza, Menozzi and Piazza 1996) and brain size (Rushton, 2000). For this reason it must be regarded as probable that differences

in average intelligence are also partly genetic. The world's populations have evolved in almost total isolation for around 50,000 to 100,000 years. In these circumstances it is impossible that they would all have remained identical in their genes for intelligence. It would have been impossible for the genetic components of intelligence to remain the same in all populations through tens of thousands of years when all other characteristics of populations for which there is genetic variance in the population show geographical and racial variance as a result of adaptations to the environments in which they have evolved, as a consequence of natural selection. We believe that those who assert that the differences in national IQs have no genetic basis can never have thought of this question in terms of evolutionary biology. The principal reason for the national differences in intelligence appears to be that when early Homo sapiens migrated out of Africa and into Eurasia they encountered the harsher environments of cold winters. In order to survive they had to solve new and difficult problems of hunting large animals, making improved weapons and tools, and for making clothing, fires and shelters. The solution of these problems required greater intelligence and this required a further growth in brain size in the Caucasian and Oriental peoples.

The conclusion that national differences in economic development are to a significant degree determined by differences in the intelligence of the populations, and that these are in turn significantly determined genetically, must mean that the potential for reducing the gap between rich and poor countries is seriously limited. It is more probable that, with further technological development and increasingly complex and intellectually demanding economies, the economic inequalities between nations will increase even more in the future. The prospects of economic growth are best in countries with large negative residuals, because these indicate that a country's level of per capita national income is much lower than expected on the basis of its population's average level of intelligence. Consequently, the human potential for economic growth is greatest in the European and East Asian countries with large negative residuals, whereas the chances are poorest in the countries of sub-Saharan Africa. Nevertheless, intelligence is partly determined environmentally. The most important environmental determinant of intelligence appears to be the quality of nutrition received by the fetus and by the infant from its mother (Lynn,1990, 1998). Hence, aid to the third world should be targeted on attempting to improve the intelligence of the populations by improving the quality of nutrition. Nevertheless, we believe that the conclusion to be drawn from our

study is that it will never be possible to achieve an economic equality between nations. The poor will always be with us. The world may need a new international moral code designed to accept and deal with the existence of significant differences in human mental abilities and consequent economic inequalities.

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BOOK REVIEW ARTICLE

The Riddle of the Tarim Basin Mummies

Alexander Jacob
Toronto

The Bronze Age and Early Iron Age Peoples of Eastern Central Asia
Ed. V.H. Mair
Washington, D.C.: Institute for the Study of Man, 2 vols., 1998

The recent discovery of four thousand year old Europoid mummies in the Tarim basin (in Sinkiang, north of Tibet) has been one of the most extraordinary anthropological revelations of this century. For it demonstrates a very ancient Indo-European presence in China which may indeed have been responsible for the transmission of chariotry, metallurgy and weaving techniques to the Mongoloid peoples of the region. However, the exact Indo-European identity of the mummies has not yet been ascertained and scholars still wonder whether they were proto-Scythians or proto-Kelts or both.

The earliest of the mummies found in the Tarim Basin can be dated to around 2000 B.C., that is, before either the earliest Indic Mitanni kingdom in Western Asia (ca. 1600 B.C.) or the full flower of the Indo-Aryan culture in the Indus Valley (ca.1500 B.C.). However, the mummies bear no records of their earliest linguistic or spiritual status, and the Indo-European Tokharian language of the region is attested from a much later date (6th-8th c. A.D.) than the mummies, which can only tentatively be identified as belonging to the ancestors of the Tokharian speakers. Tokharian itself is a centum language unlike the satem Indo-Iranian languages.[1] The pictorial representations of the historical Tokharians however exhibit Indo-Iranianan attire, while the Tokharian texts themselves are related to the Indic Buddhist religion, which the Tokharians may have been instrumental in conveying to their Chinese neighbours.

[1] The western and eastern branches of the Indo-European family of languages are divided, roughly, by their use of 'c' or 's' in words like 'centum'/'satem' (=hundred).