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The Flynn effect in Korea: Large gains ☆

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ABSTRACT

Secular gains in IQ test scores have been reported for many Western countries. This is the first study of secular IQ gains in South Korea, using various datasets. The first question is what the size of the Flynn effect in South Korea is. The gains per decade are 7.7 points for persons born between 1970 and 1990. These gains on broad intelligence batteries are much larger than the gains in Western countries of about 3 IQ points per decade. The second question is whether the Korean IQ gains are comparable to the Japanese IQ gains with a lag of a few decades. The gains in Japan of 7.7 IQ points per decade for those born approximately 1940–1965 are identical to the gains per decade for Koreans born 1970–1990. The third question is whether the Korean gains in height and education lag a few decades behind the Japanese gains. The Koreans reach the educational levels the Japanese reached 25–30 years before, and the gains in height for Koreans born 1970–1990 are very similar to gains in height for Japanese born 1940–1960, so three decades earlier. These findings combined strongly support the hypothesis of similar developmental patterns in the two countries.

1. Introduction

1.1. The secular increase in average IQ test scores

Western, industrialized countries showed average gains on standard broad-spectrum IQ tests of 3 IQ points per decade between 1930 and 1990. Verbal tests showed gains of 2 IQ points per decade, and non-verbal (fluid and visual) tests showed gains of 4 IQ points per decade. Gains on specific measures, such as the Raven's Progressive Matrices when used for the assessment of military recruits averaged about 7 IQ points per decade.

Recently, however, studies from Denmark and Norway show the secular gains have stopped in Scandinavia and even suggest a decline of IQ scores (Shayer, Ginsburg, & Coe, 2007; Sundet, Barlaug, & Torjussen, 2004; Teasdale & Owen, 2007). However, an important part of the decline in IQ scores is most likely due to the increase of low-g immigrants (see te Nijenhuis, de Jong, Evers, & van der Flier, 2004). In a recent paper Lynn has shown that fluid intelligence measured by the Progressive Matrices has increased in Britain over the years 1979–2008 among 7–12 year olds, but not among 13–15 year olds, and that vocabulary has shown no increase in Britain over the years 1982–2007 among 5–11 year olds (Lynn, 2009a). There is also recent evidence of IQ test scores continuing to rise in countries in the former communist Eastern Europe (e.g. in Estonia, see Must, te Nijenhuis, Must, & van Vianen, 2009), in less-developed parts of the world, for example in Sudan (Khaleefa, Abdelwahid, Abdulradi, & Lynn, 2008), Kenya (Daley, Whaley, Sigman, Espinosa, & Neumann, 2003), and in the Caribbean (Meisenberg, Lawless, Lambert, & Newton, 2006).

Various causes have been hypothesized for the Flynn effect. Chief among them are improved nutrition and health care and education (see Lynn, 1990; see Jensen, 1998). Some theorists argue that the Flynn effect is a byproduct of outbreeding, testing artefacts, test sophistication, cultural changes, and decreasing family size.

1.2. Lynn's contribution to the area

The so-called Flynn effect was identified by Richard Lynn (1982) two years before Flynn (1984) identified the same phenomenon in the United States. Lynn's (1982) paper showed that intelligence had increased in Japan from the 1930s up to the 1970s. In 1987 he published a further paper documenting the increase in Britain during the half century 1936–1986 (Lynn, Hampson, & Mullineaux, 1987), which was followed by Flynn (1987) showing the same increase had taken place in a number of countries. Lynn and Pagliari (1994) documented gains in the US. However, although Lynn was

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certainly ahead of Flynn in identifying the increase of intelligence that occurred in many countries in the twentieth century, he was by no means the first to show this. The first major study to identify the Flynn effect was published some forty years earlier by Tuddenham (1948), who showed that the intelligence of American conscripts had increased by 4.4 IQ points a decade from 1917 to 1943. A year later an increase of intelligence was reported in Scotland over the years 1932–1949 (Scottish Council for Research in Education, 1949). In view of these early studies, the secular increase of intelligence arguably should properly have been called the "Tuddenham effect". Many studies on secular gains have developed from Lynn's pioneering work.

Lynn has published a number of further seminal papers on score gains. His principal contributions have been to document the effect and to argue that the principal factor responsible for the effect has been improvements in nutrition (Lynn, 1990, 1998, 2009b). In the last of these he showed that the FE of approximately 3 IQ points a decade has taken place in the developmental quotients of one and two year olds. He argues that this favors the nutrition theory and makes less plausible the alternative explanations of the Flynn effect that it is due to improvements in education, advanced by Flynn (2007). However, it could also be argued that this is explained by the trend towards turning infancy into a frantic learning experience.

Lynn and Hampson (1986) review five studies providing evidence on the secular trend of intelligence in Japan for the post World War II period. They conclude that two studies of the early post World War II period show substantial IQ gains of 9.9 and 11.4 IQ points per decade, giving an average of 10.7 IQ points per decade. Three studies of a longer period from approximately 1950–1975 – so for those approximately born 1940–1965 – show lower gains of 9.1, 8.3, and 5.7 IQ points per decade, giving an average gain of 7.7 IQ points per decade. This is the highest gain on a broad intelligence battery in the literature. Since the early part of this period was characterized by a greater rate of gain, it appears that since around 1960 the IQ gains in Japan have decelerated to approximately 5 IQ points per decade. However, there are, to this date, no studies of the Flynn effect in Korea. The present paper fills this important gap in the literature.

1.3. History of Korea

The Korean peninsula has a long integrated history with China and Japan. Korea was annexed by Japan in 1910 and subjugated economically, religiously, culturally, socially, and politically resulting in mass exodus. After independence in 1945, Russian forces and American forces entered Korea in an attempt to defeat Japan. The drawing up of what was originally a temporary demarcation line between North and South Korea would eventually lead to Korea's most troubled period in history. In 1948 the South was declared a Republic with the North following suit shortly thereafter proclaiming a Democratic People's Republic of Korea. South Korea's growth and development stand in marked contrast to the North. In South Korea's per capita GNI (2007) is $20,045 in comparison to North Korea for whom the figure is $1108 (2006). (US Department of State: Bureau of East Asian and Pacific Affairs, 2008).

The Republic of Korea's education system follows a similar general pattern as to that found in typical western countries with compulsory elementary schooling with a 100% enrollment figure (http://www.korea.net). Teacher-student ratios have declined since the 1960–1970s from high ratios to figures more in keeping with western countries. Table 1 details the education level of the population above the age of 25 from 1970–2005 and Table 2 details the enrolment figures from 1945–2002.

The increase in the South Korean national educational level in just over 30 years is quite dramatic as the data shows that between 1970 and 2002 the number of students in higher education increased with a factor 18, another indication of the spectacular increase in education.

Table 1
South Korea: Education level of the population above the age of 25.

Year	Elementary school or below elementary school (%)	Middle school(%)	High school(%)	University or above university(%)	Total(%)
1970	73.4	11.5	10.2	4.9	100
1975	65.5	14.8	13.9	5.8	100
1980	55.3	18.1	18.9	7.7	100
1985	43.4	20.5	25.9	10.2	100
1990	33.4	19.0	33.5	14.1	100
1995	26.6	15.7	38.0	19.7	100
2000	23.0	13.3	39.4	24.3	100
2005	19.1	11.2	38.3	31.4	100

Table 2
Enrollment in Higher Education in South Korea and Japan 1945–2002.

Year	**Korean** students in higher education as a percentage of the total population	**Japanese** students in higher education as a percentage of the total population
1945	0.034	–
1950	0.056	1.23
1960	0.404	2.9
1965	0.486	4.43
1970	0.62	7.18
1975	0.98	8.29
1980	1.69	8.03
1985	3.55	7.99
1990	3.89	9.9
1995	5.19	12.79
2000	7.11	14.2
2002	7.5	14.55

The height of a population is a good indicator of its health and the data in Tables 3 and 4 show spectacular gains in height. Table 3 illustrates how 17-year-olds in 2005 measured 167.3 cm whereas in 1965 they measured 160.3 cm.

Taking an *SD* of 5 cm (Korean Educational Development Institute., 1966–2006), this is almost a one-and-a-half *SD* increase in height in 40 years. Looking at 17-year-olds may not give the best impression, because boys stop growing around age 18, whereas girls stop growing around age 15 (Lynn, 1994). Again taking an *SD* of 5, 13-year-olds show a gain of 15.2 cm, which is the equivalent of 3 *SD*s, and 14-year-olds show a very similar gain of 15.1 cm. The greatest increases occurred for the 11-year-old age group with a gain of 18.1 cm. A gain in height of 3 *SD* in just 40 years is spectacular.

Chief among the various hypothesized causes of the Flynn effect are improved nutrition and health care and education (Jensen, 1998). As there are such large gains in height and education it is expected there are also large gains in IQ scores.

1.4. Same patterns of development in Korea and Japan?

Lynn and Hampson (1986) report a 7.7 IQ point gain per decade for Japanese born approximately 1940–1965; this estimate is based on a number of studies and therefore quite reliable. Various studies show large gains in height and years of education for the Japanese; these gains happened at the same time as the gains in IQ.

Korea changed dramatically after the Korean war ended in 1953, just as Japan had shown a dramatic change several decades before. From poor countries they both quickly developed to rich countries. It may be that the development of Japan and Korea in the 20th century shows the same patterns in gains in height,

Table 3
South Korea: Year of birth and increase in height between ages 6 and 17 for males and females combined.

Year height measured (cm)	6 b.1959–1999	7 b.1958–1998	8 b.1957–1997	9 b.1956–1996	10 b.1955–1995	11 b.1954–1994	12 b.1953–1993	13 b.1952–1992	14 b.1951–1991	15 b.1950–1990	16 b.1949–1989	17 b.1948–1988
1965	111.5	114.9	119.3	124.7	127.8	131.6	142.0	145.3	148.8	156.4	159.0	160.3
1970	112.4	116.7	120.9	125.6	130.0	133.8	144.0	148.5	151.5	157.1	159.6	161.2
1975	111.8	118.1	121.4	127.6	132.4	137.2	144.3	149.6	153.7	158.3	160.4	161.8
1980	114.4	119.8	124.8	129.7	134.6	139.8	145.4	150.6	155.3	159.0	161.1	162.3
1985	116.0	121.5	126.4	131.5	136.7	142.3	148.6	153.6	157.9	160.8	162.3	163.4
1990	117.8	123.3	128.5	133.7	139.0	145.0	155.0	155.8	159.6	162.2	163.5	164.4
1991	117.9	123.5	128.8	134.0	139.4	145.2	155.2	156.1	159.9	162.3	163.6	164.5
1992	118.2	123.7	129.2	134.2	140.1	146.0	151.3	156.6	160.7	162.8	163.9	164.6
1993	118.5	124.1	129.5	134.9	140.3	146.3	152.0	157.1	160.9	163.4	164.4	165.0
1994	118.9	124.4	129.5	135.0	140.8	146.4	152.4	157.5	161.0	163.5	164.8	165.3
1995	118.9	124.6	130.0	135.3	141.0	147.1	152.9	157.9	161.8	163.9	164.9	165.7
1996	119.1	124.7	130.2	135.5	141.3	147.3	153.1	158.2	162.0	164.1	165.4	166.1
2000	119.5	125.4	130.7	136.3	142.1	148.7	154.7	159.6	163.1	165.0	166.2	166.8
2005	120.0	125.9	131.5	137.2	143.4	149.7	155.7	160.6	163.9	165.9	166.8	167.3

Table 4
Japan: Year of birth and increase in height between ages 5 and 17 for males and females combined.

Year height	5 b.1945–2000	6 b.1944–1999	7 b.1943–1998	8 b.1942–1997	9 b.1941–1996	10 b.1940–1995	11 b.1939–1994	12 b.1938–1993	13 b.1937–1992	14 b.1936–1991	15 b.1935–1990	16 b.1934–1989	17 b.1933–1988
Measured (cm)													
1950	104.45	108.2	113.2	118	122.5	126.85	131.4	136.65	141.85	146.95	152.5	155.55	157.25
1955	105.45	109.8	115.1	119.85	124.8	129.55	134.4	140.1	145.5	150.3	155.1	157.1	158.3
1960	106.8	111.15	116.45	121.5	126.55	131.8	137.15	142.95	148.1	152.9	156.95	158.45	159.35
1965	108.2	112.9	118.3	123.5	128.6	133.85	139.45	145.5	151	155.4	158.8	160.15	160.8
1970	109.05	114.05	119.75	125.05	130.25	135.75	141.7	147.75	153.05	157.35	159.7	161	161.7
1975	109.35	114.75	120.5	125.75	131.6	137	143.1	149.1	154.65	158.6	160.9	162.05	162.55
1980	109.85	115.35	121	126.55	131.95	137.8	143.9	150.2	155.45	159.8	161.8	162.9	163.35
1985	110.2	116.05	121.75	127.2	132.6	138.25	144.35	150.45	156.05	160.05	162.25	163.3	163.9
1990	110.5	116.4	122.15	127.75	133.15	139.05	145.35	151.45	156.75	160.45	162.55	163.55	164.15
1995	110.55	116.4	122.15	127.85	133.45	139.55	145.8	151.95	157.35	160.9	162.9	163.9	164.4
2000	110.3	116.25	122.1	127.8	133.55	139.7	146.2	152.5	157.55	161.15	162.95	163.9	164.45
2005	110.3	116.2	122.1	127.85	133.55	139.55	146	152.25	157.55	161.1	162.85	163.9	164.4

education, and IQ. It may be the case that Korea simply lags a few decades behind Japan.

1.5. Research questions

The first question is what the size of the Flynn effect in South Korea is. The second question is whether the South Korean IQ gains are comparable to the Japanese IQ gains with a lag of a few decades. The third question is whether the Korean gains in height and education lag a few decades behind the Japanese gains.

2. Method

2.1. Tests

Test data were gathered on the well-known test batteries adapted and used in many countries, such as the various versions of the Wechsler scales. Table 5 lists the Korean tests and their US counterparts.

2.2. Collecting data on height and education in Korea and Japan

Data were collected on height and education in Japan, so as to be able to make a comparison with the gains in height and education in South Korea as described in the Introduction.

Table 5
South Korean IQ tests and US originals.

Korean tests	US original	Year Korean norm sample	M/SD
Korean K-ABC (1997)	K-ABC (1983)	1996	100/15
K-WAIS (1992)	WAIS-R (1981)	1991	100/15
KEDI-WISC (1991)	WISC-R (1974)	1986	100/15
K-WISC-III (2001)	WISC-III (1991)	1999*	100/15
K-WPPSI (1996)	WPPSI-R (1989)	1995	100/15

Note. The year in which the Korean norm samples were tested was taken from the manual.
* = year estimated. When the date at which standardization was carried out is not given, it was assumed to have taken place two years before the date of publication. When the collection of the standardization sample took several years we took the year in the middle.

2.3. Statistical analyses

2.3.1. Computing secular score gains

The methods of computing secular gain scores used in this paper was also used in Flynn (1984). In studies where the same group took two different test batteries the resulting means were compared. These samples need not be representative. For instance,

Table 6
Samples Used to Determine Flynn Effect Using the Same Groups on Different Tests.

Test	Norm dates
K-WISC-III(2001) and K-WAIS (1992)	1999 and 1991
KEDI-WISC (1991) and K-ABC (1997)	1986 and 1996
K-WPPSI (1996) and K-WISC-III(2001)	1995 and 1999
K-WISC-III(2001) and KEDI-WISC (1991)	1999 and 1986

Note. Counterbalanced designs were used in all studies.

one group took both the K-WISC-III (2001) and the KEDI-WISC (1991). Comparing their scores on the older test and on the newer test with the scores of norm samples from the older test and with the scores of the norm sample of the newer test, and computing the difference, gives an estimate of the Flynn effect. For instance, if the same group of subjects took the KWIS – normed in 1961 – and the K-WAIS – normed in 1991 – they should score higher on the earlier test, the KWIS. The group's raw score on the KWIS should be compared to the norm scores of the KWIS from 1961, which might result in a score of 117. The group's raw score on the K-WAIS should be compared to the norm scores of the K-WAIS from 1991, which might result in a score of 101. The difference between their mean scores on the two tests serves as s measure of the magnitude of gains, that is, scoring 117 on the earlier test and 101 on the later test suggests a gain of 16 IQ points in 30 years. Table 6 delineates the combinations of batteries used to compute the effect in this manner.

Samples were compared when there was at least four years between the groups being compared or between the norm samples of the two tests such that the scores of one group taking two tests were compared; in such a way sampling error will not overwhelm the trend.

2.3.2. Comparison of Korean and Japanese gains

Statistics on height and education for Korea and Japan were compared to check how many decades the Koreans lagged behind the Japanese. How many decades passed before Koreans were at a specific educational level at a specific point in time in Japan? For a specific period in time, were gains in height in Japan similar to gains in height in Korea a few decades later?

3. Results

3.1. Descriptive statistics

From the four data sets in Table 7 – the same group takes two different tests using a counterbalanced design – we computed the average gain per decade; the sample sizes are quite comparable, so we did not use sample size weighed means.

The gains for Verbal, Performance, and Full Scale were, respectively, 1.6 IQ points, 16.0 IQ points, and 7.7 IQ points. Excluding the comparison between the K-WISC III and the K-WPPSI with its decrement on Verbal IQ results in a mean gain per decade on Verbal of 4.6 IQ points based on two data sets. This gain per decade on the Full Score of 7.7 IQ points for people being born in the period of about 1970–1990 is the same as the value for Japan of 7.7 IQ points gain per decade for those born approximately 1940–1965 (Lynn & Hampson, 1986)

3.2. Comparison of height and education data for Korea and Japan

The gains in IQ for Koreans born approximately 1970 – 1990 are identical to the gains for Japanese born approximately 1940–1965. So, we simply take three decades as an estimate of the developmental lag of Korea in comparison to Japan. When comparing the Japanese enrolment figures with those of South Korea, it can be seen that South Korea lags some 25 to 30 years behind Japan (see Table 2). The first example is that the number of students expressed as a percentage of the population enrolled in higher education in South Korea in 1975 is comparable to the numbers enrolled in Japan in 1950. The second example is that the enrolment figure in South Korea for 2002 and Japan 30 years earlier is highly similar, about 7%.

Table 3 shows that the gains in height in Korea are similar to the gains in height in Japan thirty years before. For instance, South Koreans born in 1968, measured in 1985 at age seventeen were 163.4 cm tall; Koreans born in 1988, measured in 2005 at age seventeen were 167.3 cm tall. This is a gain of 3.9 cm in twenty years. Thirty years earlier, Japanese born in 1938, measured in 1955 at age seventeen, were 158.3 cm tall; Japanese born in 1958, measured in 1975 at age seventeen were 162.6 cm tall. This is a gain of 4.3 cm. So, over a period of twenty years, the Koreans show highly comparable gains in education and height as the Japanese 30 years before.

4. Discussion

Secular score gains in IQ have been shown clearly for many Western countries, but there is a much smaller number of studies from Asia. In this study we tried to answer three questions concerning secular score gains in Korea. The first question is what the size of the Flynn effect in South Korea is. The results are clear: secular score gains in South Korea are large, based on findings from a substantial number of data sets. The gains per decade are 7.7 points for persons born between 1970 and 1990. The most recent gains are reliable as they are based on several high-quality datasets. These gains on broad intelligence batteries are much larger than the gains in Western countries of about 3 IQ points per decade.

The second question is whether the Korean IQ gains are comparable to the Japanese IQ gains with a lag of a few decades. Lynn and Hampson (1986) show gains in Japan of 7.7 IQ points per decade for those born approximately 1940–1965. These gains are identical to the gains per decade for Koreans born 1970–1990. Indeed, the Korean gains in IQ lag behind the Japanese gains by three decades.

The third question is whether the Korean gains in height and education lag a few decade years behind the Japanese gains. The data on education clearly show that the Koreans reach the educational levels the Japanese reached 25–30 years before, which

Table 7
Score Gains for Same Group on two Different Tests.

Test	Norm dates	(Average of) year born for 2 groups	Age	*N*	Time gap (years)	Gain per decade		
						Verbal	Performance	Full
K-ABC (1997) and KEDI-WISC(1991)	1996 and 1986	1977–1987	5–12	80	10			3.3
K-WISC-III(2001) and KEDI-WISC (1991)	1999 and 1986	1975–1988	6–16	89	13	3.15	10.46	7.23
K-WISC-III(2001) and K-WAIS (1992)	1999 and 1991	1975–1983	16	70	8	6.0	16.13	11.88
K-WISC-III(2001) and K-WPPSI (1996)	1999 and 1995	1988–1992	6–7	68	4	−4.5	21.5	8.25

Note: Gain per decade is expressed in IQ points. An *SD* of 15 is assumed.

strongly supports the hypothesis of similar developmental patterns in the two countries. The data on height clearly show that gains in height for Koreans born 1970–1990 are very similar to gains in height for Japanese born 1940–1960, so three decades earlier. This is in line with the hypothesis of similar development. The combined findings on education and height strongly support the hypothesis of similar developmental patterns. These two gains may be responsible for part of the gains in IQ in both Japan and Korea, but of course gains in GDP, urbanization, family size, health care expenditure, the dissemination of television, and teacher-to-student ratios may have shown comparable trends in the same time period and may have also contributed to the gains.

4.1. Thoughts about the future of the area

Following the pioneering work of Lynn a lot of data have been collected on secular score gains. To separate the trends from the outliers various meta-analyses are badly needed. For instance, Flynn (2007) lists all the datasets on the question whether gains are dissimilar for persons of low, average, and high IQ, and a next step is to meta-analyze these data. Flynn also describes the comparative trends on Wechsler subtests and these should also be meta-analyzed. Secular gains in variables hypothesized to be causes of the Flynn effect have been documented and also need to be meta-analyzed to be combined with the meta-analyses on IQ gains.

Some claims rest on only a small number of studies, such as Lynn's claim that IQ gains are already fully present at a young age. Some more studies on this topic are needed.

Comparison of countries which vary on variables hypothesized to be causes of the gains are also possible. For instance, communism influenced various variables, so a comparison between Estonia and Sweden would be interesting, or between former West Germany and East Germany. Theoretically, it would be very interesting to do a study of secular score gains in IQ in North Korea. It appears that height has not increased in North Korea since the end of the Korean war. However, it may be that the quality and number of years of education has improved. This experiment of nature could throw some light on the question to what degree nutrition/hygiene and education influence score gains. Following Lynn (2010) a comparison of the north and south of Italy would also be interesting.

Another fundamental question is when the secular gains have started. Some empirical studies go as far back as people born in the last part of the 19th century. The German sociologist Oesterdiekhoff (2006) has written extensively on the cognitive level of populations in earlier times, suggesting the cognitive level in 17th century France, Germany, England and the Netherlands was more than two *SD*s below the present level. He argues that the cognitive level of ancient Greeks and Romans was even lower. Oesterdiekhoff makes extensive use of the Piagetian developmental literature to back up his claims and this looks like a promising approach.

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