

# **JAPAN/USA: THE (APPARENT) MIRACLE OF CONVERGENCE\***

**Francisco J. Goerlich y Matilde Mas\*\***

WP-EC 98-20

Correspondence to Matilde Mas: Instituto Valenciano de Investigaciones Económicas (IVIE)  
C/. Guardia Civil, 22, Esc. 2, 1º. 46020 Valencia (Spain).

Tel.: 963 930 816 / Fax: 963 930 856 / e-mail: Matilde.Mas@uv.es.

Editor: Instituto Valenciano de Investigaciones Económicas, s.a.

First Edition October 1998

ISBN: 84-482-1885-X

Depósito Legal: V-3832-1998

IVIE working-papers offer in advance the results of economic research under way in order to encourage a discussion process before sending them to scientific journals for their final publication.

---

\* This note forms part of a DGICYT PB94-1523 project. The authors are grateful for the comments, without implications, made by Francisco Pérez. F.J. Goerlich would like to thank the *Instituto Valenciano de Investigaciones Económicas* for its financial assistance, and M. Mas for the *Ministerio de Educación y Ciencia* grant PR95-092.

\*\* F. Goerlich: Universitat de València; M. Mas: IVIE y Universitat de València.

# **JAPAN/USA: THE (APPARENT) MIRACLE OF CONVERGENCE**

**Francisco Goerlich and Matilde Mas**

## **A B S T R A C T**

With reference to the Baumol/de Long controversy over the importance of the sample selection when verifying the convergence hypothesis, the paper concludes that the convergence results are conditioned by the joint consideration of the United States and Japan in the same country sample. The illustration of this result lays on the  $\delta$ -convergence concept and uses the simple coefficient of variation as dispersion statistics. The database is the one provided by the OCDE regarding prices and estimates of constant purchasing power parity (base year 1990). In the Appendix, the results are compared with those obtained with an alternative source, the database supplied by Summers and Heston (Mark 5.6).

**Key words:** Convergence, sample selection, OCDE.

## **R E S U M E N**

Tomando como referente la polémica Baumol/de Long sobre la importancia de la selección de la muestra en la contrastación de la hipótesis de convergencia, el trabajo concluye que ésta se encuentra condicionada por la consideración conjunta de Estados Unidos y Japón en la muestra de países. La ilustración de este resultado descansa en el concepto de  $\delta$ -convergencia y utiliza como estadístico de dispersión el coeficiente de variación simple. La base de datos es la proporcionada por la OCDE relativa a precios y paridad de poder de compra constantes (año base 1990). En el Anexo se comparan los resultados con los obtenidos utilizando, como fuente alternativa, la base de datos proporcionada por Summers y Heston (Mark 5.6).

**Palabras clave:** Convergencia, selección de la muestra, OCDE.

## JAPAN/USA: THE (APPARENT) MIRACLE OF CONVERGENCE

The seminal work of Baumol (1986) gave impulse to the empirical discussion on the existence of convergence in the per capita income of the different countries. The somewhat heated criticism of Baumol's results by De Long (1988) rested on the argument of the ex-post selection of the sample, defending the position that if the selection had been made ex-ante, with a larger sample than the initial one, the results would have indicated absence of convergence.

At the bottom of the argument lies the idea that the countries that have converged are those that are currently "rich", whether the "Maddison 16" or those of the OECD. These countries satisfy the requirements laid down by Abramowitz (1986, 1994) in terms of "social capability", which would facilitate the processes of technological diffusion and also of catching-up with the leader, the United States. Consequently, the work of these authors has contributed to spreading the idea that convergence has occurred exclusively among the countries of this limited group, currently the most highly-developed ones, while the numerous other countries that do not belong to this select "club" have not shown signs of convergence. The aim of this note is to illustrate that previous results have been very much influenced by the inclusion of Japan and the USA in the same sample.

The Baumol-De Long controversy developed in three phases. It began with the article by Baumol in 1986. On the basis of data published by Maddison (1982) for sixteen industrialized countries<sup>1</sup>, and focusing on the negative relation of per capita GDP growth rate to its level in the initial year (1870)<sup>2</sup>, he concluded that convergence did exist in both per capita GDP and in productivity per hour worked, for the period 1870-1979.

In his reply, De Long (1988) argued that the sample should have included all the countries that in 1870 had the same growth potential, i.e. were in the same bracket of per capita income as the "Maddison 16". Since Japan was in this sample, the broadening of the sample would have meant including half the countries of the world given Japan's low level of income at that time. De Long rejected this idea, arguing that "This sample does not provide a fair test of convergence. The Japanese miracle is a miracle largely because there was little sign in 1870 that Japan -or any

---

<sup>1</sup>Australia, Austria, Belgium, Canada, Denmark, Finland, France, Federal Republic of Germany (FRG), Italy, Japan, the Netherlands, Norway, Switzerland, Sweden, the United Kingdom and the USA.

<sup>2</sup>This relation is currently known as  $\alpha$ -convergence in the terminology coined by Sala-i-Martin (1990) and Barro and Sala-i-Martin (1992).

nation as poor as Japan- was a candidate for rapid industrialization" (pg. 1141). His suggestion was to select the countries by taking as reference the second poorest country of the "Maddison 16", Finland. This would broaden the sample by incorporating Argentina, Chile, East Germany, Ireland, New Zealand, Portugal and Spain. Using simultaneously the two concepts of  $\alpha$  and  $\sigma$  convergence<sup>3</sup>, he illustrated the absence of convergence among the countries belonging to the "once-rich twenty-two" club.

The reply by Baumol and Wolff (1988) was the third round of the discussion. Now taking as reference the data for per capita Real Gross Domestic Product (RGDP) in Summers and Heston (1984) for the period 1950-1980, and using the coefficient of variation as a measure of dispersion, they calculated the evolution of the latter for different samples of countries selected ex-ante on the basis of their ranking in 1950. The first sample starts with ten richest countries, and it is broadened by means of successive inclusions until it reaches the 60 richest countries in 1950. On the basis of this exercise they conclude that "There is a sharp break in pattern of behavior between the samples that include fewer than 16 countries and those that include 16 or more. (...) the curve for the sample of the top 14 countries is typical for the (smaller) sets (...). The coefficient of variation fell steadily and sharply throughout the period, except at its very beginning and very end. Noteworthy is the fairly steady but fairly modest rise since 1975. For larger samples divergence begins much earlier and continues far longer" (pg. 1158).

The selection of the sample as made by De Long involved considering together countries of widely differing cultural traditions and political organization. An alternative criterion for the aggregation of countries, taking as reference the idea of the thresholds pointed out by Azariadis and Drazen (1990) is that developed by Durlauf and Johnson (1992). These authors combine per capita income with literacy levels in the selection of the countries belonging to the four convergence clubs that they consider. In this note we will concentrate on the 24 countries belonging to the OECD before the incorporation of Mexico (1994), the Czech Republic (1995), Poland (1996) and the Republic of Korea (1996). The selection of this sample of countries is motivated by three kinds of considerations: a) they are developed countries with similar political organization, and so are in principle subject to De Long's criticism; b) however, they still present important differences in per capita income; c) they include the "Maddison 16" and four of the

---

<sup>3</sup>Using for the latter the standard deviation of the logarithm of per capita GDP.

"once-rich twenty-two"<sup>4</sup>; and d) for these 24 countries we have a homogeneous database, provided by the national Statistical Organizations.

The selection of the source of statistics, and of the period to be analyzed, is always a very sensitive choice, particularly in the description of the existence, or absence, of convergence. In our case we are interested in the 24 countries of the OECD, which would make it recommendable to consult the data base provided by this organization as an alternative to that of Summers and Heston (1991). However, the wide acceptance of the data base provided by these authors makes it commendable to compare the results obtained by using both sources. This exercise is presented in the Appendix.

The OECD publication "National Accounts" (1997) provides information on GDP for each country for the period 1960-1995<sup>5</sup> at constant prices of 1990. It also provides annual estimates of purchasing power parity (PPP) for the period 1970-1995. The variable GDP has been constructed by applying to the national series at national prices of 1990 provided by "National Accounts", the PPP (relative to the US dollar) corresponding to the year 1990. The population data are taken from the publication "Labour Force Statistics", also by the OECD.

With these premises, figure 1 represents the evolution of the coefficient of variation of per capita GDP with the well-known profile of steep fall of dispersion until the mid-1970s, and subsequent stagnation until 1993, the last year for which data are available.

If we accept De Long's argument and select those countries of the OECD that presented the highest per capita income levels in the initial year, 1962, distinguishing them from the rest, we find the evolution of the coefficient of variation represented in figure 2. In this aggregation, the rich countries are, in general, the ones included in the "Maddison 16"<sup>6</sup>. The most notable

---

<sup>4</sup> Spain, Ireland, Portugal and New Zealand. Argentina, Chile and the Democratic Republic of Germany, included in De Long's sample, are thus excluded.

<sup>5</sup> The information for the Federal Republic of Germany ends in 1993 while that corresponding to the United Germany starts in 1991. For this reason, the data on Germany correspond to the former Federal Republic or West Germany.

<sup>6</sup> The division between rich and poor was made as follows. We considered to be rich those countries that in the initial year, 1962, presented a per capita GDP higher than the average for the countries of the OECD: West Germany, Denmark, Canada, USA, Luxembourg, New Zealand, United Kingdom, Sweden and Switzerland. To make the sample as close to Baumol's as possible the next five richest countries were included: Australia, France, Netherlands and the last ones, Belgium and Norway, which presented a per capita GDP amounting to 86% of the OECD average.

exception is the exclusion of Japan as a member of this club. Figure 2 indicates that, during the period 1962-1993, the intense process of convergence among the poor countries indicated by some authors did not take place, nor did it among the rich countries. However, it does illustrate the standard result that the reduction of disparities occurred fundamentally until the mid-1970s. From then onwards, the group of rich countries experienced divergence, while we can speak of stagnation among the poor ones. It also illustrates the well-known result that dispersion is greater among the poor countries than among the rich ones.

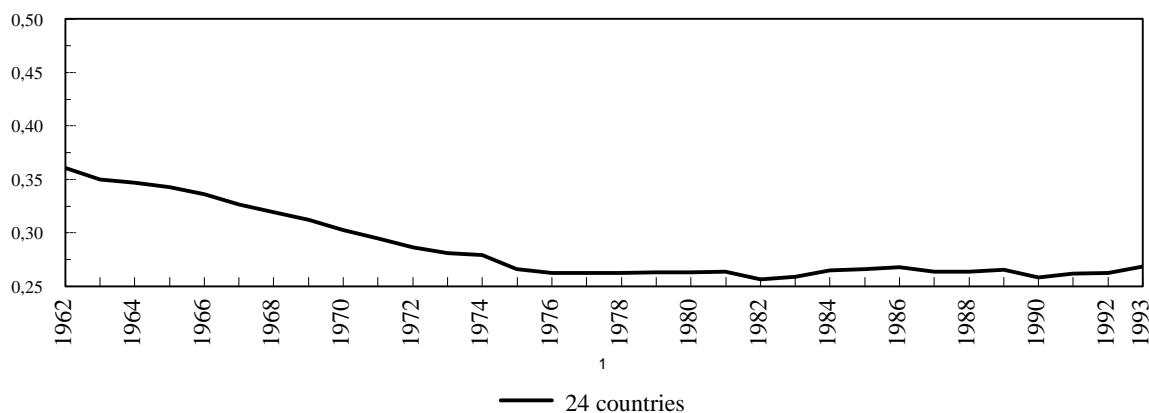
The above result may seem surprising. However, it is important to bear in mind that in figure 2, the USA and Japan are in different clubs. The importance of the intense convergence between the USA and Japan in the overall result of convergence among 24 countries is shown in figure 3 which represents the dispersion existing between the USA and Japan and the other 22 countries. As can be seen, the reduction in the disparities between these two countries is very steep, and its influence on the evolution of the coefficient of variation for the countries of the OECD as a whole is considerable.

The above results are summarized in table 1. At the top of the table appear the levels of the coefficients of variation corresponding to the different aggregations of countries, while at the bottom appear the mean averages of the annual growth rates. Within the complete period 1962-1993, two sub-periods have been distinguished: the sub-period 1962-1975, identified by most authors as the period of intense convergence; and the sub-period 1975-1993, corresponding to its stagnation. Table 1 confirms the results illustrated in the above figures, and allows us to reach the following conclusions.

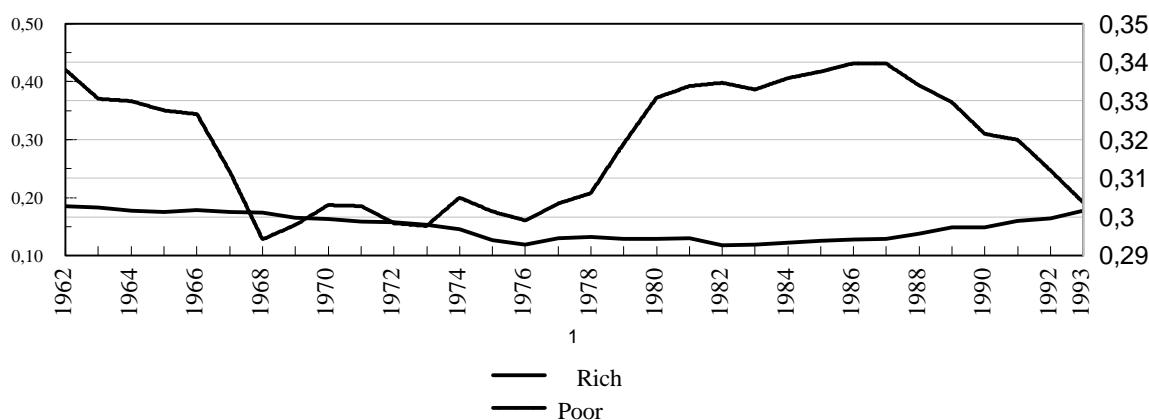
## CONCLUSIONS

1. The study confirms the well-known results of convergence among the 24 countries of the OECD during the period 1962-1993. It also confirms that this convergence was much greater in the first sub-period, 1962-1975, while in the second sub-period we can speak of stagnation, because the average rates of reduction were 2.3% per year at first, as against 0.18% in the second sub-period.

**FIGURE 1. GDP per capita  
Coefficient of variation**

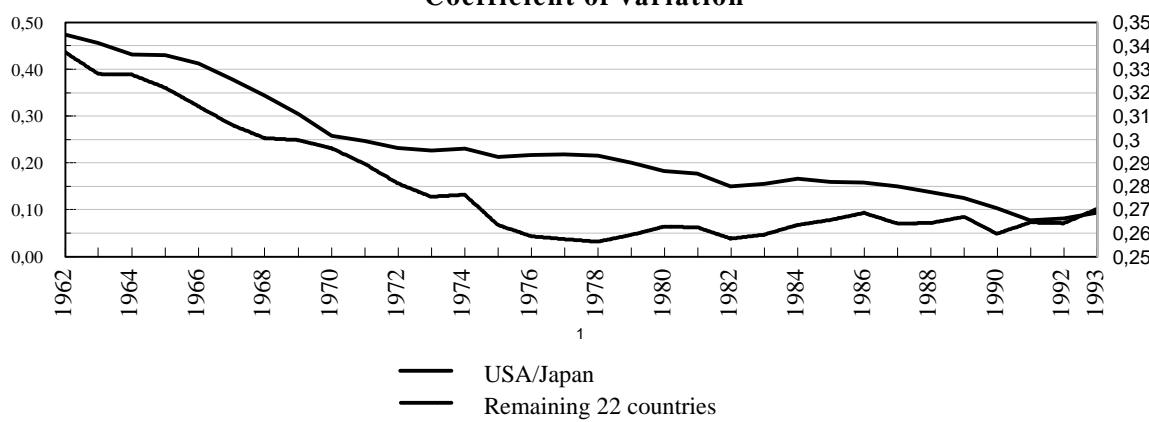


**FIGURE 2. GDP per capita  
Coefficient of variation**



Rich: USA, West Germany, Australia, Belgium, Canada, Denmark, France, Netherlands, Luxembourg, Norway, New Zealand, UK, Sweden, Switzerland  
Poor: Japan, Austria, Spain, Greece, Ireland, Iceland, Finland, Italy, Portugal, Turkey

**FIGURE 3. GDP per capita  
Coefficient of variation**



Source: OCDE.

**TABLE 1.**  
**GDP per capita**  
**Coefficient of Variation**

Levels	1962	1965	1970	1975	1980	1985	1990	1993
<b>24 Countries</b>	0,3604	0,3427	0,3024	0,2662	0,2633	0,2660	0,2582	0,2687
Rich	0,1852	0,1755	0,1632	0,1263	0,1290	0,1252	0,1484	0,1773
Poor	0,3380	0,3275	0,3031	0,3014	0,3308	0,3376	0,3215	0,3037
<b>USA/Japan</b>	0,4738	0,4301	0,2575	0,2126	0,1828	0,1596	0,1033	0,0932
<b>Remaining 22 countries</b>	0,3372	0,3222	0,2963	0,2636	0,2628	0,2657	0,2598	0,2704
<b>Rich (USA excluded)</b>	0,1571	0,1452	0,1437	0,1082	0,1120	0,1067	0,1401	0,1731
<b>Poor (Japan excluded)</b>	0,3525	0,3449	0,3151	0,3154	0,3477	0,3508	0,3268	0,2978
<b>Rich + Japan</b>	0,2252	0,2083	0,1689	0,1313	0,1295	0,1233	0,1433	0,1711

Mean Growth Rates (%)	1962-1975	1975-1993	1962-1993
<b>24 Countries</b>	-2,30	-0,18	-0,93
Rich	-2,84	1,21	-0,02
Poor	-0,85	-0,01	-0,32
<b>USA/Japan</b>	-5,87	-4,24	-4,81
<b>Remaining 22 countries</b>	-1,87	-0,10	-0,70
<b>Rich (USA excluded)</b>	-2,69	1,74	0,52
<b>Poor (Japan excluded)</b>	-0,82	-0,36	-0,52
<b>Rich + Japan</b>	-4,02	0,80	-0,76

Rich: USA, West Germany, Australia, Belgium, Canada, Denmark, France, Netherlands, Luxembourg, Norway, New Zealand, UK, Sweden, Switzerland  
 Poor: Japan, Austria, Spain, Greece, Ireland, Iceland, Finland, Italy, Portugal, Turkey

Source: OECD.

2. It also confirms that in the first sub-period, the one most frequently analyzed, the convergence among the rich countries was much greater than among the poor ones (2.84% as against 0.85%). However, this result is reversed in the sub-period 1975-1993 because while the rich countries experienced divergence, the poor stabilized their differences. In the period as a whole, the poor countries experienced greater reduction of inequalities than the rich ones. The latter experienced only a slight reduction, an annual average of only 0.02%.
3. The behaviour of the USA and Japan stands in contrast to the modesty of these results. These two countries experienced, over the period as a whole, an average annual rate of reduction of 4.81%, which was likewise more intense in the first sub-period than in the second. The exclusion of these two countries from the sample reduces the average annual rate of variation from 0.93% to 0.7% for the period as a whole. To calibrate the importance of this reduction it is important to bear in mind that we are considering an unweighted statistic, the simple coefficient of variation, and we are therefore giving the same weight to all the countries. In this case, we are eliminating two countries from a sample of 24. If we used a weighted statistic, which would take into account the population affected, the reduction would be much greater because these two countries represent approximately 45% of the population of the OECD.
4. The exclusion of the USA from the group of rich countries transforms the modest convergence among them into divergence. This result strengthens the idea of catching-up with the leader as pointed out by different authors.
5. On the other hand, during the complete period 1962-1993, the inclusion of Japan in the group of rich countries increases the convergence within this club. The exclusion of Japan also raises the level of convergence among the poor countries.
6. In the final analysis, the verification of absence of convergence does not require the broadening of the sample as suggested by De Long. The exclusion of Japan from the club of rich countries considered by Baumol is sufficient to generate absence of convergence. If the sample must not be biased ex-ante, the USA and Japan must belong to different "clubs", and in this case, some of the most long-established results of the literature must be reviewed.

## APPENDIX

The great advantage of the database in Summers and Heston (1991) lies in the wide range of countries it considers<sup>7</sup>. In our case, being interested in the countries of the OECD we have preferred to go directly to the information provided by this Organization. As well as the reasons given in the text there are two further considerations for choosing this source. First, it is possible to extend the information until 1993, whereas Summers and Heston's information for the 24 countries ends in 1990<sup>8</sup>. Second, the OECD has in the latest publication of "National Accounts" (1997) revised the figures for GDP and population of some countries, and also the estimations of Purchasing Power Parity (PPP). However, given the wide acceptance in the profession of the data provided by these authors, Table A1 reproduces the calculations of Table 1 using this alternative source. In turn, figures A1 to A3 also replicate figures 1 to 3 appearing in the text.

It is well known that the two sources do not give the same results<sup>9</sup>. However, in Table A1 it can be observed that the results are maintained in general terms. Especially, the exclusion of USA and Japan from the sample reduces the average of the annual growth rates for the period 1950-1990 from 1.56% to 1.29%. These figures contrast with the intensity of the reduction between these two countries, which was 4.36% p.a. in the same period. These data also confirm that the convergence among the poor countries was limited, the annual average being 0.55% in the period 1950-1990. However, the results for the rich countries do differ depending on the source used. As we have seen, according to the OECD data there was practically no convergence between these rich countries, but according to Summers and Heston such convergence did exist<sup>10</sup>.

---

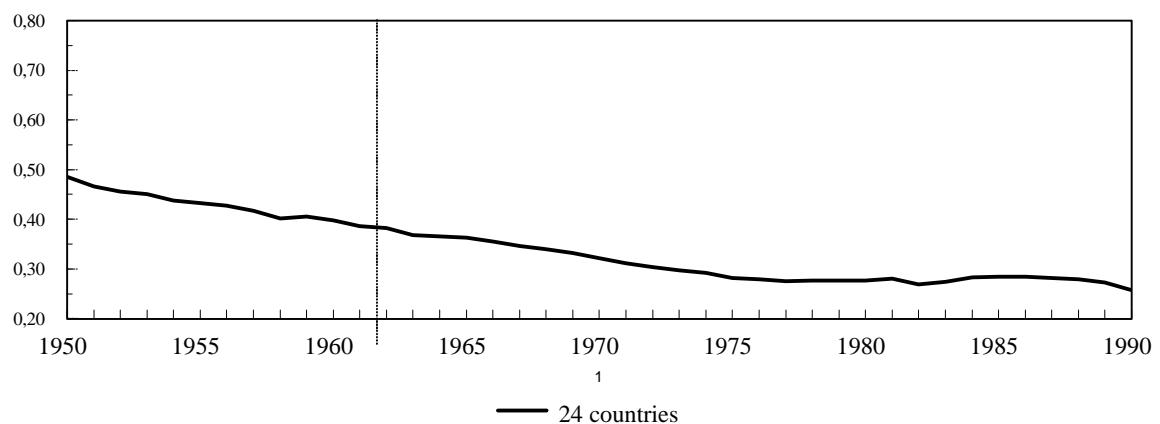
<sup>7</sup> 152 countries in the Mark 5.6 version.

<sup>8</sup> The data used in this Appendix were retrieved from the WWW in November 1997.

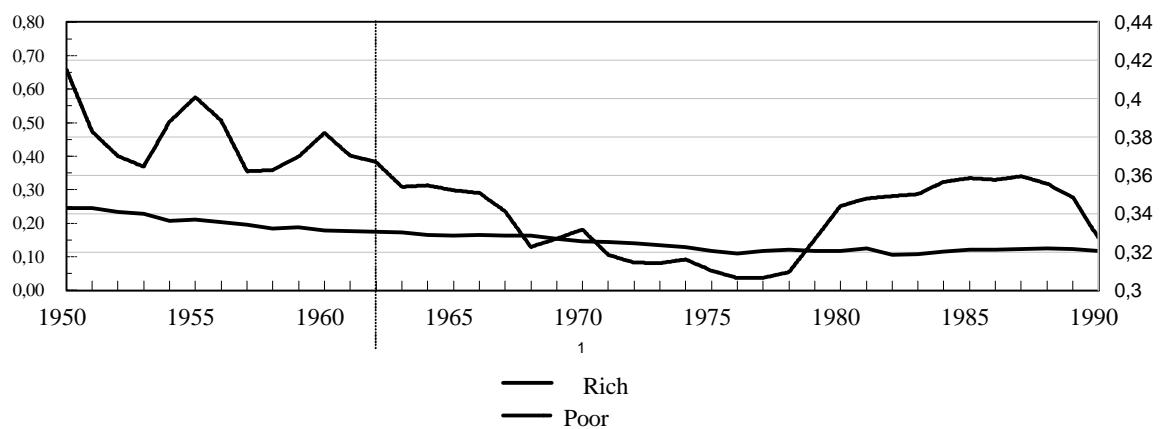
<sup>9</sup> See, for example, Dabán, Domenech and Molinas (1997).

<sup>10</sup> Observe, however, that Summers and Heston's data end in 1990, while those of the OECD extend for three years more. In figure 2 it can be seen that it was precisely in these years that according to this source divergence occurred.

**FIGURE A1. GDP per capita**  
**Coefficient of variation**

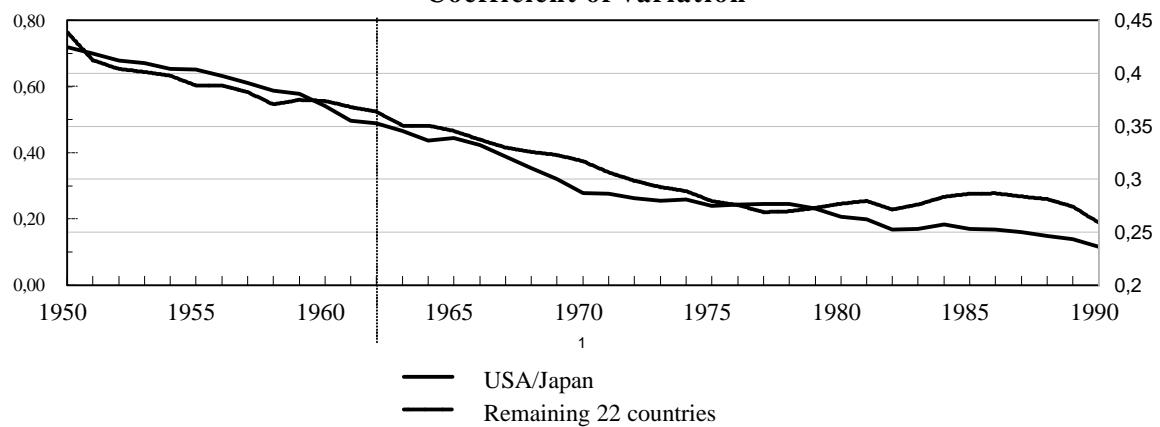


**FIGURE A2. GDP per capita**  
**Coefficient of variation**



Rich: USA, West Germany, Australia, Belgium, Canada, Denmark, France, Netherlands, Luxembourg, Norway, New Zealand, UK, Sweden, Switzerland  
Poor: Japan, Austria, Spain, Greece, Ireland, Iceland, Finland, Italy, Portugal, Turkey

**FIGURE A3. GDP per capita**  
**Coefficient of variation**



Source: Summers and Heston (1991) (Mark 5.6).

**TABLE A1.**  
**Real GDP per capita in constant dollars (Chain index)**  
**Internacional prices, base 1985**  
**Coefficient of Variation**

Levels	1950	1955	1962	1970	1975	1980	1985	1990
<b>24 Countries</b>	0,4860	0,4326	0,3821	0,3212	0,2813	0,2770	0,2850	0,2577
<b>Rich</b>	0,2444	0,2119	0,1738	0,1460	0,1169	0,1171	0,1213	0,1180
<b>Poors</b>	0,4152	0,4008	0,3670	0,3317	0,3102	0,3440	0,3585	0,3271
<b>USA/Japan</b>	0,7197	0,6513	0,4891	0,2790	0,2403	0,2059	0,1693	0,1150
<b>Remaining 22 countries</b>	0,4389	0,3884	0,3637	0,3171	0,2792	0,2769	0,2863	0,2589
<b>Rich (USA excluded)</b>	0,2063	0,1667	0,1539	0,1266	0,0997	0,0989	0,1039	0,1046
<b>Poors (Japan excluded)</b>	0,4013	0,3966	0,3824	0,3474	0,3262	0,3624	0,3718	0,3318
<b>Rich + Japan</b>	0,3165	0,2781	0,2228	0,1586	0,1292	0,1226	0,1210	0,1143

Mean Growth Rates (%)	1950-1962	1962-1975	1975-1990	1962-1990	1950-1990
<b>24 Countries</b>	-1,98	-2,23	-0,74	-1,37	-1,56
<b>Rich</b>	-2,75	-2,87	-0,33	-1,26	-1,70
<b>Poors</b>	-0,94	-1,24	0,25	-0,40	-0,55
<b>USA/Japan</b>	-3,14	-4,96	-4,73	-4,76	-4,36
<b>Remaining 22 countries</b>	-1,54	-1,95	-0,66	-1,19	-1,29
<b>Rich (USA excluded)</b>	-2,38	-3,26	-0,15	-1,27	-1,55
<b>Poors (Japan excluded)</b>	-0,32	-1,15	0,01	-0,47	-0,42
<b>Rich + Japan</b>	-2,87	-3,92	-1,19	-2,24	-2,43

Rich: USA, West Germany, Australia, Belgium, Canada, Denmark, France, Netherlands, Luxembourg, Norway, New Zealand, UK, Sweden, Switzerland  
Poors: Japan, Austria, Spain, Greece, Ireland, Iceland, Finland, Italy, Portugal, Turkey

Source: Summers and Heston (1991) (Mark 5.6).

## References

**Abramovitz, M. (1986):** “Catching Up, Forging Ahead, and Falling Behind”, *Journal of Economic History* 46, 385-406.

**Abramovitz, M. (1994):** “Catch-up and Convergence in the Postwar Growth Boom and After” in Baumol, W.J., Nelson, R.R. and Wolff, E.N. (eds.) (1994), chap. 4, 86-125.

**Azariadis, C. y A. Drazen (1990):** “Threshold Externalities in Economic Development”, *Quarterly Journal of Economics*, CV, 501-526.

**Barro, R.J. y X. Sala-i-Martín (1992):** “Convergence”, *Journal of Political Economy*, vol. 100, no. 2 (April), 223-51.

**Baumol, W. J. (1986):** “Productivity Growth, Convergence and Welfare”, *American Economic Review*, December, 76, 1072-85.

**Baumol, W.J. and E. Wolff (1988):** “Productivity Growth, Convergence and Welfare: Reply”, *American Economic Review*, December, 78, 5, 1155-1159.

**Baumol, W.J., R.R. Nelson and E.N. Wolff (eds.) (1994):** *Convergence of Productivity*, Oxford University Press.

**Dabán, T., R. Doménech and C. Molinas (1997):** “International and Intertemporal comparisons of Real Product in OECD countries: A Growth Sensitivity Analysis”, *The Review of Income and Wealth Series* 43, Number 1, March, 33-48.

**De Long, J.B. (1988):** “Productivity Growth, Convergence, and Welfare: Comment”, *American Economic Review*, December, 78, 5, 1138-1154.

**Durlauf, S.N. y P.A. Johnson (1992):** “Local versus Global Convergence across National Economies”, NBER, Working Paper 3996.

**Maddison, A. (1982):** *Phases of Capitalist Development*, Oxford University Press, New York.

**OECD (1997):** *National Accounts, Main Aggregates, 1960-1995*, Volume 1, Paris.

**OECD (several years):** *Labour Force Statistics*, Paris.

**Sala-i-Martín, X. (1990):** “On Growth and States”, Ph.D. Dissertation, Harvard University.

**Summers, R. y A. Heston (1984):** “Improved International Comparisons of Real Product and its Composition, 1950-1980”, *Review of Income and Wealth*, 30, (June), 207-62.

**Summers, R. and A. Heston (1991):** “The Penn World Table (Mark 5): An expanded set of international comparisons, 1950-1988”, *Quarterly Journal of Economics*, vol. 106, no. 2 (May), 327-68.