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Beyond income : convergence in living standards, big time

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Beyond Income:

Convergence in Living Standards, Big Time

(Final version)

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Abstract

This article tests for convergence over the period 1960 to 1999 in a wide range of fundamental aspects of living standards, namely life expectancy, infant survival, educational enrolment, literacy as well as telephone and television availability. I argue that one should look at convergence in living standards, not in some achievement index. Various techniques are applied to test for convergence, including regression analysis, the coefficient of variation, kernel density estimates and transition probability matrices. I find strong evidence for convergence in the aspects of living standards mentioned above. This result stands in stark contrast to the conclusions of an article by Hobijn and Franses (2001), published in this journal. In suggesting divergence rather than convergence in living standards, Hobijn and Franses unduly deny one of the great success stories of development in the last century.

JEL classification: H11; I31; O57

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1. Introduction

Hobijn and Franses (2001) provide an interesting discussion of many aspects related to convergence, broadly defined, in living standards. For four variables – namely daily calorie supply, daily protein supply, infant mortality and life expectancy at birth – they present a range of methods to ascertain convergence in living standards. I find Hobijn and Franses's analysis original and stimulating and I applaud them for drawing the attention of scholars, economists in particular, to the fact that besides examining convergence in income levels it is similarly important to study convergence in living standards more broadly since people derive utility or well-being not merely from the command over income alone.

However, I could not disagree more with the substantial conclusion of their article, which is that 'the persistent gap between the rich and poor apparently does not only manifest itself in real GDP per capita but also in living standards' and that, if anything, 'there seems to be more convergence in per capita GDP levels than in life expectancy and infant mortality' (Hobijn and Franses, 2001, p. 195). I will argue that daily calorie and protein supply are flawed indicators of living standards and that contrary to real GDP per capita, there is clear convergence in fundamental aspects of living standards. I will demonstrate that such convergence exists for a wide range of proxy variables for living standards, namely life expectancy, infant survival, educational enrolment, literacy as well as telephone and television availability. Even though the reasons behind this result are perhaps entirely predictable and not very surprising, the substantial convergence in living standards remains a great success story of development in the last century.

This paper stands in the tradition of such earlier contributions as, for example, Ram and Schultz (1979), Ingram (1994) and Morriss (1996). However, Ram and Schultz (1979) merely look at life expectancy and are more interested in absolute improvements therein and its effect on savings and productivity than in examining convergence. Morriss (1996) recognises convergence in the data on infant mortality, life expectancy and literacy he uses in constructing his Physical Quality of Life Indicator, but does not provide any formal analysis of convergence. Ingram (1994) is closest to the present paper. He employs one of the methods for assessing convergence used in this paper (the coefficient of variation), but none of the others. Also, the time period of his analysis and the number of countries included is substantially smaller than in the present paper. Furthermore, whilst he looks at a great number of indicators under the heading of social indicators, their relevance as proxy variables for living standards is doubtful. This is the case, for example, for the age-dependency ratio, per capita energy use and the share of defense expenditures among GNP. In contrast, for reasons that are not entirely clear he does not include such rather obvious variables as infant survival rates, literacy and secondary educational enrolment ratios.

Before the analysis starts, a few words on why we concern ourselves with convergence at all. Part of the explanation is due to the fact that neoclassical economic growth theory predicts convergence in income levels. However, this alone is insufficient. In my view, ordinary people are at least as much concerned about convergence as scholars. Why is this? Why is it not enough for people to experience absolute improvements in income levels and living standards? The answer is that relative performance always matters as well for people's satisfaction (see Easterlin (1998, 2001) and the many empirical studies cited therein). People want to see their income levels and living standards improving, but also converging to those of the better off. This is certainly true for the national level, but with the increasing interconnectedness due to globalisation it becomes true for the international level as well. Divergence, whether real or imagined, can cause severe conflict since the relative falling behind can cause feelings of deprivation and frustration in spite of absolute improvements in income levels and living standards. Convergence, I would submit, is therefore a concern that goes far beyond the realm of academic scholarship only.

2. The results of Hobijn and Franses's analysis

As mentioned, Hobijn and Franses employ a great variety of methods to test for convergence. First, in applying univariate regression analysis they find that countries that had low living standards in 1965 experienced statistically significantly greater improvements in those standards over the period to 1989 or 1990, with the exception of daily protein supply. Such convergence is often called β-convergence. Second, they find that for a specific definition of achievement in living standards, there is no β-convergence in this achievement-index. Their achievement index builds on earlier work by Kakwani (1993) and is defined as

$$v(x,M) = -\ln(M-x) \tag{1}$$

where x is the proxy variable for living standards and M is its upper or lower bound.[1] The basic idea of such an achievement index is to assign absolute as well as percentage improvements in living standards a higher change in the achievement score if the improvement is achieved from a higher starting level of the standard of living. Hobijn and Franses justify this with the fact that it is often more difficult to achieve further improvements at higher standards of living.

Third, in applying kernel density analysis they find convergence in life expectancy and infant mortality, but not in daily calorie and daily protein supply. The same is true for all indicators if one looks at Hobijn and Franses' specific definition of achievement in living standards rather than at living standards themselves. Fourth, in applying Markov transition analysis, the authors find that countries that performed relatively well in terms of living standards in 1965 were very likely to perform relatively well at the end period of their analysis as well. This holds true whether one looks at living standards or their definition of achievement in living standards. Lastly, in applying a multivariate test for zero-mean stationarity in a test for joint convergence they come to the conclusion that there are a great many clusters containing few countries that asymptotically perfectly converge in living standards. Again, this result is hardly affected by whether the focus is on living standards or Hobijn and Franses's definition of achievement in living standards.

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[1] Hobijn and Franses set 90 as the upper bound for life expectancy, 0 as the lower bound for the infant mortality rate and 4000 and 145, respectively, as the upper bounds for daily calorie and daily protein supply.

3. Convergence analysis

3.1 What does convergence mean?

Formally, one can say that countries convergence with respect to a variable of interest, if the dispersion of the variable of interest is shrinking over time, without countries permanently criss-crossing from one end to the other within the distribution. However, this definition is not quite sufficient for our purposes. In addition, we need to clarify how we measure the distance within the distribution of a variable and what we mean with a shrinking dispersion. Most of the existing literature on convergence analysis either looks at the natural log of the variable of interest (log-transformation), mainly per capita income, or expresses the variable relative to its mean (mean-normalisation). Mean-normalisation leads to very similar results in terms of convergence analysis as the log-transformation does, which is the more popular procedure. Implicitly the log-transformation implies that the distance of points within the distribution of the variable is measured in percentage terms.[2] Alternatively, if the variable is neither mean-normalised nor log-transformed, this implies that the distance of points within the distribution is measured in the units the variable is held. None of the two possibilities is obviously superior, even though the log-transformation is widely used. I would agree with the argument in favour of the log-transformation that what matters to

[2] Indeed, in principle one could of course think of other transformations than logging. However, any transformation should have some economic meaning for people and whereas percentage differences have such meaning, many other mathematical transformations would not.

people is how they fare in relation to each other, that is how far they are proportionally apart, not in terms of absolute units. However, note that it could be argued that taking the log of a variable has the tendency to overstate convergence as the same absolute amount of change in a variable translates into a smaller change in the log of that variable as the values get larger. Taking the log of a variable makes it harder for the frontrunners to run ever further away. For no clear reason, Hobijn and Franses (2001) take the log of income, but not of their indicators of living standards. As far as possible, in this article we will examine both.

3.2 Tools of convergence analysis

The next question is how one should check for convergence. We will employ a set of techniques, some of which are identical or similar to the ones used by Hobijn and Franses (2001), but somewhat easier to understand and interpret. We start by testing for β-convergence, which as mentioned above implies regressing average growth rates on the initial level and checking for whether the coefficient is statistically significantly negative. As a second tool, we check for what is known in the literature as σ-convergence (Sala-i-Martin, 1996). The two concepts of convergence are related, but not identical. β-convergence tests whether those with low performance in the past perform relatively better than past high performers, whereas σ-convergence tests whether the spread of the distribution shrinks over time. The former analyses intra-distributional movement, whereas the latter analyses changes in the distributional spread. Logically, β-convergence is a necessary, but not sufficient condition for σ-convergence. It is a necessary condition since without the catching up of the past poor performers the spread of the distribution cannot shrink, but it is not a sufficient condition since theoretically it is possible that the once poor performers overtake the once strong performers to an extent that the spread of the distribution increases (Sala-i-Martin, 1996).

How to check for σ-convergence? It is tempting to think that all one needs to do is to analyse the change in the variation of the variable over time as measured, for example, by its standard deviation. However, this would only work if the mean of the variable remained approximately the same over time. If the mean is changing over time, it becomes pointless to look at the standard deviation as it is naturally bigger in absolute amount if the mean has increased. In order to correct for this, one can look at the change in the coefficient of variation over time instead. It is defined as the standard deviation of the variable of interest divided by its mean, thus normalising the variable to facilitate comparison of the same variable at different means. The problem with this is that it is equal to the standard deviation of the mean-normalised variable and therefore approximately equal to the standard deviation of the natural logarithm of the variable of interest (Sala-i-Martin, 1995). As mentioned above, one could argue that taking the natural log of a variable has the tendency to over-state convergence. Nevertheless, we employ the coefficient of variation here since it provides easily interpretable information on one important aspect of the spread of the distribution of a variable over time.[3]

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[3] Further below, I will show that there is σ-convergence in a great variety of living standards. Of course, as Quah (1996, p. 1365) correctly points out we are unlikely to ever see perfect convergence. In other words, σ is unlikely to become zero, but rather would tend towards some (small) positive number. More realistically still, in the long run σ is likely to fluctuate slightly

As a third tool of convergence analysis, following Quah (1997) we will look at kernel density estimates of the distribution of a variable. The graph of a kernel density estimate is basically the smooth version of a histogram of the variable. Its major advantage is that one can trace nicely changes in the shape of a distribution over time and check whether it has a tendency to become more concentrated, which would indicate convergence, or more dispersed, which would indicate divergence. The major disadvantage of this type of analysis is that one needs to employ one of various possible kernels, which influences the shape of the estimated kernel density to a certain extent. Even more influential is the specification of the so-called halfwidth of the kernel. Loosely speaking, the halfwidth represents the smoothness of the estimated kernel density. Like Hobijn and Franses (2001) we use a Gaussian kernel and follow Silverman's (1986, pp. 45ff.) recommendation for optimal choice of halfwidth according to the following formula (*n* is number of observations):

$$h_{opt} = 1.06An^{-0.2},$$

$$A = \min(\text{standard deviation, interquartile range}/1.34) \qquad (2)$$

One of the problems with the last two tools of convergence analysis described so far is that they tell us something about the change in the spread of distribution (σ-convergence) or the shape and spread of the distribution (kernel density estimation), but they do not tell us anything about intra-distributional

around a small positive number. He is also right in pointing out that the process of σ-convergence can become stalled at some point with persistent inequality. Were this to happen, it would of course be detected by the fact that the coefficient of variation is no longer diminishing.

dynamics. Why are we interested in such dynamics? Quah (1996) presents a number of theoretical possibilities where, for example, there is continuous criss-crossing of countries from the upper to the lower bounds of a distribution and backwards within a σ-converging distribution. Whilst one could argue that the only thing that matters is whether the spread of the distribution is shrinking over time, one could as well argue that true convergence not only warrants a shrinking distribution, but also that countries do not constantly switch their relative positions within the distribution. Recall from the definition of convergence above that countries are supposed to incline towards each other, which stands in contrast of such criss-crossing. β-convergence relates to intra-distributional dynamics, but it compresses all available information into one single number. If we want to know more about the dynamics we can resort to so-called Markov transition analysis. Hobijn and Franses (2001) use stochastic kernels and iso-probs of the estimated kernels to undertake such analysis. In this paper, instead, we will use a transition probability matrix, which essentially represents a discretised version of these continuous kernel estimates (Quah 1993, 1996). The reason is that we find the transition probability matrix much easier to interpret and understand for readers. The matrix traces the probability with which past *relative* poor performers have become better *relative* performers and vice versa. One disadvantage of such a matrix is that one needs to decide on the number of discrete levels of performance and their boundaries, which distorts the underlying model. However, with Quah (1996) we maintain that such a matrix does not conceal any important features of intra-distributional dynamics.

3.3 Living standards or achievement index of living standards?

Should one test for convergence in living standards themselves or in an achievement index of living standards? In constructing their particular achievement index, Hobijn and Franses build upon earlier work by Kakwani (1993), who in turn builds upon earlier work by Sen (1981). Kakwani (1993, p. 309) reasons that in measuring achievement in improving an indicator of the standard of living it might be inappropriate to look at the improvement in the level. This is because, for example, 'an increase of life expectancy from 40 to 45 will be judged to be as good as an increase from 70 to 75. Clearly, this is not satisfactory because it is much harder to increase longevity from 70 to 75 than it is from 40 to 45'. He therefore builds an achievement index that gives greater weight to the improvement of countries at higher starting levels. Hobijn and Franses's index is slightly different, but it is based on the same principal idea.

Apart from the fact that, at least in my view, it is much more important to raise longevity from 40 to 45 than to raise it from 70 to 75, I have no fundamental objection against such an index *if the purpose is to measure achievement in living standards* as both Kakwani (1993) and Sen (1981) do. However, it becomes simply pointless to look at an achievement index in assessing convergence in actual living standards across nations. What people are interested in is whether living standards are converging, not whether countries' scores on an abstract achievement index are converging. I am not saying that it is of no interest whatsoever to examine convergence in an achievement index, but certainly when we talk about convergence in living standards we actually do mean convergence in living standards, not convergence in an achievement index of living standards.

In the following I therefore merely analyse convergence in living standards themselves. Note that this has the additional advantage that there is no need for postulating an achievement function and setting upper or lower bounds. The former is obviously subject to subjective judgement since the requirements for such a function are partially subjective and many functions fulfil the requirements chosen by Hobijn and Franses (2001, p. 175).[4] The latter is also subject to subjective judgement if the variable of interest does not have a natural upper or lower bound.

4. Proxy variables of the standard of living

I analyse the following proxy variables for the standard of living: life expectancy at birth, infant survival rates, literacy rates among the adult population, the combined primary, secondary and tertiary educational enrolment ratio as well as telephone mainlines and television set availability per capita. The first two variables are already included in Hobijn and Franses's analysis and refer to perhaps the most fundamental aspect of living standards.[5] As Ram and Schultz (1979, p. 402) point out 'the satisfaction (utility) that people derive from a longer life span must be substantial', even though it is difficult to measure exactly.[6]

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[4] These requirements are that the achievement function is increasing in x, convex in x and not bounded, that is, its limit for x going to M should be infinite.

[5] Note that infant survival rates are just the reverse of infant mortality rates.

[6] Ideally, one would use what the World Health Organization calls healthy or disability-adjusted life expectancy (DALE). However, no time series are available for this measure and there is a very

Literacy rates and the educational enrolment ratio capture another important aspect, which is to lead an informed, knowledgeable and educated life.[7] Telephone availability is a proxy for communication facilities and television availability a proxy for entertainment possibilities. Note that these proxy variables together capture basic, but fundamental aspects of the standard of living.

The reader should note that I do not include daily calorie and daily protein supply, analysed by Hobijn and Franses (2001). Their validity as indicators of living standards is extremely doubtful. The reason is that it has long since been recognised that the need for calorie and protein intake partly depends on climatic conditions with people in cold countries in stronger need than people in warmer climates (FAO 1974). As a consequence, for example, poor and cold Mongolia can fare much worse on all proxy variables of living standards looked at here and yet have a higher calorie and protein supply than the much richer Singapore, located in the tropics. There is therefore little reason for presuming that the supply of calories and protein will ever converge among countries (Parker, 2000). Note that none of the other proxy variables for living standards suffers from a similar contingency on climatic or other conditions.

Interestingly, while Hobijn and Franses (2001) take their calorie and protein supply data from an old edition of the World Bank's Social Indicators of Development database, the Bank stopped publishing such data in 1993 and they

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strong correlation between the DALE in 1999 and the non-adjusted life expectancy (Mathers et al., 2001).

[7] Life expectancy, literacy and the combined educational enrolment ratio form part of the Human Development Index (HDI), published annually by the United Nations Development Programme. A short discussion of the HDI as well as various references can be found in Neumayer (2001).

are no longer included in the World Development Indicators database, which replaced the Social Indicators of Development. Unfortunately, only patchy data exist for the theoretically correct concept of malnutrition or under-nutrition, which would measure the intake of, amongst others, calories, proteins and fat *relative to* the requirements for a healthy life given climatic conditions of a country. Furthermore, the existing FAO estimations have been attacked by Svedberg (1999) as unreliable, misleading and unsuitable. He recommends anthropometric measures, which measure malnutrition indirectly by weight and height deficiencies. However, data on these measures are even more sparse for children and practically non-existent for adults. Of course, since extreme malnutrition would lead to a lowering of life expectancy and infant survival, some aspect of it is already taken into account in two other variables included in this study.

It would be desirable of course to analyse convergence in living standards not only for the total population, but also on a disaggregated basis. For example, it would be interesting to look at how the genders, specific income groups or age groups within society, regions or social classes fare.[8] However, the lack of data prohibits such an undertaking. For the two indicators for which data are available for the two genders – life expectancy and literacy – the trends follow very closely that of the total population and are therefore not reported further below.

All data are taken from World Bank (2001). In principle, we look at the period 1960 to 1999 for most variables. We will look at five year averages, starting from 1960 to 1964 and ending with 1995 to 1999. However, not for all variables data are available starting from 1960. Additionally, not all countries

[8] Mcklewright and Stewart (1999), for example, examine whether the well-being of children in the European Union is converging.

have data availability over the whole period for which data for the variable of interest is generally available for other countries.

5. Results

5.1 β-convergence

Table 1 presents regression results for our indicators of living standards, both in their original form as well as log-transformed and with both normal and robust standard errors. The end period is always 1995-99, but the start period and therefore the initial level differs across variables due to data availability. The β-coefficients are statistically significant and negative in all cases of the log-transformed variables. The same is true for the non-logged life expectancy, infant survival and literacy rate variables. However, the β-coefficient is statistically insignificant in the case of non-logged combined educational enrolment and significant, but with a positive sign for telephone and television availability. Our results therefore indicate that countries with poor performance at the start period of our analysis have improved more in percentage terms than countries with strong performance. In other words, we observe a process of catching up. The same is true if we look at improvement in absolute terms for life expectancy at birth, infant survival and literacy, but not for the other three indicators of living standards.

< Insert Table 1 about here >

5.2 σ-convergence

Figure 1 presents the trend of the coefficient of variation as well as the mean over time for all countries for which data are available. Convergence is clearly visible at the same time as mean living standards are consistently improving. However, life expectancy at birth is a bit of an exception with slight divergence from 1985 onwards ending a prolonged period of convergence before.

< Insert Figure 1 about here >

Note that in Figure 1, with the exception of literacy rates, the number of countries fluctuates since all available data are taken into account. This might represent a problem since the coefficient of variation is sensitive to the number of countries included. If we restrict the analysis to those countries for which data are available throughout the whole time period, then the same basic message of convergence and improvements in mean living standards is still conveyed (graphs not shown for reasons of space).

5.3 Kernel density estimations

Figure 2 presents kernel density estimations for life expectancy, infant survival, the combined educational enrolment ratios and literacy rates. Both life expectancy and infant survival exhibit a clearly bimodal distribution in 1960-65, with countries clustered at either low or high values. In comparison, the 1995-99 kernel density estimate of life expectancy still suggests a somewhat bimodal distribution, but there is a clear tendency towards one major cluster at a high value of life expectancy. In other words, there is a tendency to converge at high life expectancy. A similar tendency is visible for literacy rates and more clearly visible still in the case of infant survival rates. There is less evidence for convergence in the case of combined educational enrolment ratios. Even then, however, the 1995-99 kernel density distribution is more concentrated around a higher ratio and less dispersed than the 1965-70 distribution. Note that the kernel density estimations for these indicators of living standards have been undertaken with the non-logged variables and with varying number of observations. Basically the same pictures emerge if the variables are logged or the number of observations is held constant. In the case of telephone and television availability, the distribution in the non-logged variable is so highly skewed that the kernel density distribution does not come even close to a normal distribution. It does so, however, if the variables are logged and then a similar convergence tendency becomes visible (see figure 2).

< Insert Figure 2 about here >

5.4 Transition probability matrix

So far we have demonstrated convergence in living standards using a variety of techniques and many would argue that we have done so conclusively (Sala-i-Martin, 1996). However, as suggested above, at least theoretically there is some doubt over our analysis as it is possible that there is criss-crossing within a distribution and one might want to argue that this contradicts convergence in spite of a shrinking distributional spread over time. A transition probability matrix is a suitable tool for checking this. Table 2 presents such matrices for the non-logged variables. Each table is built in the same way. Each column and row of the matrix represents a quartile of the variable. The first column shows the number of countries starting in each of the quartiles at the beginning of our analysis. Each cell of the matrix shows the probability that a country starting in a given quartile ends up in the same or another quartile at the end period of analysis. For example, in the case of life expectancy, there is a 22 per cent chance of countries that were in the second quartile at the start period to fall back into the first quartile at the end period, a 59 per cent chance to remain in their quartile, a 20 per cent chance to move into the third quartile and a zero per cent chance to move into the upper quartile. Note that the probabilities in each column and row must add to one (except for rounding inaccuracies).

What we see in these transition matrices is that the diagonal probabilities are always above 50 per cent, whereas the probabilities in the lower left and upper right corners are very small and often zero. We therefore observe great persistence and very little evidence for criss-crossing for all our indicators. If we undertake this analysis for smaller periods of time (up to a minimum of one year) or repeat the analysis for smaller time periods and average the probabilities over the repeated analyses, we get an even stronger impression of persistence. Of course, quartiles are just one possibility to choose as transition boundaries, but other choices lead to similar pictures. Interestingly, this confirms the result from Hobijn and Franses' (2001, p. 186) continuous Markov transition analysis that those who have performed *relatively* well in the past are not likely to perform *relatively* badly in the future.

6. Reasons for convergence in living standards

There is no need here to reproduce the well documented result of non-convergence in terms of real GDP per capita on a global scale (see, for example, Hobijn and Franses 2001; Pritchett 1996, 1997; Quah 1996). Such non-convergence holds true unless population weights are taken into account (see Cole and Neumayer 2002).[9] Why then do we observe convergence in living standards with simultaneous non-convergence in income levels? The most important reason is that while income levels can in principle grow without limits, living standards (at least the most fundamental aspects of living standards looked at here) are naturally bounded. A country cannot have more than 100 per cent literacy and almost 100 per cent infant survival rate. There is no such definite limit for the other indicators, but there are only so many telephones and television sets that any one person can usefully handle. Similarly, countries cannot have more than full enrolment of cohorts in primary and secondary education and will not find it helpful to send more and more people into universities. With respect to life expectancy, many scholars seem to believe in a genetically-determined upper limit of clearly below 100 years, which could only be overcome with major genetic engineering.[10]

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[9] There is β-convergence in income levels if regressions are run with population weights. The main reason is originally poor, very populous and fast growing China.

[10] Oeppen and Vaupel (2002) show, however, that if a definite ultimate limit exists, then average life expectancy in developed countries does not seem to be close to it, as increases in record life

At least with respect to its fundamental aspects, the standard of living therefore has an upper bound that is constant for some aspects and variable, but only slowly moving, for others. This together with the fact that for some of them it is much harder to raise them further from already high starting levels means that the frontrunners cannot permanently run too far ahead. Ironically, the main reason for Hobijn and Franses (2001) to construct their achievement index is therefore also one of the main explanations why, contrary to their suggestion, we observe convergence in living standards. For the countries lagging behind it is not too difficult to catch up if policies are not outrageously biased against improving living standards, even if increases in income levels are modest and access to foreign technologies and know-how is somewhat limited.

Of course, there can always exist some aspects of living standards where we observe divergence rather than convergence, at least at initial stages. Table 3 shows some trends in the coefficient of variation over recent periods in the availability of fax machines, mobile phones, personal computers and the number of internet users per thousand inhabitants. With such a short time period available, conclusions necessarily need to be tentative. Having said this, it is interesting to note that there is potential divergence discernible only in personal computers, whilst there is convergence in fax and mobile phone availability as well as internet usage. If we look at the same trends only for those countries for which data are available in both periods, then there is even convergence in personal computers. Note that, as was to be expected, the initial availability of these

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expectancy have not slowed down over time, but have realised at a linear rate of about three months per annum over the last 160 years.

modern communication and computation systems is characterised by substantial variation across countries.

< Insert Table 3 about here >

7. Conclusion

Hopefully, there will come the day in the not too distant future at which almost all countries enjoy literacy and infant survival rates close to 100 per cent and a life expectancy of above 80 years and are similarly similar in the other aspects of living standards looked at here in this study. Contrary to what Hobijn and Franses (2001) suggest, we are on the right track towards achieving this goal. As a scholar of development, I cannot help but feel deep relief and satisfaction with respect to the fact that living standards are converging. Because of the natural boundedness of the fundamental aspects of living standards, convergence is not all that surprising and it is not all that difficult for the poor countries to catch up with the better off. Still, the substantial convergence in living standards demonstrated in this article remains one of the great achievements of development in the last century.

Why do Hobijn and Franses (2001) not recognise convergence in living standards in their analysis? First, this is because their range of proxy variables for living standards is limited to only four, two of which are invalid (calorie and protein supply). This study has demonstrated convergence in a much broader set of proxy variables for living standards. Second, half of their analysis is concerned with an achievement index of living standards, whereas convergence in living standards is concerned with what it says: convergence in living standards, not some achievement index.

The slight divergence in life expectancy in recent years that is apparent on a global scale and for all income groups but the high income countries is disturbing. Somewhat speculatively, it can perhaps be explained with social upheaval in many countries of transition particularly in what used to be the former Soviet Union, together with the spread of AIDS and urban violence in many developing countries (for a similar view, see Wilson, 2001). One would hope that it does not mean that the tremendous past convergence in life expectancy comes to a halt or, worse still, becomes reversed. As Sen (1998, p. 22) points out 'almost all the poor countries today have higher life expectancy than most of the richer countries had not long ago'. Easterlin (1998, p. 69) calls it a 'Mortality Revolution' whilst Ram (1998, p. 849) calls it an extraordinary achievement constituting 'perhaps the most important single phenomenon to have affected human well-being'.

Still, the fight for better living standards to converge with those in better-off countries remains a complex and strenuous task for those lagging behind and policy does matter when it comes to improvement in living standards. As Anand and Ravallion (1993), Ranis, Stewart and Ramirez (2000) and many others have pointed out, how effective income growth is for improving living standards depends on how widely the fruits of growth are shared in society and whether the increase in public revenues is used productively to enhance living standards. Sen (1998) argues that significant improvements in living standards are possible without fast economic growth if priority is given to social services that target living standards as the examples of Sri Lanka, pre-reform China, Costa Rica or the Indian state of Kerala show.

Of course, it would also be wrong to belittle the impact that divergence in income levels has on the subjective well-being of people in low-income countries and on the international relations between nation states. Whilst I fully agree with Sen (1987, 1992, 1998) and Hobijn and Franses (2001) on the importance of shifting focus in economic analysis away from an exclusive concentration on income towards living standards intrinsically valued by people, income does matter enormously. The perception of divergence in income levels, whether real or imagined, creates enormous conflict and feelings of frustration and deprivation. If Quah (1996) and Pritchett (1996, 1997) are correct in suggesting that the rich countries get richer and the poor countries poorer, then this can have devastating effects on the welfare of people in poor countries, but also on humankind as a whole.[11] Maybe it is even more important then to point out that with respect to fundamental aspects of living standards at least we do observe clear convergence and the backward countries have managed to catch up with the leading ones and are likely to continue doing so in the future.

[11] Note that this need not imply that the world income distribution is becoming more unequal as conventional convergence analysis does not take into account population weights. If they are, then there is convergence in income levels rather than divergence, suggesting a more equal world income distribution (Cole and Neumayer 2002).

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Table 1

β-convergence analysis

	Life expectancy at birth (1960-65)	Logged life expectancy
β	-.0050	-.0080
	(4.65)***	(8.35)***
	(5.19)***	(9.07)***
R-squared	.1179	.3007
N	164	164

	Infant survival rates per 1000 live births (1960-65)	Logged infant survival
β	-.0127	-.0135
	(14.62)***	(16.28)***
	(13.61)***	(14.64)***
R-squared	.5734	.6250
N	161	161

	Literacy rates (1970-75)	Logged literacy rates
β	-.0111	-.0194
	(13.24)***	(36.18)***
	(11.98)***	(20.15)***
R-squared	.5722	.9090
N	133	133

	Combined educational enrolment (1965-70)	Logged educational enrolment
β	.0012	-.0144
	(0.43)	(9.87)***
	(0.39)	(6.58)***
R-squared	.0026	.5749
N	74	74

	Telephone mainlines per 1000 people (1960-65)	Logged telephone mainlines
β	.0501	-.0038
	(7.68)***	(3.27)***
	(6.08)***	(3.23)**
R-squared	.3619	.0934
N	106	106

	Television sets per 1000 people (1965-70)	Logged television sets
β	.0276	-.0212
	(5.70)***	(20.91)***
	(3.95)***	(13.86)***
R-squared	.2344	.8109
N	104	104

Note: Coefficient followed by absolute t-statistics, followed by absolute t-statistics with robust standard errors. Coefficient of constant not reported.

Table 2.

Transition probability matrices

Life expectancy (1960-65 to 1995-99)

# of countries in start period		end period: 1st quartile	2nd quartile	3rd quartile	4th quartile
41	1st quartile	0.78	0.2	0.02	0
41	2nd quartile	0.22	0.59	0.2	0
41	3rd quartile	0	0.12	0.59	0.29
41	4th quartile	0	0.10	0.2	0.71

Infant survival rates (1960-65 to 1995-99)

# of countries in start period		end period: 1st quartile	2nd quartile	3rd quartile	4th quartile
41	1st quartile	0.71	0.24	0.05	0
40	2nd quartile	0.3	0.55	0.1	0.05
40	3rd quartile	0	0.2	0.65	0.15
40	4th quartile	0	0	0.2	0.8

Combined educational enrolment ratio (1965-70 to 1995-99)

# of countries in start period		end period: 1st quartile	2nd quartile	3rd quartile	4th quartile
19	1st quartile	0.74	0.21	0.05	0
19	2nd quartile	0.16	0.58	0.21	0.05
18	3rd quartile	0.06	0.11	0.61	0.21
18	4th quartile	0.06	0.06	0.17	0.72

Table 2 (continued).

Literacy rates (1970-75 to 1995-99)

# of countries	in start period	end period 1st quartile	2nd quartile	3rd quartile	4th quartile
34	1st quartile	0.88	0.12	0	0
33	2nd quartile	0.12	0.73	0.15	0
33	3rd quartile	0	0.15	0.82	0.03
33	4th quartile	0	0	0.03	0.97

Telephone mainlines (1960-65 to 1995-99)

# of countries	in start period	end period 1st quartile	2nd quartile	3rd quartile	4th quartile
27	1st quartile	0.82	0.18	0	0
27	2nd quartile	0.12	0.65	0.23	0
27	3rd quartile	0.04	0.19	0.6	0.19
26	4th quartile	0	0	0.19	0.81

Television sets (1965-69 to 1995-99)

# of countries	in start period	end period 1st quartile	2nd quartile	3rd quartile	4th quartile
28	1st quartile	0.71	0.18	0.11	0
27	2nd quartile	0.26	0.59	0.11	0.04
27	3rd quartile	0.04	0.22	0.63	0.11
27	4th quartile	0	0	0.15	0.85

Table 3.

Time trend in the coefficient of variation (CoV) for modern communication and computation systems

Personal computers (per 1000 people)				**Mobile phones (per 1000 people)**				**Internet users (per 1000 people)**				**Fax machines (per 1000 people)**			
Period	CoV	Mean	N	Period	CoV	Mean	N	Period	CoV	Mean	N	Period	CoV	Mean	N
1990-94	1.40	37.7	95	1990-94	2.22	6.78	197	1990-94	5.24	2.8	88	1990-94	2.34	6.1	173
1995-99	1.44	72.1	152	1995-99	1.61	64.1	202	1995-99	4.58	65.1	194	1995-99	1.72	9.84	144

Personal computers				**Mobile phones**				**Internet users**				**Fax machines**			
Period	CoV	Mean	N	Period	CoV	Mean	N	Period	CoV	Mean	N	Period	CoV	Mean	N
1990-94	1.41	38.4	94	1990-94	2.22	6.78	197	1990-94	5.24	2.8	88	1990-94	1.81	5.5	142
1995-99	1.24	91.4	94	1995-99	1.63	52.8	197	1995-99	4.29	30.0	88	1995-99	1.72	9.9	142