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PERMANENT INCOME, CONVERGENCE AND INEQUALITY AMONG COUNTRIES

by José M. Pastor*

and

Lorenzo Serrano

Universitat de València and Ivie

The literature on inequality has generally focused on the analysis of annual per capita income. This paper adopts a different approach by considering the life-cycle dimension of inequality and convergence between economies from 1960 to 2000. We analyze the present value of the set of incomes individuals obtain throughout their whole life (permanent income). On the basis of this approach, various simulations are made to determine the effect on inequality in permanent income of variables such as survival rates and the long-run growth rates in current income. The results indicate that survival rates are an important source of inequality. Inequality in permanent income is about one third higher than in current income. The implication of this finding is that if the whole life-cycle dimension is not considered, the level of inequality among economies is being underestimated.

1. Introduction

Most of the literature devoted to the empirical analysis of inequality has used the current per capita income of countries and regions. The results thus obtained are informative, useful, and expand our knowledge about the evolution of the levels of current per capita income attained at any time, the differences existing between different economies, their evolution and their determining factors.

Nevertheless, this type of approach ignores the life-cycle dimension of the question. Inequality between individuals cannot be evaluated definitively without comparing the whole of their life cycle. Just as for each of us this year's income is important, but less so than the total of incomes that we will obtain in the course of our lives, the comparative study of the sum of incomes people obtain throughout their whole life cycle will provide a more complete picture of inequality among economies.

This is a rather peculiar situation. On the one hand, the theories used to analyze the phenomena of inequality and convergence are based on growth models (i.e. Ramsey, 1928) in which individuals value their whole future (and even that of their descendants). On the other hand, when measuring and valuing inequality, attention is focused on what is happening at a particular moment in time. Some studies (Becker *et al.*, 2001, 2005; Philipson and Soares, 2001; Dowrick *et al.*, 2003) have tried to overcome this drawback by also considering life expectancy, or the

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*Correspondence to: José M. Pastor, Department d'Analisi Economica (Universitat de València) and Instituto Valenciano de Investigaciones Económicas (Ivie), Facultat de Economia, Campus del Tarongers, s/n. 46020 Valencia, Spain (jmpastor@uv.es).

economic value of the increases in that expectancy, to measure inequality. However, although they take into account life expectancy, they do not analyze inequality in terms of individuals' whole lives.

This paper analyses inequality among economies by considering the set of incomes obtained throughout the whole life (permanent income) and not only the incomes obtained at a specific moment in time (current income). We use some well-known tools of economic analysis (consider consumer theory: Modigliani and Brumberg, 1954; Friedman, 1957; Ando and Modigliani, 1963; Modigliani, 1986) that allow us to consider the life-cycle income of individuals, the impact of life expectancy and the effect of the pattern of long-run economic growth. The rest of the paper is organized as follows. Section 2 reviews the literature on inequality and convergence. Section 3 presents the analytical framework necessary to carry out this task. In Section 4 we perform the empirical analysis. Finally Section 5 presents the main conclusions.

2. Inequality and Convergence: Literature and Empirical Results

As we have seen, most of the literature devoted to the empirical analysis of inequality has analyzed the current per capita income of economies.

The limitations of this single indicator are widely recognized. In fact, various attempts have been made to overcome them by means of better measures. The United Nations Development Program publishes annually the Human Development Index (HDI) based on life expectancy, degree of literacy, and per capita income, all duly weighted. Dowrick *et al.* (2003) propose their own index based on consumption and life expectancy, avoiding arbitrary weightings by means of revealed preferences. Becker *et al.* (2001, 2005) analyze welfare inequality by giving an economic value to the gains achieved in terms of life expectancy; their results indicate that countries starting with lower incomes tend to gain more in terms of life expectancy than countries starting with higher incomes. When the monetary values of these gains in life expectancy are computed in order to calculate the growth rate of what they call "income equivalent compensation," they conclude that the gains in longevity totally invert the traditional result of absence of convergence obtained in the literature on growth. Similarly, Philipson and Soares (2001) posit and analyze the properties of a measure of total income (*full income measure of human development*) which allocates a monetary value to certain non-monetary aspects of human development that are not reflected by a simple indicator such as income. These authors make an international comparison between HDI and full income measures, incorporating the longevity observed worldwide.

The usual measures of statistical dispersion, e.g. coefficient of variation, standard deviation (typically of the logarithm of the variable) and so on, are used to quantify the degree of inequality at a particular time. Similarly, σ-convergence and β-convergence are commonly used to analyze the evolution of inequality. The former compares the value of measures of statistical dispersion over time: if their value increases there is divergence, if it decreases there is convergence. The latter analyzes the relationship between the increase of the variable during a period and its relative starting levels. If the relationship is positive the differences increase and there is divergence; if it is negative, there is convergence.

The empirical results of this extensive literature are clear. On the one hand, when the existence of specific steady states is not controlled for (analysis of absolute convergence), the results indicate the existence of convergence among the countries of the OECD, the states of the US, the prefectures of Japan, the regions of Germany, France, Britain, Italy, Canada, India, Sweden or Austria or the regions of Europe as a whole (Barro and Sala-i-Martin, 1995). However, convergence would not exist at international level with a broad sample of countries.

On the other hand, when we control for the differences in the steady state (analysis of conditioned convergence) the results indicate the existence of convergence in all the areas, including worldwide (e.g. Islam, 1995). However, it is also clearly rejected that steady states are common among economies, i.e. convergence would be partial and a certain level of inequality among economies would always persist.

If the main question is whether poor economies are catching up with rich ones, the answer seems to be clearly negative. However, as we have seen, Becker *et al.* (2005) obtain the opposite result by adding the monetary value of longevity gains during 1960 and 2000 to the 2000 per capita income. Therefore, life expectancy does seem to play a significant role in the degree of worldwide inequality among countries that we should consider.

In summary, regardless of the indicator adopted and the type of analysis of convergence or the statistic used, what needs to be highlighted is that these are always comparisons of the situation at specific moments in time. In the case of per capita income, and similarly for any other indicator, we consider the per capita income at certain times. In this way, we simply obtain a snapshot of the situation in certain periods. This information is certainly useful, but incomplete.

The same objection can be applied to the paper by Becker *et al.* (2005), which compares current per capita income in 1960 to current per capita income in 2000 plus the monetary value of longevity gains between 1960 and 2000. This comparison does not take into account either whether the life expectancy differences in 1960 led to increased or decreased inequality in 1960, nor the magnitude of this effect. It should also be noted that even in 2000, inequality from a life-cycle perspective does not only depend on current per capita income in 2000 or the monetary value of longevity gains between 1960 and 2000. All current per capita incomes expected to be obtained from 2000 onward are important, that is, those obtained up to the years of 1960 life expectancy and those corresponding to the additional years of life expectancy gained between 1960 and 2000. Although they take into account life expectancy, they do not consider whole life-cycle incomes over time.

As we have already said, all these results are very valuable, but omit the life-cycle dimension of inequality. In the following sections we will analyze inequality and convergence among economies using a life-cycle perspective. This approach, we hope, may provide us with additional insights into the problem of international inequality.

3. Analytical Framework: General Formulation

The permanent income (VP_{i0}) of a representative individual of economy i at time 0 is the discounted value of the income per capita at current prices (y_{it}),

TABLE 1
SUMMARY OF SCENARIOS

	Rates of Growth (g)	Initial Per Capita Income (y_{i0})	Survival Rates (S)
Scenario 1	g_i	y_{i0}	S_{it}
Scenario 2	g_{US}	y_{i0}	S_{it}
Scenario 3	g_i	y_{i0}	S_{USt}
Scenario 4	g_i	y_{US0}	S_{it}

resulting from the initial per capita incomes (y_{i0}) and their long-run growth rates (g_i), and also taking into account the probability of survival in each period of a person born in period 0, denoted as $S_i(t, 0)$.

$$VP_{i0} = \sum_{t=0}^{120} \frac{y_{it}}{(1+r)^t} S_i(t, 0) = \sum_{t=0}^{120} \frac{y_{i0}(1+g_i)^t}{(1+r)^t} S_i(t, 0) \tag{1}$$

in which we will assume a common and constant interest rate, $\bar{r}$.

Observe that, *ceteris paribus*, economies will have higher levels of permanent income, the higher their initial per capita incomes (y_{i0}), the higher their rates of growth (g_i), the greater the survival rates in each period, [$S_i(t,t-1)$], and the lower the interest rate (r). In order to explore the influence of these factors on inequality in permanent income (VP), starting from a base scenario (scenario 1), we have constructed different counter-factual scenarios as shown in Table 1. Thus, scenario 2 analyses the effect of the long-run growth rate on inequality in permanent income. Similarly, scenarios 3 and 4 analyze the effect on inequality in permanent income of survival rates and initial per capita incomes, respectively, where g_i indicates each country's growth rate for the period 1960–2000, g_{US} the average growth rate of the benchmark economy (US) for the period 1960–2000, y_{i0} the per capita income of each country in the initial period, y_{US0} the initial per capita income of the benchmark economy, S_{it} the survival rates of each economy, and S_{USt} the survival rates of the benchmark economy.

4. Empirical Analysis: Inequality Among Countries

In this section we present the results obtained on inequality among countries at two moments in time, 1960 and 2000. All the comparisons take the US as a benchmark. The data were taken from *World Bank Development Indicators* (World Bank, 2002). The survival rates were calculated as in Becker *et al.* (2001).

Table 2 presents detailed data on life expectancies, current per capita incomes and permanent incomes estimated for the full set of countries under different scenarios, all of them relative to the US benchmark.[1] Table 3 presents the results of the analysis of σ-convergence (using the standard deviation of the logarithm of the variable) and β-convergence.

[1]The sample consists of 89 countries for which all the necessary information was available (see Table 2). Results are obtained using a common discount rate of 2 percent. Results using a rate of 4 percent are qualitatively very similar and are available upon request.

TABLE 2

INCOME, PERMANENT INCOME AND LIFE EXPECTANCY BY COUNTRY. UNITED STATES = 100. DISCOUNT RATE = 2%

	Life Expectancy		Income per Capita		Permanent Income							
					Scenario 1		Scenario 2		Scenario 3		Scenario 4	
	1960	2000	1960	2000	1960	2000	1960	2000	1960	2000	1960	2000
Algeria	67.77	92.19	8.61	5.02	3.77	2.85	5.83	4.64	5.31	3.02	43.78	56.71
Argentina	93.39	95.84	40.96	24.79	24.65	14.91	38.31	23.80	26.05	15.39	93.53	60.16
Australia	101.37	102.42	74.15	74.50	75.57	76.68	75.22	76.30	74.50	74.87	101.44	102.93
Austria	98.54	101.51	80.11	102.40	102.16	136.97	79.01	103.92	103.79	134.70	98.63	133.76
Bahamas, The	90.80	89.91	61.40	43.53	41.00	28.86	55.76	39.35	44.57	31.04	90.81	66.31
Bangladesh	57.09	79.40	1.64	1.17	0.72	0.69	0.93	0.93	1.19	0.84	56.64	58.85
Barbados	92.48	97.87	22.11	25.88	24.01	30.11	20.48	25.40	26.03	30.77	92.64	116.33
Belgium	100.86	101.49	78.14	96.36	98.29	123.52	78.87	97.72	97.31	121.55	100.94	128.19
Benin	55.71	68.76	2.43	1.29	0.85	0.54	1.34	0.89	1.40	0.72	55.34	41.91
Bolivia	61.39	81.18	6.25	2.97	2.23	1.31	3.82	2.42	3.31	1.52	61.08	44.20
Botswana	66.92	50.57	2.60	12.35	11.20	33.99	1.73	6.15	22.04	119.09	66.35	275.27
Brazil	78.59	88.33	13.17	14.45	11.31	14.07	10.35	12.81	14.48	15.98	78.58	97.36
Burkina Faso	51.95	57.38	1.11	0.79	0.45	0.34	0.57	0.45	0.81	0.56	51.50	43.25
Burundi	59.28	54.45	0.97	0.44	0.32	0.14	0.57	0.24	0.50	0.22	58.89	31.76
Cameroon	56.56	64.94	3.92	2.11	1.42	0.84	2.20	1.37	2.27	1.19	56.12	39.86
Canada	101.93	102.42	84.60	70.45	72.13	59.71	86.25	72.11	70.92	58.48	101.94	84.75
Central African Rep.	55.42	56.40	3.46	1.06	0.86	0.28	1.91	0.59	1.37	0.40	55.09	26.63
Chad	49.97	62.90	2.20	0.68	0.53	0.19	1.09	0.43	0.87	0.26	49.47	27.88
Chile	82.12	98.16	14.88	16.73	13.69	18.66	12.20	16.45	16.79	19.01	82.02	111.50
China	52.06	91.17	0.84	2.58	1.13	9.58	0.43	2.36	3.45	11.45	51.30	371.88
Colombia	81.42	92.90	8.35	7.16	5.92	5.73	6.80	6.67	7.19	6.11	81.41	80.09
Congo, Rep.	59.96	66.59	4.21	2.63	1.78	1.21	2.51	1.75	2.75	1.68	59.52	46.15
Costa Rica	88.66	100.54	14.66	12.23	10.98	10.21	13.01	12.29	12.31	10.16	88.72	83.48
Cote d'Ivoire	56.56	59.45	4.44	2.32	1.53	0.85	2.49	1.37	2.52	1.28	56.04	36.41
Denmark	103.43	99.09	123.14	120.39	124.61	116.74	127.48	119.51	120.40	117.57	103.52	96.96
Dominican Republic	74.71	87.36	5.16	6.44	4.70	7.11	3.85	5.65	6.52	8.25	74.52	110.26

TABLE 2 (*continued*)

	Life Expectancy		Income per Capita		Permanent Income							
					Scenario 1		Scenario 2		Scenario 3		Scenario 4	
	1960	2000	1960	2000	1960	2000	1960	2000	1960	2000	1960	2000
Ecuador	76.50	90.31	5.87	4.45	3.53	3.12	4.49	4.04	4.52	3.38	76.46	69.98
Egypt, Arab Rep.	66.46	87.54	2.72	3.83	2.53	4.84	1.81	3.37	3.93	5.66	66.40	126.33
El Salvador	72.84	91.02	9.91	5.48	4.43	2.93	7.20	4.99	5.86	3.15	72.71	53.57
Fiji	80.33	89.82	10.59	7.49	6.39	4.95	8.49	6.76	7.67	5.32	80.17	66.12
Finland	98.22	100.52	73.86	100.09	99.73	141.88	72.61	100.69	102.18	141.15	98.31	141.76
France	100.67	102.33	80.22	93.17	94.37	112.36	80.77	95.14	93.64	109.74	100.68	120.59
Gabon	58.60	68.41	13.69	13.68	7.97	9.33	7.98	9.34	13.68	13.68	58.27	68.22
Ghana	64.81	73.80	3.40	1.29	1.10	0.46	2.19	0.95	1.54	0.56	64.48	35.53
Greece	98.68	101.10	28.87	40.96	41.76	61.85	28.48	41.46	42.10	61.08	98.66	151.01
Guatemala	65.78	84.63	7.02	4.87	3.42	2.98	4.59	4.13	5.00	3.41	65.39	61.10
Guyana	80.71	81.60	5.12	2.94	2.62	1.51	4.13	2.41	3.12	1.75	80.67	51.32
Haiti	60.79	69.08	4.13	1.15	1.09	0.33	2.50	0.79	1.54	0.41	60.40	28.66
Honduras	66.82	85.64	3.88	2.22	1.70	1.18	2.58	1.91	2.36	1.32	66.44	53.27
Hungary	97.83	92.45	11.44	16.96	17.17	24.18	11.21	15.70	17.56	26.68	97.92	142.61
Iceland	104.98	103.18	76.85	97.84	104.72	132.65	80.67	100.82	99.13	128.10	104.98	135.59
India	63.54	81.50	1.38	1.44	0.90	1.22	0.87	1.17	1.44	1.50	63.25	84.97
Indonesia	59.47	85.69	1.88	3.11	1.76	4.59	1.11	2.67	3.29	5.61	58.98	147.81
Ireland	99.89	99.05	41.29	86.70	97.84	212.00	41.29	86.16	98.38	217.71	99.99	244.53
Israel	102.74	101.70	39.74	53.34	56.27	75.81	40.83	54.27	54.39	74.37	102.75	142.13
Italy	99.88	102.09	49.94	65.27	66.45	90.24	49.91	66.63	66.33	88.15	99.94	138.25
Jamaica	92.27	97.76	10.49	5.58	5.62	3.06	9.67	5.46	6.03	3.12	92.23	54.89
Japan	96.98	104.75	63.50	140.11	153.34	406.50	61.65	146.34	161.86	378.04	97.09	290.12
Kenya	64.43	60.95	1.52	1.03	0.71	0.46	0.97	0.62	1.06	0.70	64.04	44.66
Korea, Rep.	77.61	94.93	10.02	40.82	43.43	257.10	7.75	38.90	65.21	297.64	77.40	629.78
Lesotho	61.97	57.04	1.27	1.72	0.99	1.25	0.78	0.98	1.76	2.42	61.31	72.30
Luxembourg	98.79	99.97	119.24	176.18	179.61	275.74	117.93	176.36	182.33	276.28	98.89	156.51
Madagascar	58.66	70.93	2.89	0.77	0.67	0.21	1.69	0.55	1.05	0.27	58.54	27.97
Malawi	54.34	50.35	0.74	0.53	0.30	0.21	0.40	0.26	0.54	0.38	53.93	39.77

Malaysia	77.83	94.13	7.37	14.99	12.06	32.54	5.72	14.16	16.83	35.97	77.56	217.04
Malta	98.26	101.25	8.90	31.95	44.81	190.66	8.76	32.35	46.99	186.60	98.38	596.72
Mauritius	85.13	93.00	8.48	13.84	11.98	22.33	7.22	12.92	14.61	24.63	85.08	161.29
Mexico	82.18	94.68	12.39	11.94	9.83	10.90	10.18	11.33	11.94	11.48	82.12	91.31
Morocco	67.25	87.55	5.27	4.28	2.98	3.09	3.53	3.76	4.32	3.47	67.00	72.19
Nepal	55.20	76.37	1.05	0.75	0.45	0.43	0.58	0.58	0.77	0.54	54.83	57.39
Netherlands	105.19	101.04	90.72	96.78	102.13	104.97	95.49	97.93	96.88	103.74	105.26	108.46
New Zealand	101.61	101.46	79.63	54.84	57.25	38.55	80.97	55.63	56.38	38.11	101.69	70.28
Nicaragua	67.85	89.38	4.82	1.46	1.43	0.51	3.26	1.31	1.89	0.54	67.63	35.27
Norway	105.21	102.00	85.60	118.62	129.00	175.80	90.07	121.02	121.49	171.88	105.22	148.20
Pakistan	62.86	81.70	1.37	1.61	0.99	1.57	0.85	1.32	1.62	1.94	62.53	97.15
Panama	87.33	96.74	11.06	10.25	8.98	9.20	9.65	9.94	10.26	9.47	87.26	89.74
Papua New Guinea	58.83	76.03	4.27	2.90	1.89	1.58	2.49	2.20	2.99	1.99	58.20	54.65
Paraguay	91.60	91.30	6.73	5.31	4.95	3.89	6.17	4.87	5.37	4.19	91.68	73.29
Peru	68.77	89.94	14.18	7.40	5.79	3.79	9.72	6.68	8.03	4.07	68.58	51.16
Philippines	76.50	89.89	5.48	3.65	2.99	2.27	4.18	3.29	3.77	2.46	76.22	62.13
Portugal	90.93	98.16	20.67	39.99	39.61	86.51	18.82	39.35	44.17	89.43	91.04	216.35
Rwanda	60.71	51.83	2.09	0.76	0.65	0.20	1.26	0.39	0.92	0.32	60.24	27.08
Saudi Arabia	64.07	94.09	28.49	21.03	13.99	14.85	18.19	19.85	21.42	15.57	63.84	70.62
Senegal	54.33	67.87	5.07	1.90	1.42	0.64	2.73	1.29	2.28	0.82	53.94	33.76
Sierra Leone	45.31	50.85	1.68	0.46	0.35	0.10	0.76	0.23	0.62	0.16	44.87	22.67
Singapore	91.27	100.76	20.23	88.23	118.01	728.90	18.47	88.97	147.76	726.40	91.28	826.16
South Africa	70.45	62.03	21.40	12.46	9.86	5.26	14.97	7.68	13.19	7.48	69.97	42.26
Spain	99.24	101.41	34.93	55.63	58.24	97.54	34.68	56.43	58.42	95.94	99.30	175.35
Sweden	104.64	103.35	99.53	97.53	102.15	98.57	104.27	100.74	97.54	95.47	104.76	101.07
Switzerland	102.20	103.42	198.42	146.07	152.08	110.64	203.04	150.77	148.83	107.84	102.33	75.75
Thailand	75.46	89.30	3.52	8.77	7.11	23.50	2.65	7.85	10.64	28.39	75.30	268.02
Togo	56.63	63.98	1.73	1.02	0.67	0.43	0.97	0.65	1.08	0.62	56.19	42.58
Trinidad Tobago	91.26	94.14	14.30	16.01	14.60	17.01	13.03	15.10	16.06	18.10	97.17	106.24
United Kingdom	101.42	100.34	71.79	67.72	68.81	64.04	72.91	68.06	67.76	63.70	101.55	94.58
United States	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Uruguay	97.40	96.52	29.28	19.11	19.40	12.36	28.57	18.49	19.81	12.66	97.57	64.66
Venezuela, RB	85.75	95.18	28.13	10.32	11.36	4.25	24.12	9.84	12.44	4.38	85.74	41.23
Zambia	59.88	49.27	4.90	1.23	1.23	0.28	2.91	0.60	1.72	0.41	59.41	22.56
Zimbabwe	65.16	51.81	3.54	1.94	1.48	0.69	2.29	0.99	2.08	1.11	64.71	35.69

TABLE 3

β-Convergence and σ-Convergence in Current and Permanent Income

	Year	Mean	Stand. Dev. Logs	β-Converg.	t-Student	R^2
Life expectancy	**1960**	55	0.24	–	–	–
	2000	66	0.22	–	–	–
	1960–2000	–	–	–0.63%	–4.283	0.174
Income per capita	**1960**	3,540	1.45	–	–	–
(constant 1995 US$)	**2000**	9,687	1.73	–	–	–
	1960–2000	–	–	0.29%	2.507	0.067
Permament Income*						
Scenario 1	**1960**	307,384	1.89	–	–	–
	2000	1,336,720	2.29	–	–	–
	1960–2000	–	–	0.43%	4.893	0.216
Scenario 2	**1960**	255,636	1.66	–	–	–
	2000	795,158	1.90	–	–	–
	1960–2000	–	–	0.20%	1.964	0.043
Scenario 3	**1960**	322,146	1.71	–	–	–
	2000	1,369,613	2.18	–	–	–
	1960–2000	–	–	0.59%	6.981	0.359
Scenario 4	**1960**	983,844	0.72	–	–	–
	2000	3,003,773	0.74	–	–	–
	1960–2000	–	–	0.02%	0.310	0.001

*Assuming an interest rate of 2%. Constant 1995 US$.

Scenario 1: Individual rates of growth (g_i), individual income per capita (y_{i0}), individual survival rates ($S_i(t,0)$).

Scenario 2: USA's rate of growth (g_{US}), individual income per capita (y_{i0}), individual survival rates ($S_i(t,0)$).

Scenario 3: Individual rates of growth (g_i), individual income per capita (y_{i0}), USA's survival rates ($S_{US}(t,0)$).

Scenario 4: Individual rates of growth (g_i), USA's income per capita (y_{US0}), individual survival rates (S_i(t,0)).

The first row in Table 3 presents the results for inequality in *life expectancy*. There are wide differences in the levels of life expectancy at birth of the individuals in the different countries. However, during the four decades considered, the level of inequality declined, as this indicator fell from 0.24 to 0.22. We also observe significant β-convergence between 1960 and 2000 of –0.63 percent per year.

Regarding inequality in *current income per capita*, Table 3 shows that inequality grew from 1.45 to 1.73 during the 40 years analyzed, so there is σ-divergence in current per capita incomes. The results of the analysis of β-convergence are in line with this: there is β-divergence in per capita incomes of 0.29 percent per year.

This type of result is well established in the economic literature. However, as we pointed out in earlier sections, previous studies do not consider the life-cycle dimension of the problem, which we can analyze using the measure of *permanent income* proposed in this paper.

Scenario 1 is the base scenario built using historical data, in which each country's per capita income is considered to grow at its average rate of growth (g_i) as obtained for the period 1960–2000, and using the survival rates for each country. Results show that, in both 1960 and 2000, inequality in terms of permanent income was considerably greater than in terms of current per capita income. Thus, the standard deviation of the logarithm of permanent income stands at 1.89

and 2.29, values substantially above those of current per capita income (1.45 and 1.73 respectively).

This greater degree of inequality when an individual's whole life cycle is considered is due to the shorter life expectancy in poor countries and to the divergence experienced over time by current per capita incomes. We can therefore conclude that for the world as a whole, traditional measures of inequality seem to be substantially underestimating the "true" inequality among countries.

The β-convergence results also show an increase in inequality of permanent income over the period, as the indicators show an even more intense divergence in permanent income (0.43 percent per year) than in current incomes (0.29 percent). As can be observed, the existence of significant differences in the life expectancies at birth of the individuals in different countries, together with the existence of significant divergence in current per capita incomes, results in greater divergence among economies in terms of permanent income.

Scenario 2 simulates the effect on permanent incomes that would occur if the economies of all the countries had the same growth rates as the US. The results show the inequality in permanent income under the hypothesis that there is neither convergence nor divergence of current per capita incomes over time.

Again, the results show that inequality in permanent income is greater than that in current per capita income due to the effect of inequality in life expectancies, which are always shorter in poor countries. The standard deviation of the logarithm stands at 1.66 in 1960 and 1.90 in 2000, values substantially above those of current per capita income.

However, the values are lower than those of scenario 1, because in the latter we are considering the impact of a moderate divergence in current incomes, in accordance with the historical experience of the period 1960–2000. The evolution in this scenario also reveals β-divergence in permanent income (0.20 percent), although it is lower than that obtained in scenario 1 (0.43 percent).

Scenario 3 simulates the effect of what would occur if all the countries had the same survival rates as the US, but had kept their observed initial levels of current per capita income and long-run growth rates. The results allow us to determine how much of the inequality is attributable exclusively to differences in life expectancy.

Comparing the results with those of scenario 1, a slight reduction of inequality in permanent income can be appreciated. Total equality of life expectancies at international level would alleviate inequality in permanent income, but the relative reduction achieved would be small. Thus, in 1960 the standard deviation of the logarithm of permanent income would fall from 1.89 to 1.71 and in 2000 from 2.29 to 2.18.

With regard to β-convergence in permanent income, we observe that the divergence is even greater (0.59 percent) than in scenario 1 (0.43 percent). One of the sources of convergence in permanent income among countries was the convergence in their survival rates, so if this source of convergence is eliminated the divergence observed is greater.

Scenario 4 simulates the effect that would occur if all the countries had the same initial level of current per capita income as the US and had maintained their own observed long-run growth and survival rates. The results allow us to analyze

how much of the inequality is attributable exclusively to differences in initial levels of current per capita income. If we remove differences in initial current per capita income, we observe that most inequality in permanent income vanishes. Compared with scenario 1, in 1960 the standard deviation of the logarithm of permanent income would fall from 1.89 to 0.72 and in 2000 from 2.29 to 0.74. It should be noted that a significant level of inequality in permanent income still remains due to the effect of differences in long-run growth rates and life expectancies. The results of both σ-convergence and β-convergence (0.02 percent) indicate a remarkable stability of the degree of inequality from 1960 to 2000.

5. Conclusions

Most of the literature devoted to the empirical analysis of inequality uses the current per capita income of economies, either through the study of the evolution of the dispersion of this variable (σ-convergence), or through the study of the relationship between the relative levels of per capita income at an initial moment and its subsequent rate of growth (β-convergence).

Nevertheless, this type of approach ignores the life-cycle dimension of the issue. When studying inequality among economies, the comparative study of the sum of incomes people obtain throughout their lifetimes (permanent income) will be more complete than when only current income is considered.

In this paper we apply the permanent income approach to analyze the level of inequality in 1960 and 2000 for a broad set of countries. The results indicate that inequality in permanent income is about 30 percent higher than inequality in current income in 1960 and 33 percent in 2000. This higher degree of inequality when individuals' whole life cycles are considered is due to the shorter life expectancy in poor countries and to the divergence experienced in current per capita incomes over time. Worldwide, the usual measures of inequality would seem to be substantially underestimating the true inequality among countries.

We also obtain results corresponding to some counter-factual scenarios to analyze the sources of inequality in permanent income. If there had been no differences in initial current per capita income, but only differences in life expectancy or long-run growth rates, inequality in permanent income would have been 62 percent less than that estimated in 1960, and 68 percent in 2000. If neither convergence nor divergence had occurred in current income, with all countries growing at the same rate as the US, inequality in permanent income would have been 12 percent less in 1960 and 17 percent less in 2000. If there had been no differences in life expectancy, but only in initial levels of current per capita income and long-run growth rates, inequality in permanent income would have been 10 percent less than that estimated in 1960, and 5 percent less in 2000.

These results would seem to indicate that the main source of inequality in permanent income is the initial inequality in current per capita income. However, survival rates and long-run growth rates also appear to play a significant role. In fact, our estimates show that inequality in permanent income is about a third higher than what current per capita income would indicate. Therefore, policies aimed at both fostering faster growth and increasing life expectancies in poor countries are needed if a target of full equality is to be met. This double approach

would reinforce the effect of each set of policies and the overall gains in terms of reducing inequality.

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