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2009

Online at <https://mpra.ub.uni-muenchen.de/18510/>
MPRA Paper No. 18510, posted 11 Nov 2009 00:00 UTC

European integration and inequality among countries: a lifecycle income analysis*

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Abstract

We analyze the effects of the expansions of the European Union on inequality using an approach based on individuals' lifecycle incomes. This allows us to consider the effect of different rates of growth and survival rates. This differs from the usual analyses of inequality that focus on the evolution of current per capita income for the period. Our results show that inequality in terms of permanent income was substantially less than in current per capita income at the time of all the expansions except those of the last ten years. The results point to the key role of policies that stimulate growth in the less developed countries. With an annual β -convergence of 2% in current income, inequality in permanent income would be one third lower.

*The authors wish to thank the Ministerio de Educación y Ciencia-FEDER (SEC2008-03813/ECON) for their financial support.

1. Introduction

With the entry of Rumania and Bulgaria in 2007 the European Union (EU) reached the figure of 27 members and culminated, for the moment, a process of expansion begun half a century earlier when a group of six countries took the first steps in the project of European unity, from which substantial economic and social benefits were expected. The road travelled has not been without difficulties, but it is fair to acknowledge that the result of the successive expansions, always at the voluntary request of the candidate countries, shows that the advantages have clearly been greater than the possible disadvantages.

The economic dimension of the project of European unity has been fundamental from the start. Indeed, the integration project has frequently been criticised for the “excessive” weight of economic aspects to the “detriment” of other matters. This is undoubtedly due in part to the substantial economic benefits that the countries expected (and still expect) to obtain in the long term as a consequence of the process of integration. At the present time these economic advantages associated with integration continue to be a constant incentive to progress along the path undertaken, in spite of the difficulties.¹

One of the reasons given to justify the benefits of economic integration is that the progressive expansion of the markets for goods, services and factors of production (capital and labour) will generate a greater and more efficient use of European countries' resources, stimulating the economic development of the area. Few doubt the long term advantages of economic integration for the member countries; however, the process of integration raises a series of questions that deserve an adequate response. In particular: 1) Do all member countries benefit equally? 2) Can the more developed countries better exploit the advantages of a wider market? Or, on the contrary, 3) Can the less developed countries, due to their lower labour costs, benefit to a greater extent from the entry of capital, foreign investment and the transfer of technology?

¹ In fact, after the 2004 enlargement, in mid-2005, French and Dutch voters rejected the Treaty establishing a Constitution for Europe in national referendums, thus throwing into doubt the EU's ability to work effectively and drive integration forward. At the same time, public scepticism about future enlargements began to mount and this opposition was indeed one of the reasons cited by Dutch and French opponents of the Constitutional Treaty. Many people in the “old” EU Member States think that the EU has not yet successfully digested the 2004 enlargement. They feel that the addition of the Central and Eastern European countries has changed the nature of the Union

Answering these questions implies analyzing the economic convergence of the member countries of the EU. The fundamental question is whether European integration gives rise to a pattern of growth that generates among the member countries convergence, greater differences, or has no appreciable effect in this regard. The analysis of this phenomenon is of special relevance since one of the explicit objectives of the EU is convergence among its countries and regions, and to this end it has devoted and intends to devote a large part of its budget through instruments such as the FEDER or the Cohesion Fund.

The successive expansions, analyzed in greater detail later, have affected both countries already highly developed (e.g., United Kingdom, Denmark or Sweden) and others initially less developed (e.g. Ireland, Greece, Spain or the countries of Eastern Europe). Obviously, though perhaps for different reasons, both types of countries expect to benefit from joining the EU.

At the empirical level there is little literature about the effects of the process of European integration on the convergence of the economies of the EU, and what there is not dedicated explicitly to the analysis of the repercussions of the process on inequality in per capita income of the member countries. Thus, a first group of studies are dedicated to analyzing the evolution of the economies in the fulfilment of the criteria for forming part of the Euro area (e.g. Guldager 1997 and Cappelen et al. 2003 and Ertur and Koch 2006). Another group of studies analyze convergence at regional level, rather than country level (e.g. Quah 1996), and in most cases do not refer to the explicit analysis of the effects of the process of European integration, but simply test for the existence of convergence among the economies analyzed. Finally, a third group of studies, though dedicated to the analysis of the convergence of countries, do not analyze the collective of EU countries, but study the individual experiences of countries, the countries of the OCDE as a whole, or all the economies of the world (e.g. Barro, Sala-i-Martin 1992, Shultz 1998, etc.).

Most of these studies use measures of dispersion, such as the standard deviation of the logarithm of the variable (σ -convergence), or analysis of β -convergence so as to analyze the evolution of the income disparities among economies. However, regardless of the indicator used and the type of analysis of convergence, it should be pointed out that these studies are usually based on current per capita income. Although this methodology provides useful information, this approach could be enriched with a methodology that also takes into account the whole life cycle dimension. Some recent studies have tried to consider this issue by the use of alternative measures. Dowrick et al. (2003) propose their own index based on consumption and life expectancy, avoiding arbitrary

weightings by means of the revealed preferences; Becker et al. (2001 and 2005) analyse inequality of welfare by giving an economic value to the gains achieved in terms of life expectancy; likewise Philipson and Soares (2001) propose and analyse the properties of a measure of total income (Full Income Measure of Human Development).

In this study we aim to use an approach that is also different from the conventional one, though complementary to it. It is a type of approach similar to that proposed by Serrano (2006)². The main characteristic of the method is that it considers the lifecycle income of individuals (present value of future income) and not only the income of a specific period. By using the present value (permanent income or lifecycle income) we continue to take into account the level of current income of the period, but we also value aspects such as the different life expectancies in each country and the different pace of future growth of per capita income (which may converge much, little or not at all). The idea is that to judge inequality it may be appropriate to consider their lives as a whole, using well known tools of economic analysis like permanent income or lifecycle income which are basic to the modern theory of consumption (Modigliani 1986, Friedman 1957, Modigliani, Brumberg 1954).

A country's entry into the EU is a structural change in its economy whose effects can only be valued from a long term perspective. For this reason, it is appropriate to use a lifecycle approach to analyze the effects of integration on the citizens' lifecycle income, and not only on the incomes of specific periods.

The proposed approach enriches the traditional approach in that it considers that the different countries may grow at different rates, which will determine the future incomes of their inhabitants. It also allows us to consider different rates of survival of the individuals of each country, which influences the number of years during which incomes are generated, and therefore the total incomes that they will obtain in the course of their lifetime. Both aspects may have important implications when judging the degree of inequality of the EU economies and their evolution following the successive expansions.

The paper is organised as follows. The next section reviews the positive effects on economic growth associated with integration and, briefly, the history of the process of European integration. Section three reviews the existing literature on European convergence. Section four presents the general

² This approach has been used recently by Pastor and Serrano (2008).

formulation of the approach. Section five presents the data and the results regarding inequality among EU countries at different moments in time. Finally, the last section presents the main conclusions.

2. The process of European integration: expected effects on economic growth

The main economic objective of European integration is to increase the rate of growth of the incomes of the participating economies, of per capita income, and in the final instance, of the well-being of their citizens. The underlying idea is that the construction of a wider European economic and social area will benefit the participating economies.

The sources of the potential benefits associated with integration are very diverse (Viner 1950). Thus, integration favours greater specialization and better use of the comparative advantages of the economies as well as permitting more extensive exploitation of economies of scale (Harris 1984, Gasiorek, Smith & Venables 1992, Francois, McDonald & Nordström 1994). Also, the opening-up of markets among the member countries (elimination of legal and customs barriers) increases competition, exerting further pressure to increase the efficiency of production (MacDonald 1994, Caves, Barton 1990) and countries can purchase raw materials and intermediate goods on better terms, with the consequent increase in productive efficiency (Lee 1992). Finally, changes in the quantity and quality of the factors of production used can also be expected, due to the greater mobility of the factors of production within the area and to increased technical progress (Maudos, Pastor & Serrano 1999).

These potential advantages have been a continued stimulus towards an ever greater degree of integration among European countries. It has been a long and many-staged process whose ultimate outcome is the European Union of 27 members, and whose successive phases it would be appropriate to review before undertaking the empirical analysis.

The European Union has its origin in the European Coal and Steel Community (ECSC) founded in 1951 and formed of six countries (France, the Federal Republic of Germany, Italy, The Netherlands, Belgium and Luxemburg). These six countries, signatories of the Treaty of Rome in 1957, were the founders of the European Economic Community (EEC), a much more ambitious project no longer limited to the coal and steel industries. This led to the total abolition of customs tariffs on industrial

products in 1968 and to the development of common policies (as in the case of agricultural and trade policies).

The success of the project attracted new candidates and in 1973 the EEC expanded to nine members with the entry of Denmark, Ireland and the United Kingdom. In the 1970s the EEC's field of action expanded with the development of social, environmental and regional policies, with the creation of the European Regional Development Fund (ERDF) in 1975.

In the 1980s the process of expansion continued. 1981 saw the entry of Greece and 1986 that of Spain and Portugal. This brought with it a greater role for regional policies, with greater budget allocations for the structural funds, with the aim of reducing the disparities of economic development among the twelve member countries. With the signing in 1986 of the Single European Act the creation of a great single market was agreed, becoming reality in early 1993. At the end of 1990 the reunification of Germany took place, so that the *länder* belonging to the former GDR came to form part of the EEC.

In 1993 came into force the European Union treaty planning the creation of the Monetary Union for 1999, as well as setting in motion various institutional reforms and once again expanding the EU's field of action with common policies on citizenship, the common security and foreign policy (CSFP) and dispositions regarding homeland security.

At the start of 1995 three other countries joined (Austria, Finland and Sweden), raising the total membership to 15. The single currency (the euro) was created on 1st January 1999, and twelve of the EU's fifteen member countries joined it (all except the United Kingdom, Denmark and Greece, though the latter country would join it in 2001). In 2002 this currency physically entered into circulation.

In the mid-1990s the former people's democracies of the Soviet bloc knocked at the EU's door. As a consequence of the negotiations begun in the later years of that decade, in May 2004 there was a new expansion with the entry of ten new members (Malta, Cyprus, Czech Republic, Slovakia, Hungary, Poland, Slovenia, Estonia, Latvia and Lithuania). Finally in early 2007 there occurred what for the moment is the last expansion, with the entry of Rumania and Bulgaria into the European Union of 27 members.

The reduction of the differences in standard of living among the member states and among their different regions is one of the explicit objectives of the EU. Regional policy achieves this by transferring resources from the richest regions to the poorest ones, being an instrument of economic solidarity and a tool of economic integration. The joint result of the dynamic effects of EU entry combined with the action of the EU's regional policy, which it is intended to make more powerful and with more clearly defined targets after successive reforms of its operation, will translate into greater equality. The Commission itself pointed with satisfaction to the case of Ireland (currently with one of the highest per capita GDPs when at the time of its entry it barely reached 64% of the EU average) as an example of what can be achieved.

The financial effort has been substantial. In the 2000-2006 period the structural funds dedicated to this purpose amounted to 213,000 million euros (one third of the EU's total spending in that period). For the period 2007-2013 the resources budgeted are approximately 308,000 million euros, or 36% of the total expenditure planned.

3. Review of the literature on European convergence

There is surprisingly little scientific literature about the effects of the European integration process on the convergence of the economies of the EU, particularly with regard to explicit analysis of the repercussions of the integration process itself on convergence and inequality in the per capita income of the economies of the member countries following the successive expansions of the EU.

The small amount of empirical evidence available on the process of convergence in the European Union can be classified into three groups of studies. A first group, perhaps the most numerous, contains studies that in reality focus on the analysis of the criteria for entering and forming part of the euro zone. This type of studies analyze macroeconomic convergence in terms of public deficit, interest rates or inflation rate (e.g. Guldager 1997). Another considerable part of the literature analyzes convergence in per capita income but at regional level rather than by countries (e.g. Quah 1996) and only sometimes directly linked with the process of European integration (e.g. Ertur, Koch 2006). Finally, in a third group of studies, long term economic growth and the convergence of the countries of Europe considered as countries is habitually subsumed in wider collectives such as the OECD or the world as a whole (e.g. Barro, Sala-i-Martin 1992), or analyzed only for the case of individual experiences (recently, for example, the case of Austria in Stockhammer (2009)).

The empirical literature on the countries of the European Union indicates that convergence is not steady over time. Various factors seem to act in opposing directions, some generating convergence and others divergence. Furthermore these factors seem to have different importance for different types of countries, so the effect of integration can vary significantly among countries.

Thus, the results obtained in Henrekson et al. (1997) suggest that European integration may affect not only static efficiency through changes in resource allocation, but also long term growth rates. Their basic result is a fairly robust association between European integration and growth. The growth effect would be of the order of 0.6-0.8 percentage points p.a. The results also suggest that technology transfer is the main mechanism through which EC and EFTA membership affect growth.

Delgado-Rodriguez and Alvarez-Ayuso (2008) analyze the evolution of labour productivity among EU-15 countries over the period 1980-2001. Using β -convergence techniques they identify periods of non-significant convergence (1980–85 and 1993–96), as well as others of rapid and significant convergence (1986–92 and 1997–2001) in which less productive economies tend to grow faster than more productive economies. For the whole period results are not statistically significant. Physical and human capital accumulation appeared to be the main driving force behind the process. On the other hand, technological progress tended to contribute to divergence, although a change in the trend was observed at the end of the period.

Maudos et al. (1999) analyze the evolution of the countries of the European Union and the impact on efficiency and productivity of the successive expansions during the period 1965-90. The results show that until 1990 integration was beneficial for all the participants. The countries that joined experienced substantial relative gains in efficiency, greater in all cases than those registered in the period prior to their entry. Also the growth rate of TFP in the founder countries received a positive impulse with each new expansion. Kaitila (2004) analyzes both σ and β convergence and discusses the impact of EU membership. According to the results, the EU15 countries' real per capita GDP levels, adjusted for purchasing power, converged in 1960–2001. Convergence occurred in two spells, in 1960–73 and 1986–2001, with an interim period of stagnation. Abiad et al (2007) stress that, due to increasing financial integration, capital in Europe has travelled “downhill” from rich to poor countries, and has done so with gathering strength. These inflows would have been associated with a significant acceleration of income convergence. In Reza et al (2008) real convergence of the

ten new members' economies to the EU average income is tested by using quarterly real GDP per capita data from 1995 to 2005. Application of the unit root tests for testing absolute convergence and catching-up make it possible to conclude that the 10 new members of the EU in 2005 tend to converge towards the EU average income.

In any case, these studies are dedicated to the analysis of convergence and inequality in current per capita income and/or labour productivity. However, the effects of European integration are long term, so it is natural to use also a lifecycle approach like that described in the next section.

3. General formulation

As we have already indicated, this paper analyzes inequality within the EU throughout its existence, using as the key variable the per capita permanent income or lifecycle income.

The per capita permanent income (PI_{i0}) of economy i at time 0 is the discounted value of the present and future per capita current income (y_{it}), taking into account the survival rate in each period. We define $S_i(t, t-1)$ as the probability that a person who is alive in period $t-1$ will still be alive in period t . Thus, the permanent income at time 0 is defined as indicated in the following expression

$$PI_{i0} = \sum_{t=0}^{120} \frac{y_{it}}{(1+r)^t} S_i(t, t-1) \quad [1]$$

in which we assume a common and constant interest rate, r , and that the maximum life of an individual is 120 years (an unrestrictive assumption).

Analysis of inequality and convergence in permanent income provides an analytical framework permitting us to identify their determinants and their sources of possible convergence. A more formal analysis of this type of approximation and its relationship to theoretical models of growth is offered in Serrano (2006).

The approach proposed is more complete than the traditional one because it permits the

consideration that countries grow at different rates and their individuals have different survival rates. All this influences (i) their inhabitants' capacity to obtain future incomes and (ii) the number of years during which such incomes can be generated.

To illustrate the proposed approach let us imagine two EU countries. Currently country 1 has a lower per capita income than country 2. If country 1 grows at a faster rate than country 2, the income of country 1 will therefore be closer to that of country 2 in the future. If we were to measure inequality using not only current income, but all incomes obtained throughout the lifetime of individuals, the inequality would be less than that observed when we use only current income. A similar argument can be applied to the situation where the countries differ in their survival rates. If individuals have a higher rate of survival in country 2, which is richer, the number of years during which incomes are generated will be greater, and thus, *ceteris paribus*, their future flow of incomes will also be greater. If we measure inequality again using not only current income, but all the incomes that will be obtained throughout individuals' lives, the inequality in this case will be greater than that observed when using only current income.³

Note that, *ceteris paribus*, according to expression [1], countries will have higher levels of permanent income:

- the higher their initial per capita incomes (y_{i0}), since the higher the initial income, the greater the future income flows (y_{it}) given the rates of growth (g_i), [$y_{it} = y_{i0}(1 + g_i)^t$];
- the higher their rates of growth (g_i), since the higher the rate of growth, the higher their future per capita incomes (y_{it}) given the initial levels of per capita income (y_{i0}), [$y_{it} = y_{i0}(1 + g_i)^t$];
- the greater the survival rates, [$S_i(t, t - 1)$], since this will determine that incomes will be obtained for more years and that the present value of those income flows will increase;
- the lower the rate of discount (r), since this increases the present value of future incomes.

³ Of course, although the approach proposed is more complete than the traditional one based on current income, the permanent income approach poses some problems: 1) It is not such a straightforward concept as current income and 2) a number of additional assumptions (on future current incomes, life expectancy and discount rates) are needed to estimate it. For these reasons, we do not think that permanent income supersedes current per capita income, which is a very useful and informative way to look at inequality issues. However, we do believe that permanent income is a complementary, useful and suitable way to look at inequality between economies because it tries to take into account whole life cycles of representative individuals. This approach, we hope, may provide us with additional insights on the problem.

At empirical level, three factors will influence the inequality in permanent income:

- the initial levels of per capita current income,
- the per capita future income flows,
- the survival rates of individuals.

Bearing this in mind, in the next section we will consider different counterfactual scenarios to evaluate separately the role of each of these determining factors. This will enable us to value the effect of each of these factors on inequality and convergence in the EU.

4. Data and results

In this section we present the results regarding the inequality among EU countries at two moments in time, 1960 and 2005. The comparisons were always made using the United States as benchmark⁴. All the data are taken from *World Bank Development Indicators 2006*⁵. A detailed discussion of how the survival rates were obtained can be found in the appendix.

Table 1 offers the detailed data regarding life expectancies and per capita current incomes. Since we are interested in analyzing precisely the relative differences between countries, the data are shown relative to the USA. Additionally we present the relative positions of each country in terms of current and permanent per capita income in both periods.

⁴ Using the USA as the benchmark economy is habitual in international work. This allows us to avoid using any EU average which could be a problem given the changing composition of the EU over time. Furthermore, we avoid having to choose any specific European country. At the same time, we also obtain results on inequality within the EU as well as on the relative performance compared with the world leader economy. This has the additional advantage of using as a benchmark a country which is not directly affected by the European integration project.

⁵ Cyprus and Luxembourg have been excluded because of information problems.

Table 1: Current income, permanent income and life expectancy in the EU countries.

Benchmark country=100.

Year of EU Entry	Country	Life Expectancy (years)		Current Per capita income		Permanent income* (Historical scenario)	
		1960	2005	1960	2005	1960	2005
1951	Belgium	100.9	101.9	52.7	62.2	61.9	74.5
1951	France	100.7	103.5	54.5	62.9	62.6	74.8
1951	Germany	99.7	101.4	63.2	64.3	64.0	67.6
1951	Italy	99.1	103.3	41.6	51.6	50.3	66.0
1951	The Netherlands	105.2	101.6	62.9	62.6	65.9	63.5
1973	Denmark	103.4	100.1	88.7	84.1	87.6	80.3
1973	Ireland	99.9	101.1	34.6	78.0	79.5	191.7
1973	United Kingdom	101.9	101.4	73.4	71.0	72.8	70.0
1981	Greece	98.7	102.0	21.6	32.9	32.1	51.7
1986	Portugal	90.9	100.0	15.8	27.4	24.5	48.7
1986	Spain	99.1	103.9	26.6	41.5	40.5	68.8
1995	Austria	98.3	102.3	53.6	67.1	64.8	86.0
1995	Finland	98.6	101.7	51.3	68.1	65.7	91.8
1995	Sweden	104.6	104.0	78.4	78.6	82.3	81.9
2004	Czech Republic	100.8	97.8	22.3	17.3	18.2	13.7
2004	Estonia	98.2	92.4	14.8	15.6	15.3	15.2
2004	Hungary	97.5	93.8	9.2	15.1	14.5	23.4
2004	Latvia	100.0	92.3	9.4	13.4	13.2	17.4
2004	Lithuania	100.1	92.9	17.6	12.9	13.4	9.2
2004	Malta	98.3	101.7	8.0	25.6	27.6	101.3
2004	Poland	97.0	96.2	13.8	13.8	13.4	13.4
2004	Slovak Republic	100.7	95.5	14.8	12.7	13.0	10.6
2004	Slovenia	98.2	98.9	24.3	30.3	29.2	37.2
2007	Bulgaria	99.3	93.5	4.5	5.5	5.4	6.2
2007	Romania	93.8	92.1	5.8	6.0	5.6	5.7
-	United States	100.0	100.0	100.0	100.0	100.0	100.0
Deviation coefficient							
	EU6 (1951)	0.024	0.010	0.161	0.085	0.101	0.074
	EU9 (1973)	0.021	0.011	0.292	0.152	0.170	0.500
	EU10 (1981)	0.021	0.010	0.371	0.235	0.252	0.509
	EU12 (1986)	0.036	0.013	0.469	0.309	0.336	0.499
	EU15 (1995)	0.035	0.013	0.420	0.278	0.302	0.430
	EU25 (2004)	0.029	0.038	0.670	0.583	0.596	0.699
	EU27 (2007)	0.030	0.042	0.735	0.653	0.666	0.770

* Permanent income calculated using individuals' rates of growth (g_i), individual income per capita (y_i) and individuals' survival rates ($S_i(t,0)$). Discount rate = 2%.

Source: World Bank and own preparation.

In respect of life expectancy at birth, the data show modest but significant differences. Thus, in 1960 a country such as The Netherlands had a life expectancy 5.2% longer than the USA, while Portugal ranked 9.1% below that level. This is a substantial difference, of the order of 15%. Among the rest of the countries the differences were smaller but appreciable. In 2005 the greatest difference was between Sweden (4% above the USA) and Rumania (7.9% below the USA), a difference of 12%. There were significant changes during this period, such as the relative improvements of countries such as France, Italy, Portugal, Spain, Austria and Finland; on the other hand in other cases the evolution was less satisfactory (The Netherlands, Denmark and nearly all the eastern European countries). These differences in terms of life expectancy and the changes occurring during the period make this an aspect to be taken into account when valuing the levels of inequality in the EU and convergence among countries from a long term perspective.

In terms of per capita income the differences are of greater magnitude. In 1960 Denmark and Bulgaria were the extreme cases with per capita incomes equivalent respectively to 88.7% and 4.5% of the per capita income in the USA. In 2005 these two countries still showed the maximum and minimum values within the group of countries currently forming the EU27, Denmark with a per capita income of 84.1% that of the USA and Bulgaria barely reaching 5.5%. As well as the size of the differences, the changes occurring during the period should also be taken into account. The extreme values show a stability which it would be deceptive to consider something general. Thus, countries like Ireland, Belgium, Italy, Greece, Portugal, Austria, Finland, Hungary, Malta or Slovenia achieved substantial improvements in relative terms. Other countries like Denmark, The Netherlands, United Kingdom, Czech Republic or Sweden, however, presented a less satisfactory evolution.

This disparity of behaviours over time makes it important when valuing the inequality among those countries at each moment in time to take into account not only the per capita incomes at that moment, but also the present value of the per capita incomes expected in the future. With such disparate growth rates of per capita income, inequality in terms of lifecycle income can vary significantly from inequality in income of the period.

The estimations of per capita permanent income based on the “historical scenario” are offered in the third column of table 1. In this scenario, according to expression [1], the initial per capita income and the survival rates have been used for each country. Also, we have used a long term growth rate based on the assumption that per capita income grows at the mean rate achieved during the period

1960-2005. Finally, to convert future incomes to present values we have used a discount rate of 2%.

In 1960 permanent income varied between the value for Denmark (87.6% of the USA's) and that for Bulgaria (5.4% of the USA's). It would seem, therefore, that considering the lifecycle is not too important given that the results for both extreme cases are similar to those obtained using simply the current income for 1960. However, when we observe what happens in the other countries and not only in the extreme cases we see important changes. Though all the countries are below the USA, their relative positions change substantially if current income or permanent income is considered. Among others, Belgium, France, Italy, Greece, Portugal, Spain, Austria, Finland, or especially Malta and Ireland, improve considerably when permanent income is considered⁶. Thus, for example, Ireland goes from 34.6% of the USA to 79.5%; Spain from 26.6% to 40.5%, or Italy from 41.6% to 50.3%. On the other hand, there are countries such as the United Kingdom or Denmark where the opposite occurs and others where the improvement is unimportant (e.g. Germany, The Netherlands or Poland). In 2005 something similar occurs and it is easy to see that the ranking of countries would change considerably if permanent income were considered instead of current income.

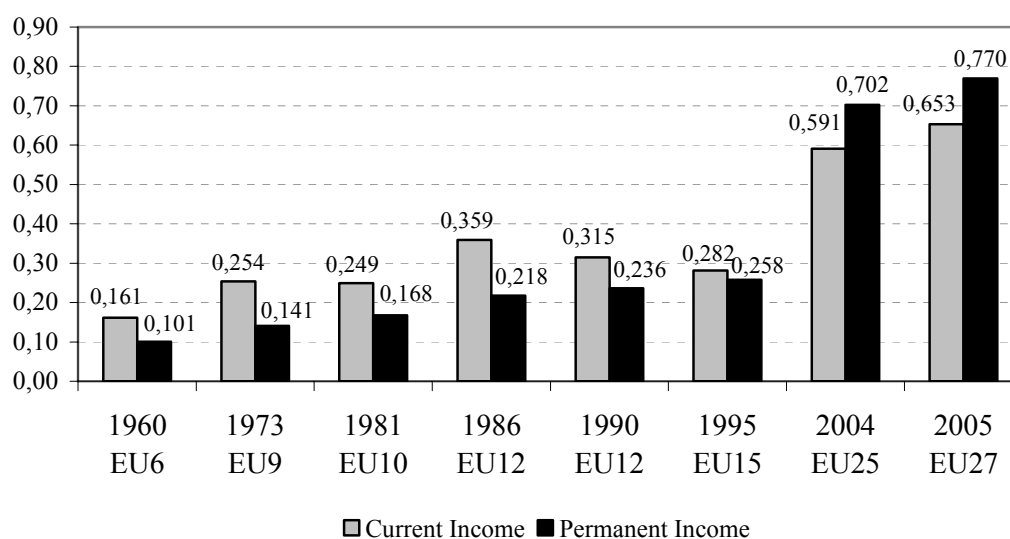
The above results show the existence of differences in terms of life expectancy and economic growth rates among European countries which justify the interest in adopting a permanent income approach to analyze inequality in the EU. Also, the estimations of permanent income indicate that the results can differ in many countries from those habitual in exercises based on current income. For this reason, we will analyze the evolution of inequality among countries within the EU throughout the period, and the possible changes associated with the various expansions thereof, with this lifecycle perspective always in mind.

Our analysis of inequality in the EU will be based on the use of the coefficient of variation of per capita income, a dispersion statistic habitual in this type of inequality analysis. **Figure 1** shows the level of inequality in different periods (including those years when expansions of the EU occurred) for the countries forming the EU at that time, both in terms of current income and of permanent income. Let us first examine the results in terms of current income. The coefficient of variation of current income of the EU6 was 0.161 in 1960. Following the entry in 1973 of Denmark, the United

⁶ The results for Malta and Ireland (both countries showing an estimated permanent income greater than the US in 2007) is due to applying the previous long run rate of growth in this scenario, which is very high in both countries. Recent developments show a less extraordinary performance. Other scenarios estimated in the paper allow for different hypotheses about future rates of growth.

Kingdom and Ireland the inequality increased to 0.254. In 1981, the year of Greece's entry, it was moderated to 0.249, growing substantially to 0.359 in 1986 (entry of Portugal and Spain). From then onwards there was a gradual descent, to 0.315 in 1990 (reunification of Germany) and 0.282 in 2004 (expansion of the EU to 15). It has to be said that the effect of the most recent expansions has been a very significant increase of inequality among countries in the EU. In 2004 (expansion to 25 member countries) the coefficient reached 0.591 and if we include Bulgaria and Rumania (which joined in 2007) the coefficient would be at levels around 0.653.

Figure 1. Inequality in per capita current income and permanent income in the EU countries
(Deviation coefficient)



In sum, we observe a progressive increase in inequality until the mid-1980s, a reduction over the next 20 years and a sharp rise as a consequence of the latest expansions towards Eastern Europe. The current levels of relative inequality, then, within this much more heterogeneous 27-member EU, multiply several times those existing among the original members of the project of European integration.

Let us now consider inequality from a lifecycle perspective, using once again the coefficient of variation, but in this case that of permanent per capita income. The results appear in the same **figure 1**. The temporal profile now shows a continued growth which, indeed, accelerates quite visibly with the latest expansions. Thus the coefficient starts at a level of 0.101 in 1960 (EU6), increases to 0.141 in 1973, 0.168 in 1981, 0.218 in 1986, 0.236 in 1990, 0.258 in 1995, 0.702 in 2004 and 0.770

in 2005. Also when permanent income is used we observe that levels of inequality are at maximum values for the EU, much higher than the initial ones.

When the results obtained from these two perspectives (current and permanent income) are compared, we observe some interesting differences. During the period prior to the latest expansion, inequality was much lower if permanent income is considered, especially for the years before 1995. That is to say, taking into account the future and not only the income of the period, the levels of inequality within the EU were substantially less than those indicated by the current per capita income of the period. However, after the latest expansions taking place this century the image is quite the contrary. Inequality is greater in terms of permanent per capita income. The differences of life expectancy and of incomes foreseeable in the future tend to magnify the inequality among the members of the present EU, whereas in the past the opposite occurred. This means that, unless European cohesion policies contribute more actively to changing this panorama, the levels of inequality in the EU will continue to be high.

In this sense, it has to be pointed out that the latest reform of the EU's regional policy (European Commission 2004) motivated to a large extent by the latest expansions with the entry of more heterogeneous countries, is moving in the direction of concentrating its actions most on the unequivocally less developed areas. The aim of these reforms is to make the regional policy more effective in boosting the development of the less developed regions, essentially the majority of new member countries.

Once we have analyzed inequality and convergence in permanent income (scenario 1 or historical scenario), our next step is to evaluate separately the role of each of their determining factors, such as survival rates, per capita current income and rate of convergence. In order to do this, the effect of each of them will be isolated step by step, i.e. allowing for changes only in one of these variables each time. These correspond to different assumptions as to survival rates, the initial levels of per capita current income and the existence or otherwise of convergence among countries in terms of per capita current income. On the basis of these scenarios, we simulate the inequality of permanent income of the countries by building some counterfactual scenarios. Particularly, the following scenarios will be considered:

- Scenario 1 (Historical base scenario): In this scenario it is considered that the per capita income of each economy in the initial period (y_{i0}) grows at the individual average rate of growth (g_i) during the period 1960-2005. The series of per capita incomes (y_{it}) obtained in this way [$y_{it} = y_{i0}(1 + g_i)^t$] is used to calculate permanent income (PI_{i0}) according to expression [2].

$$PI_{i0} = \sum_{t=0}^{120} \frac{y_{it}}{(1+r)^t} S_i(t, 0) = \sum_{t=0}^{120} \frac{y_{i0}(1+g_i)^t}{(1+r)^t} S_i(t, 0) \quad [2]$$

- Scenario 2 (without convergence in current per capita income): In this scenario it is considered that the per capita income of each economy in the initial period (y_{i0}) grows at the average rate of growth of the benchmark economy (g_{US}) for the period 1960-2005. The series of per capita incomes (y_{it}) obtained in this way [$y_{it} = y_{i0}(1 + g_{US})^t$] is used to calculate permanent income (PI_{i0}) according to expression [3].

$$PI_{i0} = \sum_{t=0}^{120} \frac{y_{it}}{(1+r)^t} S_i(t, 0) = \sum_{t=0}^{120} \frac{y_{i0}(1+g_{US})^t}{(1+r)^t} S_i(t, 0) \quad [3]$$

- Scenario 3 (Scenario with identical survival rates): This scenario is the same as scenario 1 with the sole exception that the per capita incomes of each economy (y_{it}) obtained as described [$y_{it} = y_{i0}(1 + g_i)^t$] are combined with the survival rates of the benchmark economy ($S_{US,t}$), obtaining the permanent income (PI_{i0}) according to expression [4]. In this way we can evaluate the differences in permanent income that would persist even if the survival rates did not differ between economies.

$$PI_{i0} = \sum_{t=0}^{120} \frac{y_{it}}{(1+r)^t} S_i(t, 0) = \sum_{t=0}^{120} \frac{y_{i0}(1+g_i)^t}{(1+r)^t} S_{US}(t, 0) \quad [4]$$

- Scenario 4 (Scenario of identical initial per capita incomes): In this scenario it is considered that the per capita income of each economy in the initial period is equal to that of the benchmark economy ($y_{i0} = y_{US0}$) and grows at the individual average rate of growth (g_i) during the period

1960-2005. The series of per capita incomes (y_{it}) obtained in this way [$y_{it} = y_{USo}(1 + g_{it})^t$] is used to calculate permanent income (PI_{i0}) according to expression [5].

$$PI_{i0} = \sum_{t=0}^{120} \frac{y_{it}}{(1+r)^t} S_i(t, 0) = \sum_{t=0}^{120} \frac{y_{USo}(1 + g_{it})^t}{(1+r)^t} S_i(t, 0) \quad [5]$$

- Scenario 5 (considering the rates of growth since integration): In this scenario it is considered that the per capita income of each economy in the initial period (y_{i0}) grows at the individual average rate of growth (g_i^{POST}) during the post-integration period to 2005. The series of per capita incomes (y_{it}) obtained in this way [$y_{it} = y_{i0}(1 + g_i^{POST})^t$] is used to calculate permanent income (PI_{i0}) according to expression [6].

$$PI_{i0} = \sum_{t=0}^{120} \frac{y_{it}}{(1+r)^t} S_i(t, 0) = \sum_{t=0}^{120} \frac{y_{i0}(1 + g_i^{POST})^t}{(1+r)^t} S_i(t, 0) \quad [6]$$

- Scenario 6 (Scenario with convergence in current per capita income): In this scenario it is considered that the per capita income of each economy in each period (y_{it}) converges towards that of the benchmark economy (y_{USt}) at a speed of convergence β . If we define the per capita income of an economy at moment t , relative to the benchmark economy, as $\eta_t = y_{it}/y_{USt}$ and we further assume that there are no differences in steady state, then convergence at an annual rate of β makes $\eta_t = [1 - e^{-\beta t} (1 - \eta_0)]$ and $y_{it} = y_{USt} \cdot (1 - (1 - \eta_0)e^{-\beta t})$. The series of per capita incomes (y_{it}) obtained in this way is used to calculate permanent income (PI_{i0}) according to expression [7]. In this scenario three rates of convergence are considered, $\beta=2\%$, $\beta=3\%$ and $\beta=5\%$.

$$PI_{i0} = \sum_{t=0}^{120} \frac{y_{it}}{(1+r)^t} S_i(t, 0) = \sum_{t=0}^{120} \frac{y_{USt} \cdot (1 - (1 - \eta_0)e^{-\beta t})}{(1+r)^t} S_i(t, 0) \quad [7]$$

Table 2 shows the coefficients of variation of permanent per capita income corresponding to these new counterfactual scenarios.

Table 2: Inequality in current income and permanent income in the EU countries. Different scenarios. (Deviation coefficient)

	Current income	Permanent income (Scenarios)							
		Scen. 1	Scen. 2 (g_{USA})	Scen. 3 (S_{USA})	Scen. 4 (Y_{pcUSA})	Scen. 5 (g_{post})	Scen. 6 ($\beta=2\%$)	Scen. 6 ($\beta=3\%$)	Scen. 6 ($\beta=5\%$)
1960 EU6	0.161	0.101	0.175	0.089	0.075	0.101	0.075	0.060	0.045
1973 EU9	0.254	0.141	0.263	0.140	0.360	0.241	0.112	0.085	0.058
1981 EU10	0.249	0.168	0.251	0.182	0.338	0.440	0.099	0.074	0.048
1986 EU12	0.359	0.218	0.358	0.228	0.313	0.772	0.129	0.093	0.059
1990 EU12	0.315	0.236	0.313	0.248	0.312	0.851	0.115	0.083	0.053
1995 EU15	0.282	0.258	0.281	0.267	0.294	1.078	0.106	0.077	0.049
2004 EU25	0.591	0.702	0.603	0.695	0.507	2.699	0.209	0.157	0.109
2005 EU27	0.653	0.770	0.667	0.761	0.499	2.850	0.223	0.167	0.116

As we have shown above, one of the potentially important factors in determining permanent income is the future rate of growth of current per capita income. To estimate its impact on inequality we define **scenario 2**. In it we have obtained the permanent incomes of each country on the assumption of a common future growth rate. Specifically, the growth rate of per capita income of the USA from 1960 to the present has been used for all countries. The initial levels of per capita income and life expectancies, on the other hand, continue to be those of each country. The results of scenario 2 show increasing inequalities until the creation of the EU12, followed by slight reductions in the 1990s and a sharp rise with the latest expansions. Of more interest is the comparison between these results and those of scenario 1, as the differences between the two indicate the part of the inequality in permanent income associated with the different long term growth rates of the current per capita income of each country. As can be observed, the different rates of growth of per capita income during the period 1960-2005 helped to reduce inequality, with the exception of 1960 and 2005. In the successive expansions from 1973 to 1995 we can observe that the inequality in permanent income of the historical scenario (scenario 1) is always less than that which would have been obtained with a common rate of growth. Thus, in 1986 the coefficient of variation of the EU12 countries was 0.218, but applying the common growth rate (scenario 2) this coefficient would be 0.313, indicating nearly 50% more inequality in permanent income. The reason is that, when the member countries of the EU9, EU10, EU12 and EU15 are considered as a whole, the countries with lowest per capita income showed faster long term growth during the period 1960-2005. However, the latest expansions again show differential characteristics. For the EU25 inequality stands at 0.702 and for the EU27 at 0.77, according to scenario 1. Using a common growth rate the inequality falls to 0.603 and 0.667 respectively. This is because the latest expansions have brought in countries that are less developed and which have in the past shown less capacity for long term growth.

The second important factor for explaining inequality among countries is the difference in life expectancy. **Scenario 3** has been defined for the purpose of evaluating the importance that differences in life expectancy have had for the levels of inequality among the countries of the EU throughout its history. The results of this scenario were obtained under the assumption that all the countries had a common life expectancy, specifically that of the USA. Therefore, the differences between the inequality levels of this scenario 3 and those of scenario 1 (historical scenario) have to be attributed to the differences in life expectancy of each country. Thus, in 1960 the differences in life expectancy among the member countries of the EU6 explain a significant part of the inequality in permanent income (with a common life expectancy like that of the USA the coefficient of variation of permanent income would have been 0.089 instead of 0.101). On the other hand during the 80s and 90s the effect was the opposite, helping to reduce slightly the inequality in permanent income (thus, in 1995 the coefficient of variation among the countries of the EU-15 with a common life expectancy would have been 0.267 instead of 0.258). The impact of life expectancy is currently very low, and the levels of inequality would barely change even though the differences in life expectancy disappeared.

Scenario 4 corresponds to the estimations of permanent income obtained by assuming that all the countries of the EU start with the same initial per capita income, but maintaining the life expectancies and long term growth rates of each country. In 1960 this gives an inequality of permanent income of 0.075, clearly below the inequality in current per capita income and also below the inequality observed in the historical scenario (scenario 1). This confirms that differences in life expectancy and, particularly, in growth rates, were contributing significantly to the inequality among the member countries of the original EU. From that moment onwards, the impact of these two factors becomes more and more substantial. Inequality in permanent income is greater than that obtained in scenario 1 in 1973, 1981, 1986 and 1995. With the latest expansion this trend has been broken since most of the new member countries present a substantial gap between their initial current per capita incomes and those of the existing member countries. The impact of growth rates and of differences in life expectancy is substantial (thus the inequality in scenario 4 rises from 0.294 for the EU15 in 1995 to 0.507 for the EU25 in 2004), but the differences are smaller than in scenario 1 (thus, for the EU25 in 2004 inequality in permanent income is 0.507 in scenario 4 and 0.702 in scenario 1).

The evidence for the growth trajectories of the European countries after each expansion are not

especially encouraging. The results of **scenario 5** were obtained by estimating in each year the future current incomes on the basis of the growth rates experienced by each country since that year. Let us recall that the estimations of scenario 1 are based always on the growth rates measured from 1960 to the present. The comparison between **scenario 5** and scenario 1 is clear. We can leave aside the result for 1960 which, naturally, has to coincide. In the rest of the years the inequality estimated in permanent income is significantly greater because post-expansion growths are used. This already occurs in 1973 (0.241 and 0.141) and the phenomenon persists with increasing intensity. In 1995 the level of inequality would be multiplied by four (1.078 and 0.258) and with the latest expansion the result is similar (2.85 and 0.77). Naturally, we have to bear in mind that the more recent the year analyzed, the shorter the period that serves to calculate the growth rates, which may be subject more to immediate factors than to long term ones. In sum, the results indicate that if the current post-integration growth rates are maintained, substantial levels of inequality will remain.

Let us recall that the base estimation (scenario 1) was obtained from the rates of growth of per capita long term income (1960-2005) of each country in the past. A different pattern of growth in the future could have a substantial impact. In **scenario 6** these growth rates have been replaced by others that correspond to a situation of convergence in per capita current incomes among the countries of Europe. Under this hypothesis the countries with lowest per capita income would grow most and would do so faster due to their relative backwardness. Three different annual convergence rates have been posited: 2%, 3% and 5%. These three convergence scenarios correspond to the hypothesis that each country manages to reduce the gap in current per capita income by 2%, 3% or 5% (respectively) each year.

The results indicate that this would lead to a steep reduction of the inequality in permanent income among countries of the EU. The results of scenario 1 indicate that the inequality in permanent income in the EU is currently 0.77. However, if instead of maintaining the past growth rates of each country we assume that in the future there will be an annual convergence of 2%, the estimated inequality in permanent income would currently be only 0.223, less than one third. If a somewhat greater annual convergence in current per capita income (3%) were achieved, it would be only 0.167. Finally, with a convergence rate of 5%, the inequality in permanent income would be barely 0.116.

In other words, if thanks to the process of economic integration itself or to the EU's cohesion policies, a convergence rate of 2% were achieved, the inequality in current income in 2005 of 0.653

would be compatible with a lifecycle inequality two thirds lower (0.223).

It should be emphasized that rates of convergence between economies of 2% are perfectly feasible. Numerous studies have estimated similar convergence rates among the countries of the OCDE, the states of the USA, the prefectures of Japan, the regions of Germany, Spain, etc. (Barro, Sala-i-Martin 1995). Furthermore, any increase in that rate of convergence would have its reward in an appreciable reduction of the inequality in permanent income.

After analyzing the influence of the determinants of permanent income on inequality, we may wonder about the evolution of inequality following the successive expansions, both for the “old” member countries, and for the countries that are joining. **Table 3** permits us to observe the phenomenon of inequality in this multiple dimension, both in terms of current per capita income (panel a) and in terms of permanent per capita income under the scenario 1 (panel b).

Table 3: Inequality in current income and permanent income in the EU countries.
(Deviation coefficient)

a) Per capita income

	1960	1973	1981	1986	1990	1995	2004	2005
EU6 (1951)	0.161	0.110	0.084	0.086	0.079	0.078	0.082	0.085
EU9 (1973)	0.292	0.254	0.196	0.222	0.168	0.151	0.143	0.152
EU10 (1981)	0.371	0.291	0.249	0.282	0.252	0.250	0.232	0.235
EU12 (1986)	0.469	0.353	0.329	0.359	0.317	0.316	0.306	0.309
EU12 (1990)	0.466	0.353	0.327	0.357	0.315	0.315	0.306	0.309
EU15 (1995)	0.420	0.320	0.299	0.324	0.289	0.282	0.274	0.278
EU25 (2004)	0.670	0.636	0.597	0.608	0.596	0.631	0.591	0.583
EU27 (2007)	0.735	0.702	0.661	0.671	0.663	0.699	0.661	0.653

b) Permanent income

	1960	1973	1981	1986	1990	1995	2004	2005
EU6 (1951)	0.101	0.068	0.058	0.060	0.064	0.058	0.073	0.074
EU9 (1973)	0.170	0.141	0.143	0.136	0.182	0.251	0.490	0.500
EU10 (1981)	0.252	0.158	0.168	0.176	0.222	0.289	0.501	0.509
EU12 (1986)	0.336	0.199	0.210	0.218	0.236	0.294	0.490	0.499
EU12 (1990)	0.336	0.199	0.210	0.218	0.236	0.294	0.491	0.498
EU15 (1995)	0.302	0.187	0.198	0.209	0.218	0.258	0.424	0.430
EU25 (2004)	0.596	0.567	0.553	0.556	0.577	0.644	0.702	0.699
EU27 (2007)	0.666	0.640	0.624	0.626	0.650	0.717	0.773	0.770

The rows of the upper panel permit us to see the evolution of the inequality in current per capita income of the successive groups of countries that have come to form the EU throughout the period 1960-2005. In the first row we can observe that the inequality among the founding countries at the start of the EU (EU6) decreased progressively from 0.161 to less than half that in 1995 (0.078), rising slightly thereafter (0.085 in 2005), though remaining well below the initial levels. For the expanded group of countries that formed the EU9 in 1973 something similar occurred, with inequality decreasing from 0.254 in 1973 to 0.152 in 2005. With the entry of Greece in 1981 the EU10 was formed, the reduction of inequality for this group being weaker (from 0.249 in 1981 to 0.235 in 2005). More positive was the experience of the EU12 with the entry of Spain and Portugal in 1986: inequality was reduced from a level of 0.359 in that year to 0.309 in 2005. Slight reductions are also observed for the expanded collectives EU15 and EU25 as from their respective creations. That is to say that the general tone is one of the successive expansions being accompanied by reductions in the inequality among the “old” members.

Analysis of the columns of the table indicates that the inequality for the total of the countries of the EU would have increased as a consequence of the entry of new, more heterogeneous, countries. Thus, observing the levels of inequality in current per capita income in 2005 for the different subgroups (last column) we observe that it increases with the subgroup considered: 0.085 for the EU6, 0.152 for the EU9, 0.235 for the EU10, 0.309 for the EU12, 0.278 for the EU15 (only exception, logical given the characteristics of the three new members), steep rise to 0.583 for the EU25 and 0.653 for the EU27 countries.

The lower panel shows the results in terms of permanent per capita income. There are many similarities, but also some significant differences from the estimates in terms of current per capita income. Thus, observing the level of inequality in 2005 we can see that the various expansions have meant a clear increase in inequality for the EU, from the level of 0.074 for the founding countries (EU6) to levels of around 0.50 for the EU9, EU10 and EU12 and, finally, levels of 0.699 for the EU25 and 0.77 for the EU27. No increase in inequality is observed for 2005, when the EU9 expanded to EU10 or EU12, something which did happen when current income was examined.

If we now focus our attention on the impact of the successive expansions over time we will see that only in the case of the founding countries (EU6) do we observe a reduction of inequality in permanent income: the coefficient of inequality went from 0.101 in 1960 to 0.074 in 2005. For the rest of the groupings that have formed the EU at each time, the trend is the opposite; the EU9 countries go from 0.141 in 1973 to 0.500 in 2005 ; the EU10 countries from 0.168 in 1981 to 0.509 in 2005; the EU12 countries from 0.218 in 1986 to 0.499 in 2005 and the EU15 countries from 0.258 in 1995 to 0.430 in 2005. The general tone is that the successive expansions have been accompanied by substantial increases in inequality of permanent incomes among the “old” members, except in the case of the 6 founding countries.

4. Conclusions

One of the basic objectives of the process of European integration is that the potential positive effects deriving from it should economically benefit all the member countries. In particular, the European Union's regional policy devotes a substantial part of the resources of the Union's budget for the purpose of reducing the economic inequalities in the territorial sphere.

The usual analyses of inequality focus on the evolution of the current per capita income of the period. Thus, when a fixed group of countries is analyzed over time (i.e. that formed by the 6 initial member countries or any of the groups that have come to form the area, EU9, EU12, EU15, etc.) a trend towards convergence in current per capita income can be appreciated between 1960 and 2005. When the analysis focuses on the changing group of countries that have formed the European Union over time, what we observe is an increasing level of inequality until the expansion of 1986, followed by an intense convergence until the latest expansions from 2004 onwards. On the other hand, the latest incorporations have led to the European Union having the highest levels of inequality among member countries of its entire history.

In this study, we have adopted a complementary approach to the usual one to analyse the problem of inequality and convergence among the EU countries. This approach is connected with the permanent income and life-cycle theories. The main issue in these theories is the fact that they consider the complete flow of discounted future incomes. Regarding inequality, the results obtained with this permanent income approach may differ from those obtained when only differences in current income are used. The reason is that this approach takes into account the fact that countries may grow at different rates, which will determine the future incomes of their inhabitants. Moreover, if individuals do not have the same survival rates in different countries, the number of years during which the incomes are generated will be different. Therefore this will also affect the present value of the total sum of incomes that they will obtain throughout their lives.

The results obtained indicate that inequality in terms of permanent income was substantially less than that shown by current per capita income for the European Union until the most recent processes of expansion. However, with the expansions of the last decade the opposite occurs. The inequality in current income currently underestimates the inequality in permanent income, a somewhat unsatisfactory situation.

Nor does the temporal evolution of inequality in permanent income permit us to be too optimistic. Focussing the analysis on the fixed groups of countries that have formed the different European Unions we observe convergence until the mid-1980s and divergence from then onwards. On the other hand, the behaviour of the changing group of countries that have formed the European Union in the course of time shows an almost permanent tendency towards divergence.

Differences in life expectancy would have helped to increase inequality in permanent income in the

initial phases of the European integration project. However, at present they have very little impact. The overall level of inequality would now be practically the same even if all the countries had the same life expectancy.

The differences in the starting level of per capita current incomes are a more important factor than inequality in permanent income, though the sign of their effect varies in the course of the period analyzed. In the 1960s and also at the present time they contribute substantially to generating greater inequality in permanent income.

Finally, we should point out the influence of the different economic growth rates of each country. This factor would have clearly contributed to reducing inequality in permanent income systematically since 1960. However, with the latest expansion its effect has been inverted and it becomes a source of greater inequality in permanent income.

The analysis of the effects of the expansions on the different groups of countries indicates that the successive expansions have been accompanied by substantial increases of inequality in permanent income among the “old” members, except with regard to the case of the 6 founding countries.

All these results point to the key role of economic growth in achieving further reductions in inequality in the EU, as the contribution of other variables such as life expectancy seems, at present, to be rather limited. Policies that stimulated greater growth of the least developed countries would have considerable effect. The simulations carried out show that with an annual convergence rate of 2% (i.e. the countries reduce the gap existing in current per capita income by 2% every year), the inequality in permanent income would be less than one third of what it is now. This rate of convergence is ambitious, but not impossible, as it is consistent with that recorded by the countries of the OCDE in the past and with those habitually obtained when analyzing convergence among the regions of a single country.

Appendix: Construction of survival rates

The survival rates for each age are not available for a large number of countries. To calculate them, in this study we use the same procedure as in Becker, Philipson and Soares (2001), based on the data offered by *World Bank Development Indicators 2006*. The procedure is based on four types of information available relating to survival rates⁷: infant mortality⁸ in the first year ($S(1,0)$), infant mortality in the first five years⁹ ($S(5,0)$), the survival rate at 60 years¹⁰ conditional on reaching 15 ($S(60,15)$), and Life expectancy at birth (total years) (E_0). Using this information, together with some simplifying assumptions, it is possible to construct the survival rates of 89 countries considered in the study for ages between 1 and 120 years.

By definition we have the following relationships between the rates of survival

$$S(5,1) = \frac{S(5,0)}{S(1,0)} \text{ and } E_{60} = \sum_{t=61}^{\infty} S(t,60) = \frac{E_0 - \sum_{t=0}^{60} S(t,0)}{S(60,0)}$$

where E_{60} are the additional years of life for an individual of 60 years.

The assumptions made with regard to the rates of survival are as follows:

$$\begin{aligned} S(t,t-1) &= S(t+1,t), & \text{for } 2 \leq t \leq 4; \\ S(t,t-1) &= 1, & \text{for } 6 \leq t \leq 15; \\ S(t,t-1) &= S(t+1,t), & \text{for } 16 \leq t \leq 59; \\ S(t,60) &= e^{-(t-60)} & \text{for } 60 \leq t \leq 120; \\ S(t+1,t) &= 0 & \text{for } t > 120 \end{aligned}$$

Given the information available, this information is sufficient to reconstruct all the distribution of survival. This is done as follows:

⁷ The information provided by the WDI is presented as number of deaths (n_{ij}) per 1000 individuals, so it has had to be converted to rates $S(i,j)$ using the following formula $S(i,j) = \frac{1000 - n(i,j)}{1000}$.

⁸ Mortality rate, infant (per 1,000 live births).

⁹ Mortality rate, under-5 (per 1,000 live births).

¹⁰ Mortality rate, adult (per 1,000 adults). The information from the World Bank captures the mortality rate separately for men and women. In this study we consider the average.

where $S(t,60)$ for $t > 60$ is obtained from $S(t,60) = e^{-\beta(t-60)}$ and $\beta = \frac{1}{E_{60}}$ (from the integration of $S(t,60)$ of 60 to ∞).

The assumptions adopted are not very far from the reality, and permit us to use the full potential of the information available.

References

- Abiad, A.G., Leigh, D. & Mody, A. 2007, "International Finance and Income Convergence: Europe is Different", *International Monetary Fund (IMF) Working Paper*, no. 07/64.
- Barro, R.J. & Sala-i-Martin, X. 1995, *Economic Growth*, NY: Mc Graw-hill.
- Barro, R.J. & Sala-i-Martin, X. 1992, "Convergence", *Journal of Political Economy*, vol. 100, pp. 223-251.
- Becker, G., Philipson, T.J. & Soares, R. 2005, "The Quantity and Quality of Life and the Evolution of World Inequality", *American Economic Review*, vol. 95, no. 1, pp. 277-291.
- Becker, G., Philipson, T.J. & Soares, R. 2001, "Growth and Mortality in Less Developed Nations", *Unpublished manuscript, University of Chicago*.
- Cappelen, A., Castellacci, F., Faggerberg, J. and Verspagen, B. 2003, "The Impact of EU Regional Support on Growth and Convergence in the European Union", *Journal of Common Market Studies*, vol. 41, no. 09, 621-644.
- Caves, R.E. & Barton, D.R. 1990, *Efficiency in US manufacturing industries*, MIT Press Cambridge, Mass.
- Delgado-Rodriguez, M.J. & Alvarez-Ayuso, I. 2008, "Economic Growth and Convergence of EU-member Status: An Empirical Investigation", *Review of Development Economics*, vol. 12, no. 3, pp. 486-497.
- Dowrick, S., Dunlop, Y. & Quiggin, J. 2003, "Social Indicators and Comparisons of Living Standards", *Journal of Development Economics*, vol. 70, no. 2, pp. 501-529.
- Ertur, C. & Koch, W. 2006, "Regional disparities in the European Union and the enlargement process: an exploratory spatial data analysis, 1995–2000", *The Annals of Regional Science*, vol. 40, no. 4, pp. 723-765.
- European Commission 2004, "A new partnership for cohesion convergence competitiveness cooperation", *Third report on economic and social cohesion*.
- Francois, J.F., McDonald, B. & Nordström, H. 1994, *The Uruguay Round: A Global General Equilibrium Assessment*, Centre for Economic Policy Research (CEPR). Discussion Paper 1067.
- Friedman, M. 1957, *A theory of the consumption function*, 4th print edn, Princeton University Press, Princeton NJ.
- Gasiorek, M., Smith, A. & Venables, A. 1992, "Trade and welfare: a general equilibrium model" in *Trade Flows and Trade Policy after 1992* Cambridge University Press, , pp. 35-63.
- Guldager, P. 1997, "Convergence of the EU Member States towards the EMU requirements, 1986 to 1993", *European Journal of Political Economy*, vol. 13, no. 2, pp. 247-259.

- Harris, R. 1984, "Applied General Equilibrium Analysis of Small Open Economies with Scale Economies and Imperfect Competition", *The American Economic Review*, vol. 74, no. 5, pp. 1016-1032.
- Henrekson, M., Torstensson, J. & Torstensson, R. 1997, "Growth effects of European integration", *European Economic Review*, vol. 41, pp. 1527-1557.
- Kaitila, V. 2004, "Convergence of real GDP per capita in the EU15: how do the accession countries fit in", *European network of Economic Policy Research Institutes*, vol. Working Paper 25, pp. 1-34.
- Lee, J.W. 1992, *International Trade, Distortions, and Long-Run Economic Growth*, International Monetary Fund, Research Department.
- MacDonald, J.M. 1994, "Does Import Competition Force Efficient Production?", *Review of Economics and Statistics*, vol. 76, no. 4, pp. 721-727.
- Maudos, J., Pastor, J.M. & Serrano, L. 1999, "Economic integration, efficiency and economic growth: the European Union experience", *Applied Economics Letters*, vol. 6, no. 6, pp. 389-392.
- Modigliani, F. 1986, "Life Cycle, Individual Thrift, and the Wealth of Nations", *American Economic Review*, vol. 76, pp. 297-313.
- Modigliani, F. & Brumberg, R. 1954, "Utility Analysis and the Consumption Function: An Interpretation of Cross-Section Data", *Post-Keynesian Economics*, vol. 388, pp. 436.
- Pastor, J.M. & Serrano, L. 2008, "Permanent income, convergence and inequality among countries", *Review of Income and Wealth*, vol. 54, no. 1, pp. 105-115.
- Philipson, T.J. & Soares, R. 2001, "Human Capital, Longevity, and Economic Growth: A Quantitative Assessment of Full Income Measures", *Manuscript*.
- Quah, D.T. 1996, "Regional convergence clusters across Europe", *European Economic Review*, vol. 40, no. 3-5, pp. 951-958.
- Reza, R. & Zahra, K.T. 2008, "Evaluation of the Income Convergence Hypothesis in Ten New Members of the European Union. A Panel Unit Root Approach", *Panoeconomicus*, vol. 2, pp. 157-166.
- Serrano, L. 2006, "Convergencia y desigualdad en renta permanente y corriente. Factores determinantes", *Fundación BBVA, Documento de Trabajo*, vol. 12/06, pp. 1-33.
- Schultz, T. P., 1998, "Inequality in the distribution of personal income in the world: How it is changing and why", *Journal of Population Economics*, vol. 11, pp. 307-344.
- Stockhammer, E. 2009, "Effects of European integration on Austria's economy", *International Review of Applied Economics*, vol. 23, no. 1, pp. 19-40.

Viner, J. 1950, *The Customs Union Issue*, New York.