

**INCOME INEQUALITY AND INNOVATIONS
IN THE PROCESSES OF ECONOMIC GROWTH AND REAL CONVERGENCE**

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Abstract

The paper deals with the relation between income inequality, innovation processes, economic development and income convergence within the European Union. The presented results suggest a non-linear relation between the economic development and the income inequality. There is also visible the significant influence of innovation activity and technology diffusion on the economic growth. We could observe strong and stable innovation-related polarisation into two different groups of countries in the European Union, as well as a phenomena that countries considered as technological followers imitate the innovation leaders very quickly. The real convergence occurs on the international scale, but not at the regional level. It seems that the latest tendency will remain in the future.

Key words: income, inequality, convergence, innovations.

JEL classification: O15, O16, O31, O47.

Introduction

The existing theories of growth have been trying, and often failing, to answer the question what is the mechanism that makes some countries more prosperous than others. According to the majority of studies the fundamental factor that determines both the income divergence as well as balancing the GDP *per capita* levels in different countries are the discrepancies in long-term economic growth rates. It is the growth rate observed through decades, or even centuries, that defines best the pace of the economic and social development of a given country. As mathematical models of growth show, the long-term growth of a gross domestic product per person strongly influences the development of knowledge and the resulting technological advancement, which in turn leads to narrowing the distance between less and more developed countries¹.

The processes of economic growth are sensitive to many other, often indirect, factors which create conditions that can stimulate or hinder economic growth. One of them is income inequality within a society. Unfortunately, in case of this particular factor both the theory of economics and the empirical studies fail to provide an explicit answer how it affects the economic growth dynamics.

The main aim of this article is to present theoretical premises concerning the relation between the level of income inequality and technical advancement measured by the intensity of innovation processes on the one hand and the economic growth and income convergence on the other, on both regional and international scale. The theoretical part of the article will be illustrated with the results of empirical research that are to indicate regularities seen in the European Union countries.

1. Income Inequality in a Society and the Economic Growth

Most theoretical studies and research results indicate adverse effects of significant income inequality on the rate of economic growth. It is worth pointing out, however, that the character of the relationship between these two factors depends mostly on the assumptions concerning proposed growth theories. There is a common belief that in the countries with the low GDP *per capita* income inequality has a negative effect on growth due to limited consumption, while in those countries where the GDP *per capita* is high its influence on the economic growth is neutral. Simultaneously, it is believed that what is crucial for the growth

dynamics is not the uneven distribution of incomes but the participation of people whose earnings remain below a certain level.

Saying that most empirical research based on large-scale data indicate a negative effect of income inequality on the economic growth², V. Grossmann gives four basic reasons (channels) of negative influence of income inequality on the economic growth dynamics³:

- higher level of income inequality leads to vaster redistribution of generated income, which results in the decreased effectiveness of resource allocation (*fiscal policy approach*),
- higher level of income inequality leads to limited access to education and to less investment in human capital in the times when capital market is imperfect (*imperfect capital market approach*),
- higher level of income inequality results in political and social instability as well as in foreign investors' limited trust (*sociopolitical instability approach*),
- as a result of higher level of income inequality fertility rates grow, which makes investment in human capital fall due to women's limited access to education (*fertility approach*).

Starting from S. Kuznets and ending on R. Lucas many researchers suggested a non-linear relation between the development level of a given country and the level of its income inequality taking the shape of an inverted letter U. The character of this relation stems from the irregular growth course in time. Regional income inequality tends to grow at an initial stage of development of a country, then it starts to fade out. In such a case a vital condition for convergence to take place are the positive effects of diffusion of growth and technical advancement processes among less and better developed regions. S. Barrios and E. Strobl conducted a study the aim of which was an empirical test of the above mentioned dependency. Basing on regional data available in the European countries and applying the procedures of semiparametric estimation they proved the significant dependency between the GDP *per capita* and the level of income inequality. Their results were resistant to changes in the observed period and in the set of studied administration units as well as to the introduction of diversified determinants of regional inequalities into the model⁴.

Apart from analysing the relationship between the income inequality level and the economic growth rate it seems crucial to take into consideration the impact of this inequality on national prosperity. For instance, S.M. Kot claims that the less significant is the inequality in income distribution, the higher are the welfare function values⁵. Also, he compares the

growth levels and productivity in Polish provinces with income inequality and welfare levels. He points out that his results prove the relation between the GDP *per capita* and Gini coefficient that is opposite to the one suggested by S.Kuznets⁶.

But in the literature dealing with economic growth we can find not only the opinions about negative impact of income inequality on the economic growth⁷. Some researchers claim that this relation is very weak or even insignificant. For example R. Barro says that the research carried out in a large group of countries indicated the insignificant dependency between income inequality and the rates of growth and investment⁸. G. Woźniak emphasises the positive effect of such inequality saying: 'Inequality in income distribution can become a stimulus to business activity and to the economic growth if they make national savings grow'. At the same time, however, G. Woźniak believes that too much inequality leads to decreased entrepreneurship, creates demand barriers, deepens poverty and causes the rise in social tension⁹. The opinions stressing the positive dimension of income inequality were also expressed by S. Kot who mentioned Okun's law according to which the decrease in inequality is associated with the drop in cost-effectiveness¹⁰, or by R. Koch who claimed that the variability of things leads to more diversity, improves adaptation and development¹¹. Also H. Leibenstein in *A Theory of Economic-Demographic Development* points out that the rise in an average income is accompanied by a regular increase in income inequality (in this case we observe right-side asymmetric distribution of this characteristic), which results in more investment and stimulates the economic growth. It is possible due to the fact that people who earn more tend to save and invest more while less money is allocated to people with low income, which leads to a lower population growth rate¹².

The authors who indicated diversified influence of income inequality on the economic growth rate include P. Kumor and J. J. Sztudynger. They studied a growth model featuring an income inequality measure making an assumption that there was a certain level of income inequality (their results indicated the value of Lorenz concentration index close to 28-29 %) where the GDP growth rate was the highest. They also formed a hypothesis of a non-linear (parabolic) relation between the rate of productivity growth and the diversification of incomes and then proved that until reaching a certain point of income inequality the productivity grows increasingly slower to start falling increasingly faster after having reached this point (Kumor, Sztudynger, 2007, s.48).

2. Processes of Real Divergence in Regional Development

The phenomenon of income divergence can be assessed in the context of similarities in the levels or rates of income growth (products) *per capita* in different economies or regionally. In the latter case it is the real convergence in a given country that is analysed most often. The existing theories of regional development do not provide a basis allowing to decide if a hypothesis about income convergence among regions is justified. According to the neoclassical theory the workforce from less developed regions migrates to the better developed ones because of a higher supply of jobs, while the capital moves in the opposite direction due to lower production costs. It results in the rise in salaries and the fall in unemployment rates as well as in the levelling out of incomes in the regions. On the other hand the *cumulative causation theory* states that income discrepancies in regions tend to grow regularly due to imperfect mobility of workforce and capital and to the fact that the developed markets are more attractive¹³. A high level of salaries, which additionally determines higher production costs in the well-off regions, is in this case neutralised by technological innovation and higher rise in production factor productivity.

In the early 1980 the Western Europe observed the significant slowing down of regional income convergence process although the real convergence rate on the national scale still took place¹⁴. It is believed that one of the reasons of such situation was the influence of funds allocated by the European Union which usually make infrastructure in particular regions differentiated¹⁵. It also seems that workforce migration to the regions with higher personal incomes, the regional differences in technology absorption rates and different potential to build technologically advanced sectors played an important role here¹⁶.

The analysis of regional income inequality and the real convergence in Poland was carried out in 1999 by P. Kliber, P. Maćkowiak and K. Malaga. The authors used Solow-Swan and Mankiw-Romer-Weil models to calculate the difference between the rate of convergence of the GDP per an employed person to the state of balance and the rate of convergence resulting from the half convergence period. On the basis of the obtained results they concluded that the rate of convergence of growth paths to the constant balance in the better-off provinces was slower than in the poorer ones¹⁷. It is worth pointing out, however, that both the mode of research and the obtained results suggest that there is a clear division of the Polish provinces into two groups as far as their productivity is concerned, which implies at least two convergence clubs and the regional income polarisation.

In his work dealing with the above issues M. Próchniak says that ‘It is rather difficult to accept the thesis, at least until it has not been empirically verified, that the differences among the regions are smaller than those among the countries’. At the same time he points out the absence of absolute β convergence in Polish provinces¹⁸.

3. International Real Convergence – the Reality or the Utopia?

The European studies on the income convergence have not provided so far any clear proof that the tendency to reduce income inequalities among the European countries does exist. W. Nowak claims: ‘The hypothesis of the convergence understood as levelling out the GDP *per capita* in different economies has both its followers and outright opponents, but also the followers of this hypothesis do not agree as for its reasons, interpretation or the ways of empirical verification’ and ‘the results of empirical research into the convergence of economies are differentiated and depend largely on the choice of the countries to be tested, the analysed period or the applied methods’¹⁹.

Table 1 presents data illustrating the development of the European Union countries in 1993 and 2006. The development has been measured by means of the GDP *per capita* expressed in constant prices of 2007.

Table 1. Real GDP *per capita* in the European Union countries in 1993 and 2006 (USD 2007, EKS PPP 2005)

Country	Level 1993	EU = 100 1993	Level 2006	EU = 100 2006
Austria	28 564	133	37 391	130
Belgium	26 799	125	34 887	121
Bulgaria	6 951	32	10 957	38
Cyprus	16 612	77	26 005	90
Czech Republic	15 147	71	22 642	79
Denmark	27 724	129	36 580	127
Estonia	7 730	36	19 927	69
Finland	21 661	101	33 915	118
France	26 226	122	32 499	113
Greece	18 885	88	29 210	102
Spain	20 840	97	29 087	101
Holland	28 334	132	37 171	129
Ireland	19 662	92	43 458	151
Lithuania	7 975	37	15 304	53
Luxemburg	51 356	239	75 414	262
Latvia	6 332	30	15 809	55
Malta	17 487	82	22 440	78
Germany	27 322	127	32 997	115
Poland	8 337	39	15 022	52
Portugal	16 715	78	21 260	74
Romania	6 833	32	10 348	36

Slovakia	10 190	48	17 993	63
Slovenia	14 583	68	24 920	87
Sweden	24 501	114	35 299	123
Hungary	11 179	52	18 879	66
Great Britain	24 281	113	33 878	118
Italy	25 227	118	30 120	105
EU-27	21 447	100	28 761	100

Source: own calculations on the basis of the data by The Conference Board and Groningen Growth and Development Centre, Total Economy Database, January 2008.

The analysis of the relation of this measure to its 2006 values proves that as far their growth is concerned individual countries have maintained their positions (see Figure 1)²⁰.

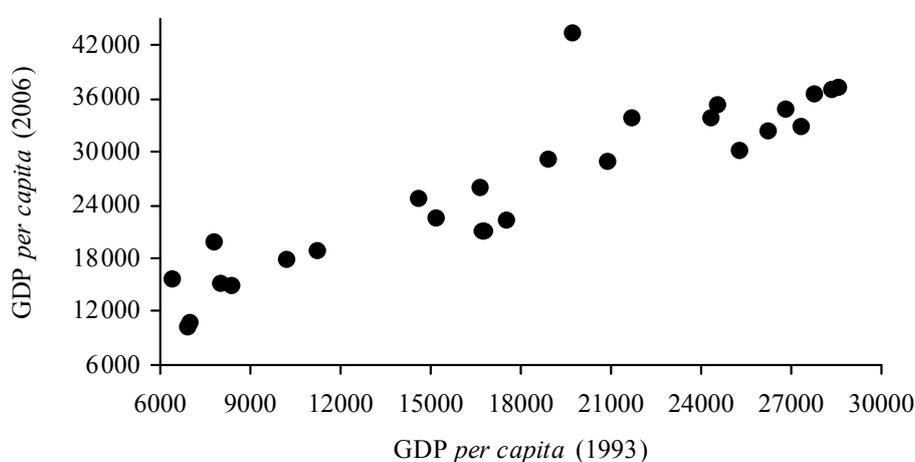


Fig. 1. A correlation chart of initial and final *GDP per capita* levels in the European Union countries

Source: own study based on Table 1.

This regularity is well illustrated by the results of the estimation of the linear model of the relationships among the *GDP per capita* levels in the compared years:

$$GDP_{2006} = 7395.70 + 1.064 \cdot GDP_{1993}, \quad R^2 = 0.81; \quad F = 109.22 \quad (1)$$

(1983,10) (0.102)

Such a conclusion would be an oversimplification, though. In the compared period we observed the levelling out of the *GDP per capita* values between the ‘old’ member countries and the new EU members. The average *GDP per person* increased in the former group from 112.1% to 116.2% (UE = 100%), while in the latter it rose from 50.3% to 63.8% in the UE-12 countries (including Bulgaria and Romania) and from 54.0% to 69.2% in the UE-10 countries.

The hypothesis that the income convergence has been taking place in the European Union in the last several years has been proved in Batóg, Batóg (2007). Their results indicate the reduction of income inequality in the European Union countries, in terms of both the absolute β convergence and the σ -type convergence.

4. Innovation Processes and the Economic Growth

In the long term the world's economic growth rate depends on the rate of innovation processes undergoing in the countries that are the technological leaders. Those countries where technology is less advanced can copy new solutions and thus catch up with the better developed areas. Such process is for them more cost-effective than investing in their own research and development activities. The answer to the question if the existing development discrepancies decrease, stay at the same level or grow depends largely on the rate at which the adapted innovation is distributed²¹. The course of diffusion of new information and communication technology across individual sectors of the economy is first of all the function of: the size of the ICT sector, its share in the GDP and in the investments in a national economy, the direct costs and the security level of the new solutions as well as the amount of competition – along with the competition among companies getting stronger their eagerness to apply innovative solutions grows as well. T. Mukoyama also emphasises the fact that an important factor affecting the innovation adaptation rate is how professional skills are distributed within an individual economy²².

Macroeconomic analyses of the ICT sector impact on the economy as a whole lead to the conclusion that the investment in modern technologies results in the GDP *per capita* growth by 0.3 to 0.8 of the percentage point²³. Figure 2 shows a regularity typical of the European Union (excluding Cyprus, Luxemburg and Malta), i.e. a positive relationship between the expenditure on the ICT sector and the GDP dynamics in 2004-2006. At the same time it is worth pointing out that it was those countries that enjoyed the fastest economic growth – Estonia and Latvia – who invested most in the advanced technology.

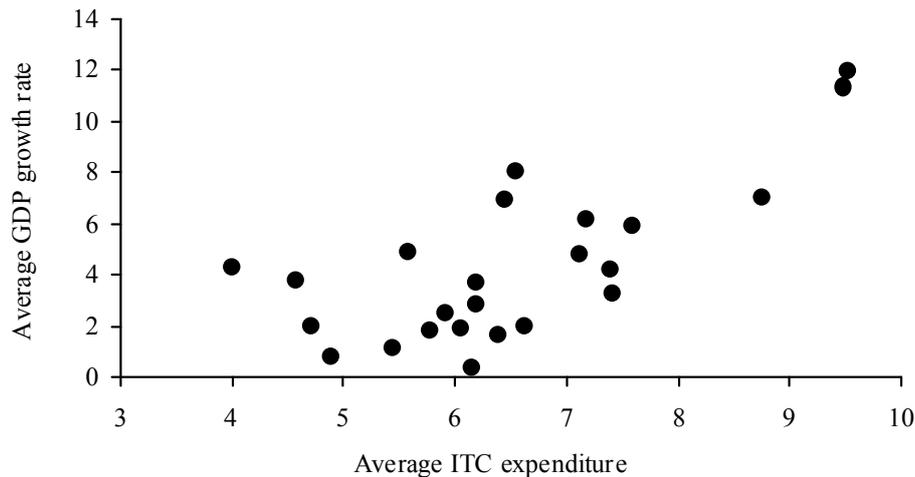


Fig. 2. A correlation chart of average spendings on ICT (% GDP) and the average GDP growth rate in the years of 2004-2006

Source: own study based on the data by the Eurostat and The Conference Board and Groningen Growth and Development Centre, Total Economy Database, January 2008.

Interesting conclusions can be drawn from the analysis of the relationship between the effects of innovation and the dynamics and level of the gross domestic product in the examined countries. On the one hand the countries with a higher number of patents observe a slower rate of the GDP growth in comparison with those countries where R&D is less advanced (see Figure 3), which proves that the countries that imitate the innovation leaders adopt new technologies very quickly.

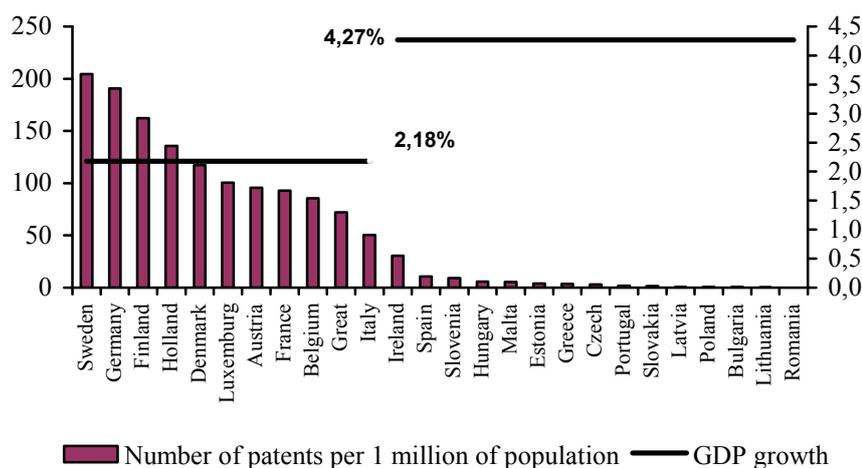


Fig. 3. An average GDP growth rate in 1996-2005 and the number of patents per 1 million of population in 1996 – without Cyprus

Source: own study based on the data by the Eurostat and The Conference Board and Groningen Growth and Development Centre, Total Economy Database, January 2008.

On the other hand, however, there is a distinct disproportion in the innovation potential between the old and the new EU members which is linked to the development level those countries have reached. In the highly developed countries with high GDP *per capita* the number of patents in relation to population is also high. Statistical data prove a strong positive dependence of a non-linear character between these variables (see Figure 4).

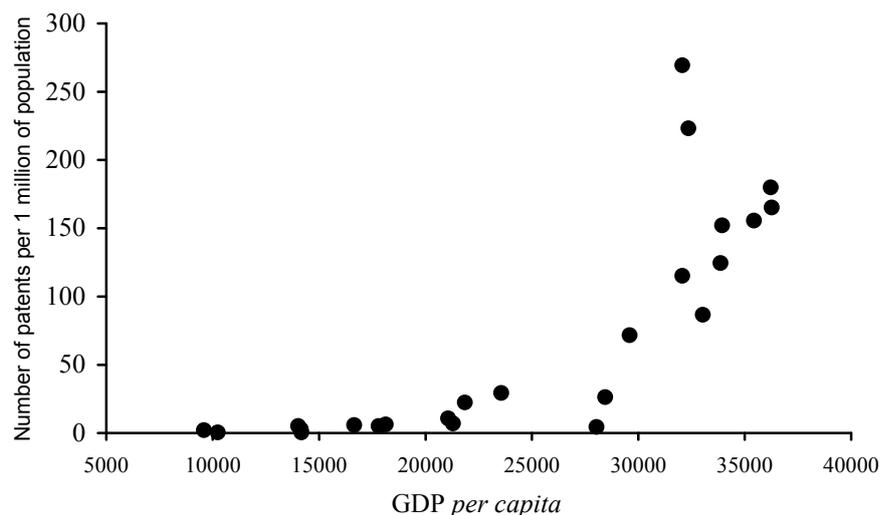


Fig. 4. A correlation chart of the GDP *per capita* level and the number of patents per 1 million of population in 2005 (without Cyprus, Luxemburg and Ireland)

Source: own study based on the data by the Eurostat and The Conference Board and Groningen Growth and Development Centre, Total Economy Database, January 2008.

According to the results of the econometric model estimation that illustrates the above dependency, in 2005 in the EU countries the 1% rise in the number of patents per 1 million of population induced the growth of the GDP *per capita* by 0.194%:

$$\ln PKB_{2005} = 9.455 + 0.194 \cdot Patents_{2005}, \quad R^2 = 0.82; F = 107.05 \quad (2)$$

(0.067) (0.019)

It also seems justified to say that in the European Union we can observe strong and stable innovation-related polarisation into two significantly different groups of countries. The first includes technological leaders represented above all by Germany, Finland, Luxemburg, Austria, the Netherlands, Sweden and Denmark. The second one consists of the countries of low R&D potential who will remain technological imitators for the years to come. The latter group includes all the Central and Eastern European countries and Greece.

Conclusions

On the basis of the presented considerations it can be concluded that there are visible tendencies that are typical of the economic growth European Union countries in the last decades. It is clear that these countries are divided into two groups as far as their research and development activity is concerned. This phenomenon has been proved by the 1996 and 2005 analysis of innovation intensity measured with the number of patents per 1 million of population. The results of this analysis indicate a very stable polarisation in the relation to the above mentioned variable. At the same time it should be noticed that a very low level of innovation activity in the new member countries does not mean that their economies are also technologically lagging. On the contrary, they take advantage of the opportunities to buy or transfer new technologies which often arise along with the flow of direct foreign investments. Such an approach enables them to reduce costs of technological advancement, which in turn contributes to accelerating their economic growth and income convergence resulting from the levelling out of the GDP per person among the EU countries.

Unfortunately the real convergence occurring on the international scale is not accompanied by the processes of narrowing income gaps among regions. This aim seems impossible to be achieved despite a long term and often very costly European Union's policy whose objective was to reach a high level of regional cohesion. It also seems that within the next several decades we will be observing at the very most stable income divergence among the European regions. The reduction of this inequality is hindered both by the current international situation and by increasingly more limited capacity to support such efforts from the European Union budget.

It still remains controversial what is the character of the influence on the economic growth dynamics of the significant income inequality not only among individual regions but also among the citizens of an individual country. The existing economic theories as well as the economic practise create an opinion that the shape of these relationships depends mainly on the economic development level in a given country.

Notes

¹ Woźniak (2004), p.57.

² Grossmann (2001), p.33.

- ³ Ibidem, p.33.
- ⁴ Barrios, Strobl (2005).
- ⁵ Kot (2000), p.103.
- ⁶ Ibidem, p.144 and further.
- ⁷ A choice of related articles can be found in e.g. Benabou (1996). See also Aghion, Caroli, García-Peñalosa, (1999), pp.1615-1660; Persson, Tabellini (1994), pp.600-621).
- ⁸ Barro (2000), pp.5-32.
- ⁹ Woźniak (2004), pp.85-88.
- ¹⁰ Kot (2004), p.237.
- ¹¹ Koch (2002), pp.19-21.
- ¹² Leibenstein (1954), p.94.
- ¹³ Similar conclusions about regional divergence of growth processes are to be found in the location theory pointing out the significance of such factors as transport availability or optimal sale market areas as well as in the growth poles theory assuming the importance of trade, of the potential of individual regions and of the effects of gravitation and agglomeration. See Gawlikowska-Hueckel (2002), p.91.
- ¹⁴ See e.g. Rokicki (2004), pp.715-725.
- ¹⁵ See Dall'erba, Hewings (2003).
- ¹⁶ See Niebuhr, Schlitte (2004), pp.167-176.
- ¹⁷ See Kliber, Maćkowiak, Malaga (2005), p.200.
- ¹⁸ See Próchniak (2004), pp.27-33.
- ¹⁹ Nowak (2007), pp.86-92.
- ²⁰ For the sake of transparency in Figure 1 an observation concerning Luxemburg has been omitted.
- ²¹ See Batóg, Batóg (2008).
- ²² Institutional factors also play an important role. See Scarpetta, Tressel (2002). See also Mukoyama (2004).
- ²³ Compare research results presented in the article by Pilat, Lee (2001) and Truskolaski (2004).

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