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Timo Wochner, Dr. Arne Holzhausen

Convergence of European regions:

Does the narrative of the ever-widening rural-urban divide hold?

Allianz

Working Paper

No. 215

Convergence of European regions? An assessment in times of increasing rural exodus

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AUTHORS:

Timo Wochner
Phone +49.893.800.62147
Timo.Wochner@allianz.com

Dr. Arne Holzhausen
Phone +49. 893.800.17947
Arne.Holzhausen@allianz.com

Summary

- Regional inequality in Europe is a matter of fact and our data displays vast economic gaps between European regions with wide-ranging differences in economic indicators. Nonetheless, economic convergence is taking place, at least on a national scale. But the catch-up often goes hand in hand with growing internal divergence: National convergence is mainly driven by "champion regions" i.e. urban areas, outperforming other national regions.

- At the regional level, the picture is also quite encouraging. Rural areas catch up relatively, displaying the highest growth rates – albeit not fast enough to close the gap to urban regions in absolute terms. As a consequence, overall disparities are increasing, as measured by the Coefficient of Variation. But this is mainly due to the outstanding performance of a handful "super-champion" regions in Europe; overall regions seem to converge: The poorest regions move closer to the average and the number of regions in the middle of the income distribution increases.

- Our "European" Lorenzcurve, Gini coefficients as well as an assessment of the amount of income concentration display improvements for the poorest regions over time. Concentration, for example, increases for the poorest 10% decile. (Internal) migration patterns serve as a possible explanation for such a balancing mechanism.

- The case study for Germany shows overall convergence, the opposite holds true for the UK. Most rural regions in Germany managed to improve their relative position, which is also shown by decreasing sigma and GINI coefficients. The divergence pattern for the UK – driven by large urban outliers – is reflected in an increase in our inequality measurements over time. Hence, rural areas in the UK did not manage to hold up with the pace of growth in urban regions.

- Our results allow for cautious optimism. Rural and poor regions have fared better than expected over the last two decades. Overall, they are not falling further behind. The popular narrative that all rural areas are losing in the race of economic development is too simple; it neglects the multilayered aspects of the topic, not least the role of internal migration to equalize regional disparities.

1. Introduction

In the recent European election, populist political parties managed to increase the number of parliamentarians, whereas parties of the political centre, conservatives and social democrats, lost seats. Especially the voting results in Italy and in France with the right-wing populist parties Lega and Rassemblement National winning the national election fuel fears of a turn away from the idea of an economic and political union in Europe.

In this context, the question of European economic convergence is an important topic in the public debate. Cohesion is directly stated as a key target of policies in the treaty that established the European Community. The European Structural Funds amongst others is one of the leading players in achieving the EU Cohesion Policy goals, which are to promote economic, but also social progress (Goecke & Hüther, 2016). Closely related to this topic are growing concerns about rural exodus and the resulting impact on regional economic development. The European Community tackles this issue in Article 158, stating that it “aims to reduce the disparities between the levels of development of the different regions and the backwardness of the least favored regions or islands, including rural areas”.

Nonetheless, in the recent past we have observed troubling events and conflicts (such as the Brexit and the Yellow vest movement in France) throughout Europe that are often explained and fueled by an urban-rural divide. People feel left behind and excluded from the beneficial effects of globalization. Populist parties use these arguments to attack the European Union as well as established national governments. With our research we try to shed some light on the winner and loser regions in terms of GDP per capita (p.c.) since the introduction of the Euro as a common currency.

A lot of work has been done on assessing general diverging/converging economic and societal trends in the European Union (e.g. recent publications by Alcidi, 2019; Butkus et al, 2018). The named authors mainly concentrated on comparisons of developments of old and new member states, as well as the divide between Central, Eastern and Southern countries. Our research focuses on an urban-rural typology to approach the following questions: Do we observe regions in the EU converge towards their average over time? Are rural regions really losing in the race of economic development?

Economic literature is split on the topic of convergence: On the one hand, the long-term Solow growth model predicts convergence to happen due to free movement of capital. Since capital is redistributed towards higher returns, which are diminishing on the level of accumulation of capital, initially poorer countries should exhibit higher growth levels (Solow, 1956). On the other hand, research on economic integration predicts that agglomeration effects of production (and hence income) should take place, which opens up the possibility for within-state income divergence (Alcidi et al, 2018).

The paper is organized as follows: The next section presents our data and gives an introduction to our urban-rural typology. A first descriptive analysis is undertaken in Section 3, followed by the calculation of beta convergence measurements in Section 4. The UK and Germany were taken as two more in-depth case studies in Section 5, while we tackle the aspect of production concentration and distributional effects in Section 6. The last section then concludes and discusses our findings.

2. Data

For our analysis, we use regional data on GDP per capita from Eurostat. All our data is expressed in the common currency unit PPS (Purchasing Power Standard) to adjust for price level differences between countries by using Purchasing Power Parities. The advantage of this data is the precise subdivision of regions. Namely, the data is available at the NUTS-3 (Nomenclature of Territorial Units for Statistics) level, which is the smallest geographical subdivision for statistical purposes. More important, the NUTS statistics are used by the European Union for their Structural Fund delivery mechanism (Becker et al, 2010). In total there are 1,348 regions at NUTS 3 level. Since only 24 countries[1] consistently provided data in the timespan 2000 to 2017, we limit our analysis to those and are left with 1,078 regions in total. We use a linear forecast model to gain estimates for the year 2018 to enable assessments at the end point. Our results are, however, insensitive to using 2017 as the most current data. The data set provides accurate information on GDP and population levels in each region and is hence very suitable for assessing converging processes within the European Union.

[1] The following countries are included in our analysis: Romania, Northern Macedonia, Bulgaria, Latvia, Estonia, Croatia, Slovakia, Hungary, Czech Republic, Slovenia, Malta, Portugal, Greece, Cyprus, Spain, United Kingdom, Finland, Italy, Germany, Denmark, Sweden, Austria, Ireland, Luxembourg.

We make use of a consistent urban-rural typology by Eurostat, which is applied to the NUTS 3 level regions. The classification differentiates between predominantly rural regions, intermediate regions and predominantly urban regions. Since the classification is based on 1 km² population grid cells, it avoids distortions that occur in administrative data for local administrative units (such as municipalities), as they vary in size (Eurostat, 2018). Predominantly urban regions, are regions where more than 80 % of the population live in urban clusters. Regions, are considered to be intermediate, when more than 50 % and up to 80 % of the population live in urban clusters and in predominantly rural regions at least 50 % of the population live in rural grid cells. A visualization of all classified regions can be found in the Appendix. In our dataset, we observe 299 urban, 451 intermediate and 328 rural regions.

Combining the urban-rural indicator to our GDP data, we are able to perform distinguished evaluations of economic developments in order to answer the question if the narrative of the ever-widening rural-urban divide holds.

3. Descriptive Analysis

In 2000, our regions used cover a population of 357.8 million people. This figure increased by 18.6 million to 376.4 inhabitants by 2018. At the same time, Europe became more “urban” in terms of population: the share of population living in urban areas increased from 44.18 % to 46.42 %, which corresponds to an absolute increase of 16.6 million people (from 158.1 to 174.7 million). The share of rural population decreased during the same timespan from 18.16 % to 16.52 % (-2.7 million; from 64.9 to 62.2 million people). Comparative figures from the European Commission place the share of European population living in urban areas at almost three quarters (Kotzeva & Brandmüller, 2016). This is however due to the fact, that they only distinguish between rural and urban regions and thus use a different typology.

The following histograms of regions display vast economic gaps, but also show a positive trend for regions at the lower bottom of the GDP distribution. Since the decision on the number of bins is rather arbitrary and the data is smooth, a kernel density estimator (represented by the green line) is used to get an estimate for a smooth function.

Figure 1 GDP p.c. levels in the EU, year 2000

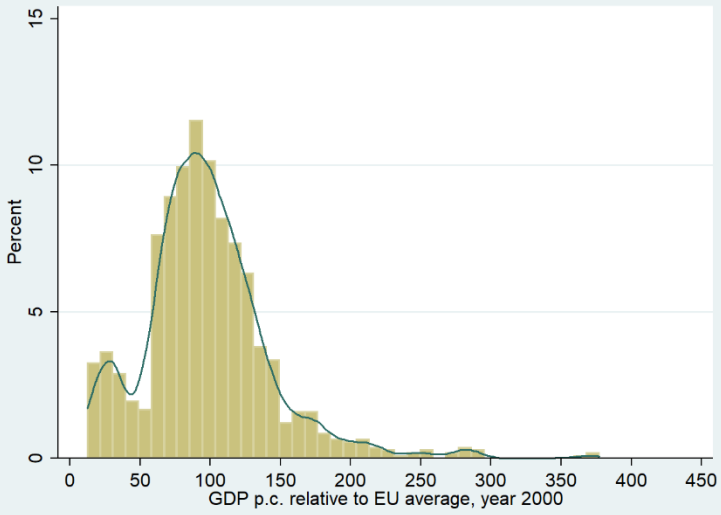
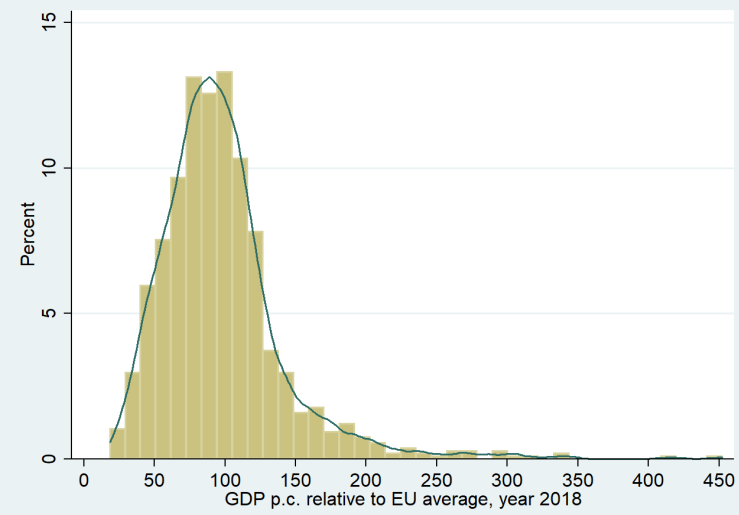


Figure 2 GDP p.c. levels in the EU, year 2018



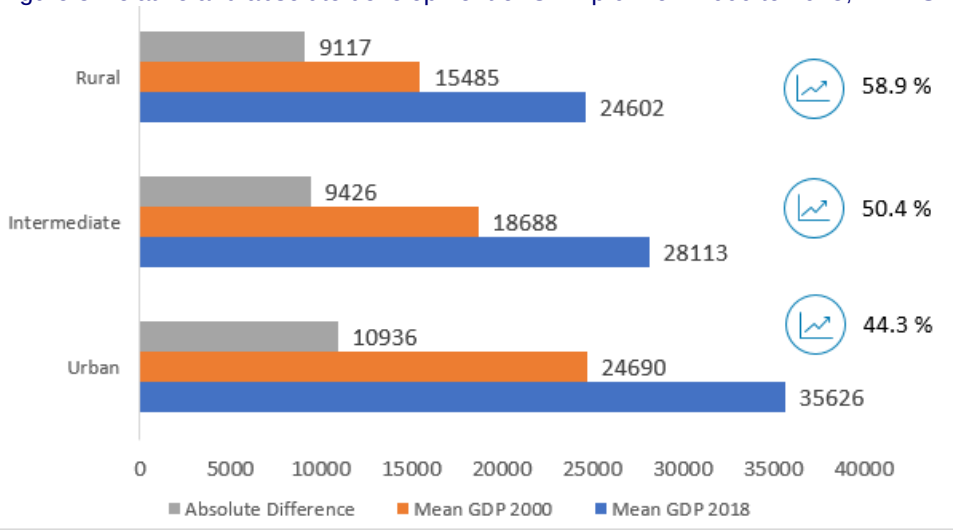
In 2000, the five poorest regions only had 12.3% to 15.4% of the average GDP p.c. – these numbers went up to a range of 18.3% to 25.4% by 2018.[2] One indicator that the distribution is more balanced is that the number of regions that are located in the 80-120% interval increased from 462 to 502. However, we also observe that the five richest regions in 2000 gained even more until 2018 relative to the EU average.[3] Their GDP p.c. levels increased from 375-1,099 % to 415-1,406% of the EU average. That the number of regions that dramatically outperform the EU average is nonetheless falling can be seen by the decline in 7 regions (from 101 to 94 regions) that have GDP p.c. levels of 150% or more compared to the average. It appears to be the case that in the upper distribution, there are a handful of "champion" regions that show outstanding economic performance, but overall the regions seem to converge at first glance.

While in 2000 eight of the ten poorest regions are classified as rural, this figure changed dramatically in 2018, where only three of the ten poorest regions have the status of a rural area. Additionally, we see that although not surprisingly no rural area is among the ten richest regions in both time points, the number of intermediate regions in that top ten list increased from one region in 2000 to four regions in 2018.

[2] A tabular register of the five poorest and richest regions in 2000 and 2018 is displayed in the Appendix.
[3] Both histograms omit the regions „Westminster" and "Camden & City of London" (both UK) as those high outlier values distort the graphs.

So the question arises if these observations can be seen in relation to a bigger pattern of rural areas improving their economic conditions. Looking at the absolute changes of GDP p.c. levels distinguished by the three classifications, gives first insights to the answer of this question.

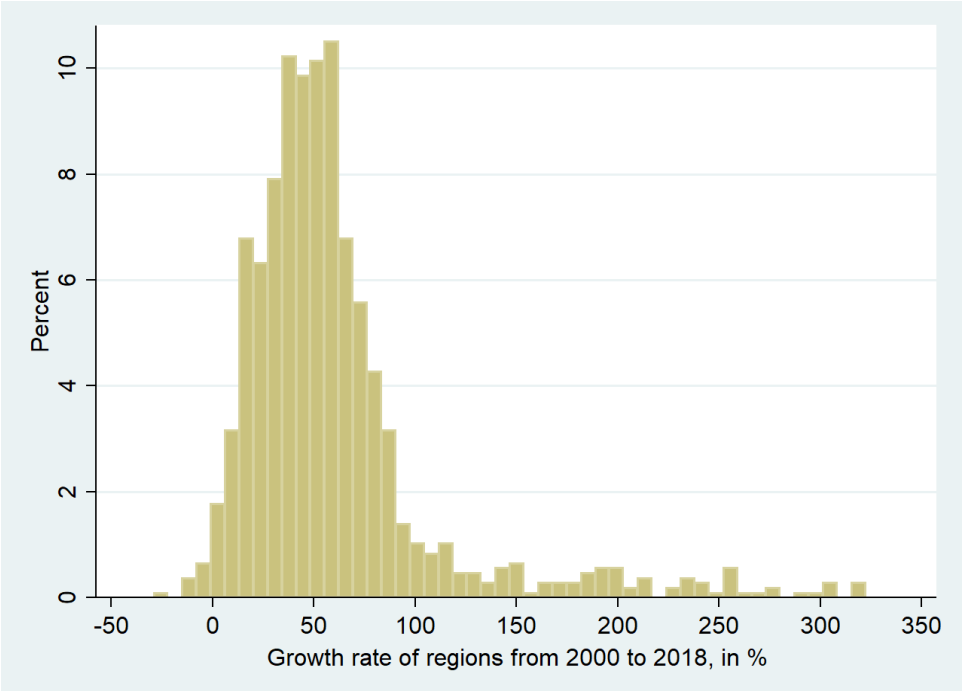
Figure 3 Relative and absolute development of GDP p.c. from 2000 to 2018, in PPS



The graph reveals an interesting fact: Although urban areas have significant higher absolute GDP p.c. levels at both points in time compared to intermediate and rural areas, the absolute growth of GDP p.c. levels shows no large variation between urban, rural and intermediate regions. On average, urban areas increased their GDP p.c. levels by 10,936 PPS units, while rural areas show an increase of 9,117 PPS units. Although an absolute difference of 1,819 PPS units p.c. exists, the picture changes when we look at relative changes. The average growth rate of GDP p.c. levels from 2000 to 2018 is displayed in the respective boxes next to the graph. They show that on a descriptive level, rural areas seem on average to catch up in relative terms. While urban areas “only” grew by a bit more than 44%, rural areas exhibited a 14.6 percent point higher growth rate of 58.9% since 2000.

However, large gaps between those regions exist, as the growth rates of regions range from a negative value of -29% (Thesprotia in Greece) to a maximum value of +322% (Giurgiu in Romania). The following histogram exemplifies the differences in growth rates across European regions:

Figure **4** Growth rates of NUTS-3 regions



The financial crisis continues to show long-lasting impact. In total, 14 regions exhibit a decline of GDP p.c. levels over time, eight of them located in Greece. Even more worrying, five of the remaining six regions are located in Italy, where high debt levels and structural problems seem to slow down economic development. As researchers note, the financial crisis has also a strong impact on the pace of convergence, which we will turn to next (Diermeier et al, 2018; Dolls et al, 2018).

4. Economic Convergence

4.1 Beta convergence

Research by Barro and Sala-i-Martin (1992) and with Mankiw et al. (1992) was the first that made the concept of convergence measures widely known. “Beta convergence” represents a negative partial correlation between the initial GDP level and the growth in income over time. This is equivalent to saying that poorer countries grow faster than rich ones and thus catch up over times in economic terms. Beta convergence can also be classified as an absolute and a conditional concept: Absolute beta-convergence implies that all countries converge towards the same steady-state, while conditional beta-convergence allows for different long-run levels of income. Those different steady-states depend on specific features such as endowments or institutions, which vary across economies.

Formally, the computation of beta convergence follows the approach of Sala-i-Martin (1996):

$$Y_{i,t,t+T} = a + \beta \cdot logY_{i,t} + e_{it};\ where\ Y_{i,t,t+T} = \frac{log(Y_{i,t+T})/(Y_{i,t})}{T} \qquad (1)$$

In our set-up, we use the Compound Annual Growth Rate (CAGR) since it provides a more accurate economic measurement for an average growth rate.

Figure 5 Beta convergence on a national level

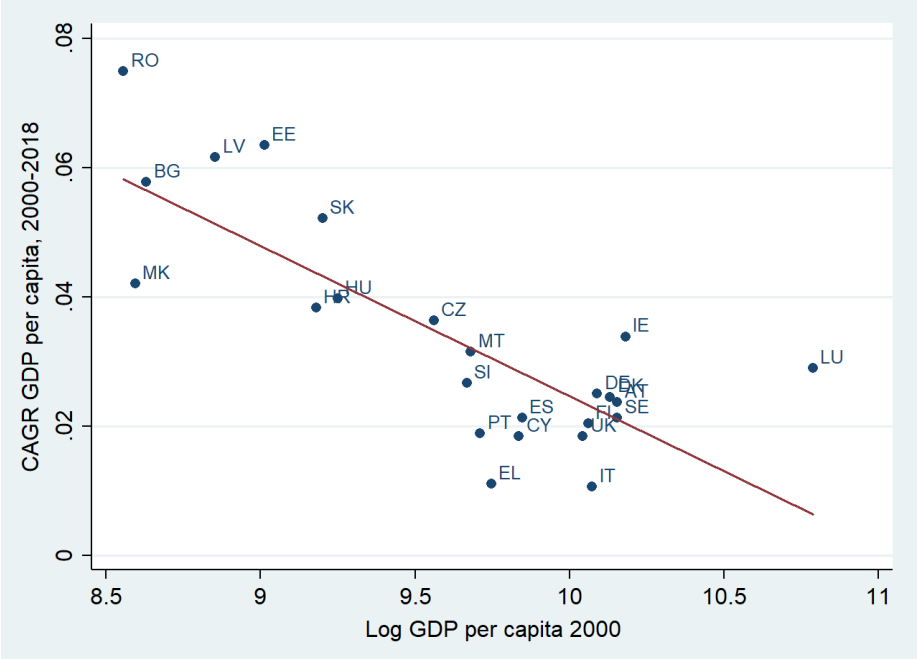
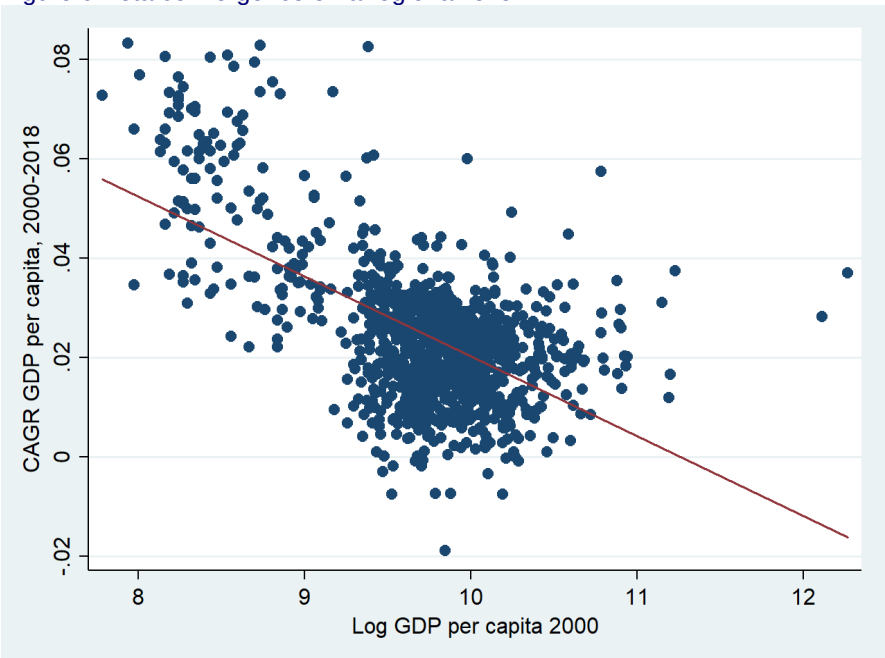


Figure 5 contrasts the initial level of GDP in 2000 with the Compound Annual Growth Rate (CAGR).[4] Thus, a clear convergence trend can get detected: Countries with initial lower GDP p.c. levels show significantly higher annual growth rates. This is represented by the downward sloping line in the graph. Figure 6 repeats this analysis but uses the regional data (NUTS-3):

Figure 6 Beta convergence on a regional level



Again, we find a significant downsloping line, which confirms that over the timespan 2000 to 2018, we observe countries as well as regions converge. Borsi & Metiu (2015) amongst others perform a long-term assessment of income convergence. They find that convergence depends on so called convergence clubs, which motivated us to seperate the assessment by the three urban-rural types.

[4] The regression outputs can be found in the Appendix.

Figure 7 Beta convergence for urban regions

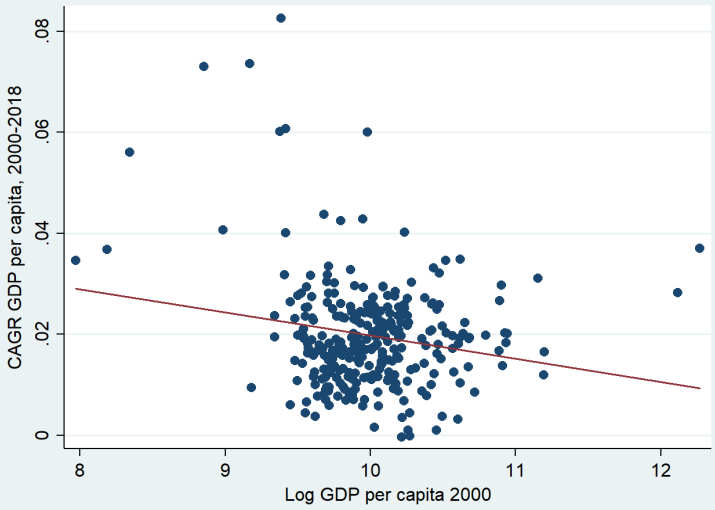


Figure 8 Beta convergence for intermediate regions

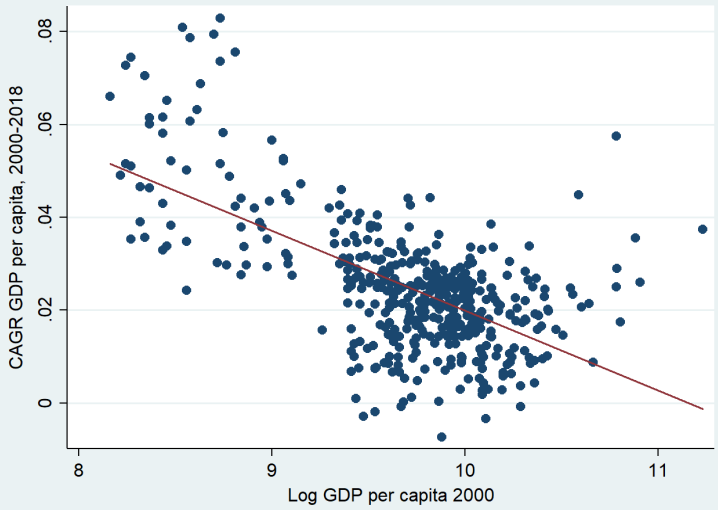
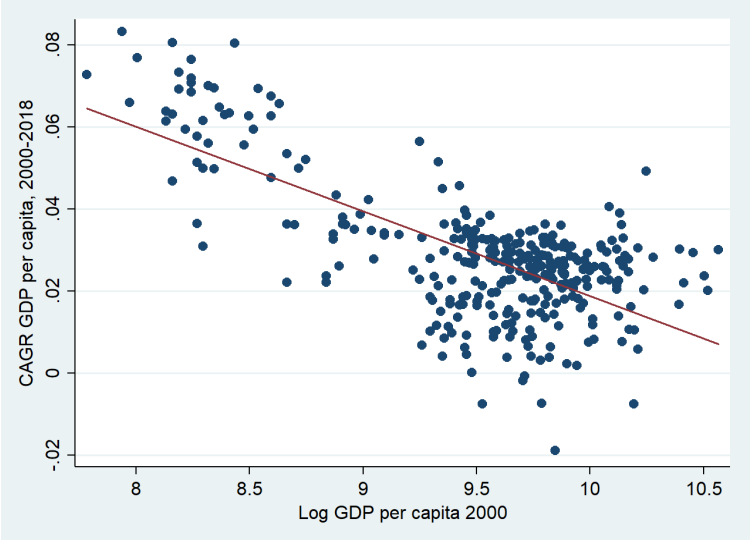


Figure 9 Beta convergence for rural regions



A display of the convergence distinguished by urban, rural and intermediate regions (Fig 7-9) reveals, which types of regions experience stronger convergence processes. While we see a perfect downward sloping line for rural areas (as well as for intermediate regions), the regression line for urban areas exhibits a significantly smaller slope. This is further supported by the smaller R^2 of the regression, which states that for rural areas roughly 48% of the variation in annual growth rates can be explained by initial GDP levels compared to only 4% for urban areas.

Although it is important to note, that this does not have any implications for the absolute difference between rural and urban areas, it shows that rural areas across Europe strongly converge while urban areas do not show such a strong pattern. One explanation could be the “middle-income trap”, which states that due

to sectoral reallocation of labor and increased wages, further economic growth requires a shift to more innovative production. Since urban areas often experience an increase in economic growth due to labor accumulation at first, a further shift is often challenging and leads to a slower pace of convergence (Żuk & Savelin, 2018). The possible impact of inequality within one state is discussed in the next section, while the driving regions of the convergence process are identified in section 4.3.

4.2 Internal convergence dynamics

Investigating the convergence process across regions in a selected country, answers the questions if countries also converge internally. Figures 10 and 11 for Bulgaria and Romania exemplify a trend that especially holds for the new member states located in Eastern Europe: they show an internal divergence rather than convergence pattern. This is represented by an upward-sloping line in the graphs. Quite evidently, the capital cities Sofia and Bucharest are large outliers. Although they had already high initial levels of GDP per capita, they outgrew most of the other regions in the respective countries.

Figure 10 Internal divergence, Bulgaria

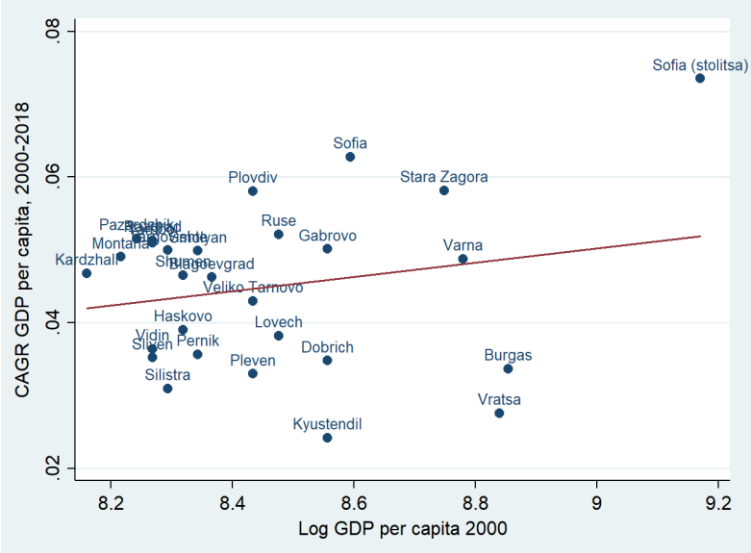
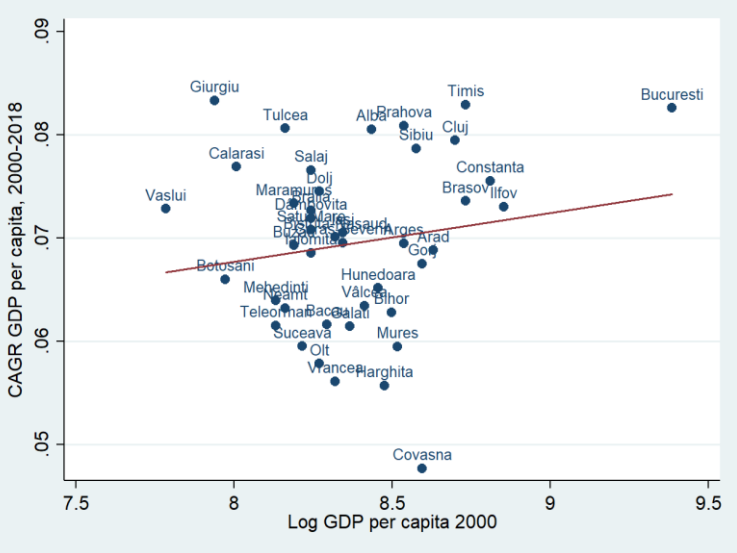


Figure 11 Internal divergence, Romania



This indicates that the overall national convergence process is driven by a “champion region” (which are often capital cities) that outperforms other regions. The performance of this champion region drives the national average, while other regions in the country are unable to keep up the pace. This internal dynamic of a diverging pattern is mainly true for Central and Eastern European countries.

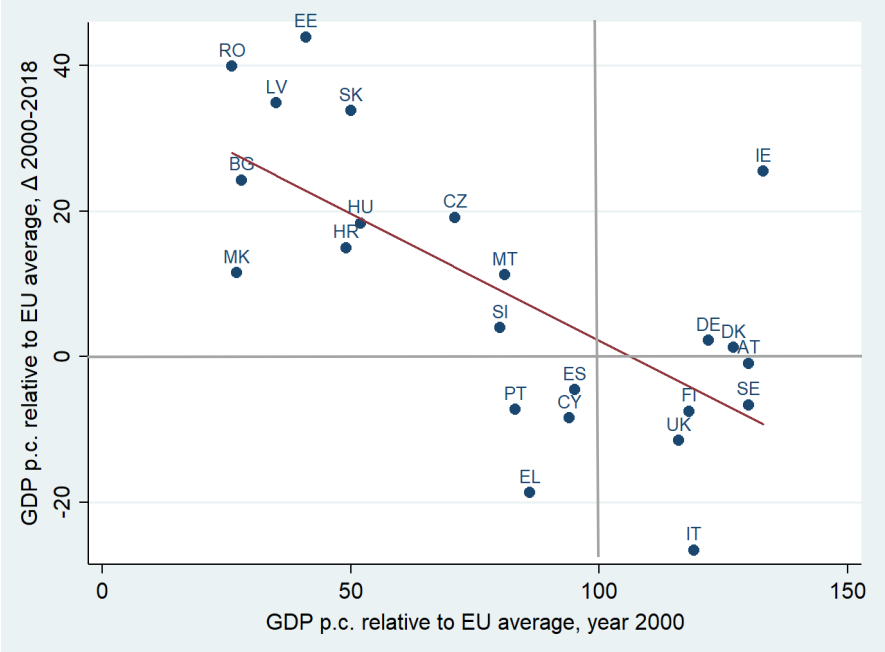
As other researchers also mentioned, it is noteworthy, that nearly all countries that show internal divergence are not members of the Eurozone, while many old EU member states seem to have slowed down, but are characterized by an internal converging process (Alcidi, 2018b).

These findings leaves us with the question which type of areas are dominantly responsible for the overall economic convergence process.

4.3 Driving regions of convergence

To identify the countries that caught up over time, we express GDP p.c. levels relative to the EU average in 2000 and compare that with the percentage point change of the relative GDP p.c. level in 2018 (Fig. 12). Thus, the y-axis shows the countries' change of its relative position.

Figure 12 Beta convergence relative to EU average



The top-left-corner (above zero on the y-axis, but below hundred on the x-axis) contains all countries that caught up since 2000.[5] Over the whole timespan Italy was the country that lost the most in terms of its relative position – even exceeding Greece by nearly five percentage points. Although still well below the EU average, Romania and Estonia improved their relative position by 39

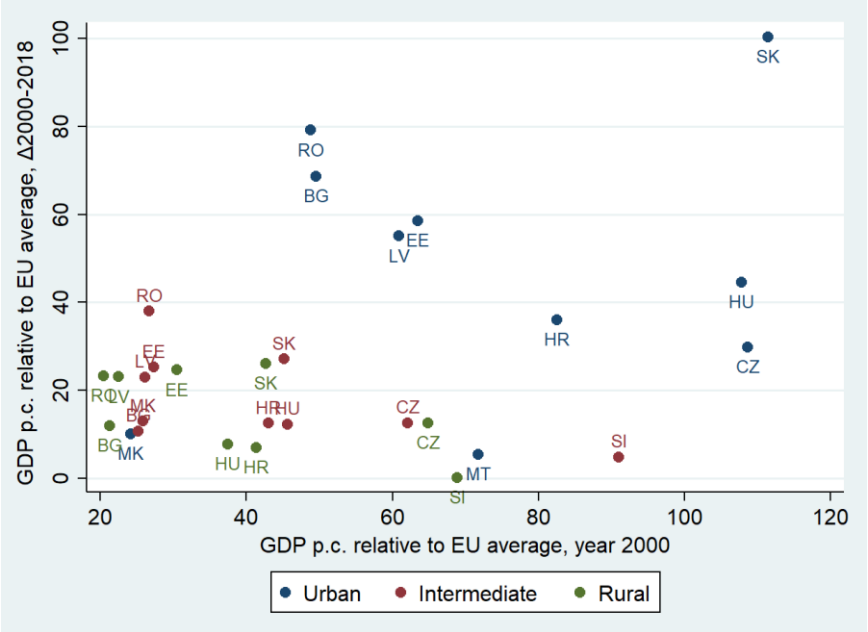
[5] In detail, the countries are: Bulgaria, Czech Republic, Estonia, Croatia, Hungary, Latvia, North Macedonia, Malta, Romania, Slovenia, Slovakia

respective 44 percentage points during 18 years, which is the highest increase among the countries. Germany, with an increase of 2.2 percentage points since 2000 also shows a modest gain in its relative position. Ireland represents an exceptional case: Although the country was severely affected by the financial crisis, it managed to improve its already above-average position in 2000 by more than 25 percentage points. This is, however, also due to a quirk in national accounts in 2015 which gave an artificial boost to economic growth.

This picture reflects a main finding from the literature: New EU members experience real income convergence, while original euro area members do not converge significantly anymore since the advent of the common currency. This goes beyond mere income measures, business and financial cycles also became more synchronized over time (Franks et al, 2018; Forgó & Jevcák, 2015).

In the remaining part of this section, we focus on the subset of countries that caught up over time. By assessing the improvement of the countries' relative position distinguished by urban, intermediate and rural areas, we are able to identify the main drivers of the overall convergence process.

Figure 13 Average growth of regions in catch-up countries



The results demonstrate a clear pattern: On average, there was no rural or intermediate region that exhibits a 40 percentage (or more) increase in its relative position, while for the urban areas six regions are above that level. Again, Romania with a nearly 80 percentage point increase and Slovakia with a more than 100 percentage points

represent the high end of the range of relative improvements. The good news is that among those countries all regions, including the rural ones, on average improved their position. Although the figure makes it pretty clear that the economic progress was predominantly due to growth in urban regions, research (e.g. Goecke & Hüther, 2016) shows that receiving subsidies from the EU structural funds indeed has positive influence on the opportunity to converge. It would however be wrong to conclude that the overall lower growth rates of rural areas should result in a favoritism to grant those subsidies to urban areas, as that would directly contradict the intended goals of the EU Cohesion Policy goals.

5. Income Distribution and Concentration

This section aims to link the results on convergence processes to the corresponding effect on inequalities. The question is whether the convergence process also leads to a decrease of overall inequality. We first introduce the concept of sigma convergence in addition to beta convergence and discuss the effect of convergence on the reduction of absolute disparities. We then investigate the development of the European wide GINI-coefficient, and as a third approach we calculate income concentration measures for the 10%, 90% and the median percentile.

5.1 Sigma convergence

The second convergence measurement that we use is the concept of sigma convergence, which refers to the simple reduction of disparities among regions over time. It therefore does not focus on catching-up processes, but rather takes into account the possibilities of random shocks pushing economies apart from each other. Hence, beta convergence is necessary but not sufficient for sigma convergence.

Sigma convergence is often expressed with the “Coefficient of variation”, which is a normalized measure of dispersion of a probability distribution. Following the literature, we calculate the coefficient of variation (CV) in the following way (Monfort, 2008; Simionescu, 2014). First the variance is calculated:

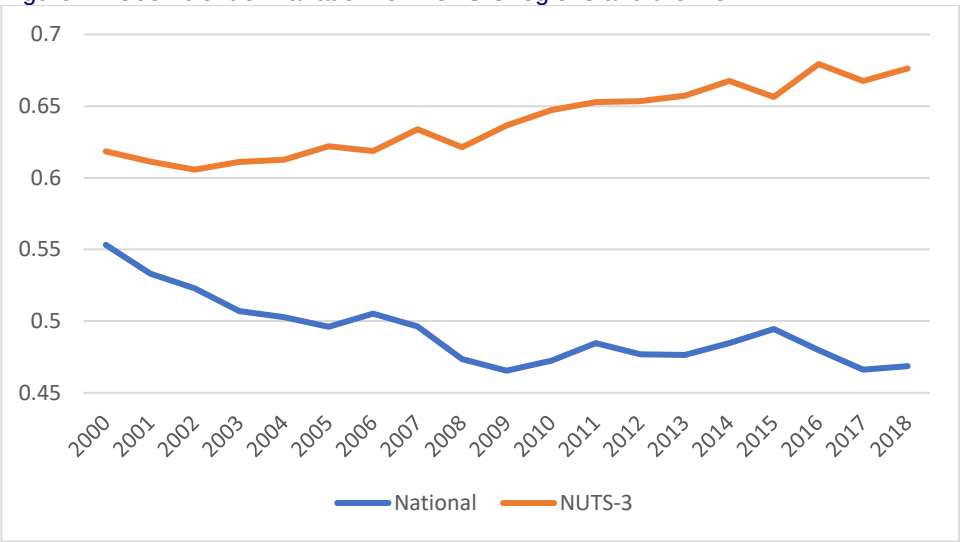
$$\sigma^2 = \frac{1}{n}\sum_{i=1}^{n}(y_i - \bar{y})^2 \qquad (2)$$

And then the standard deviation is divided by the mean:

$$CV = \frac{\sqrt{\sigma^2}}{\bar{y}} \qquad (3)$$

In our context Y corresponds to the respective GDP p.c. levels. A higher ratio of the standard deviation to the mean represents a more unbalanced distribution, while a decreasing coefficient of variation is a sign for more equal distribution.

Figure 14 Coefficient of Variation for NUTS-3 regions and the EU



The decreasing Coefficient of Variation on a national level confirms our findings that convergence is still at work between the countries. The CV declined from 0.55 in 2000 to 0.47 in 2018. Similar to our previously established findings, this is due to catch-up processes, whereas among EU-15 regions convergence is hardly taking place anymore. The impact of the financial crisis also becomes also apparent since we can clearly observe an increase in the coefficient after 2009. In 2015 this upward trend inverted again.

The picture changes when we look at computed values of the Coefficient of Variation for NUTS-3 regions. Since 2000 we observe a more or less steady increase, with the coefficient reaching a value of 0.68 in 2018 compared to the initial value of 0.62. This confirms our findings of increasing regional disparities, which are fueled by divergence trends within countries. This is in line with findings by Marelli (2007), who observed a trade-off between fast national growth and internal distribution from 1980 to 2005.

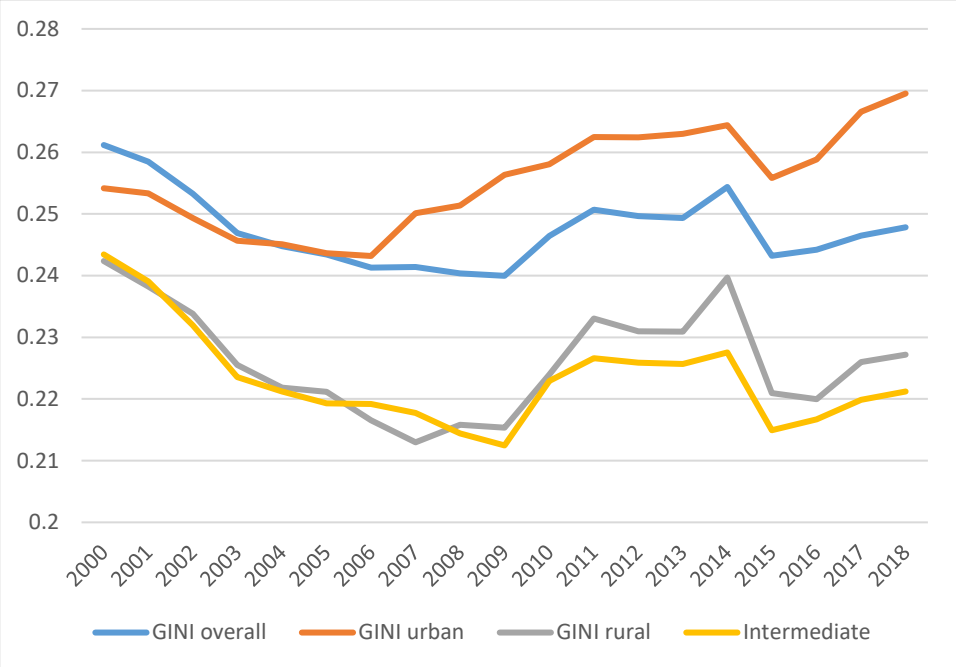
As Monfort (2008) points out, the CV is pretty sensitive to changes in the upper end of the distribution and thus an assessment using other measurements is necessary to get a broader picture.

5.2 GINI Coefficient and European Lorenzcurve

The most frequently used measurement of inequality is the concept of the GINI coefficient. It varies between 0 (perfect equality) and 1 (perfect inequality), hence a decrease of inequality due to a

convergence process should go hand-in-hand with a decline of the GINI coefficient.
Figure 15 displays the temporal progression of an overall European wide GINI index, as well as the GINI for all three types of urbanization classifications.

Figure 15 Evolvement of GINI Coefficients

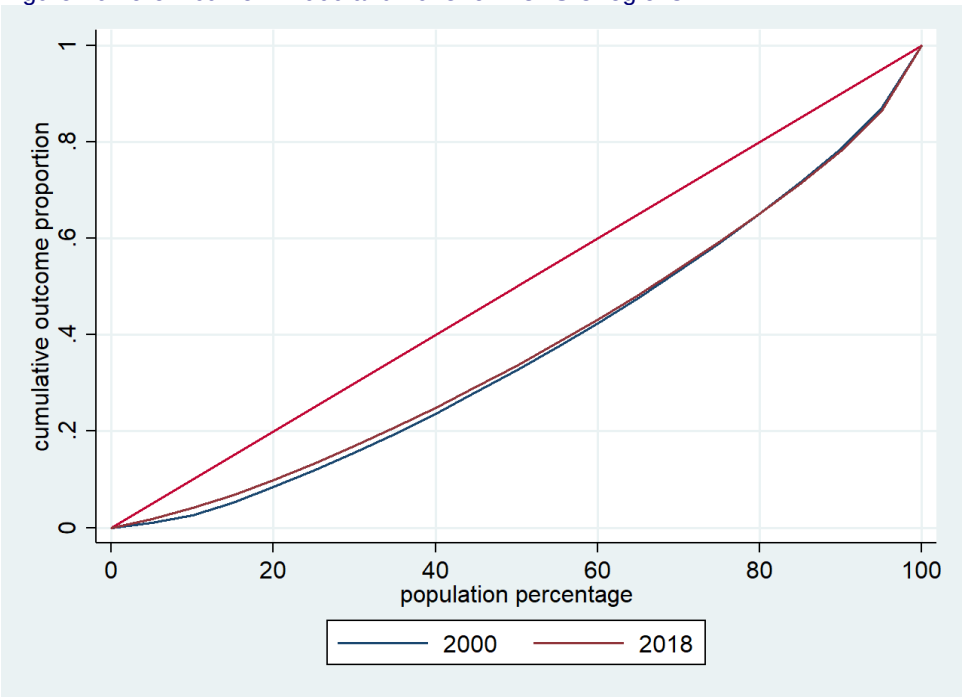


As expected, a comparison of values in 2018 with the baseline of the year 2000 confirms that the GINI index overall decreased from 0.261 to 0.247. However, a closer look unmasks that the downward trend inverted after the financial crisis in 2009.

One has to be careful, when interpreting the result of the types of urban-rural: The indices for a certain type of region only display the inequality developments across these types of areas. The indices for rural and intermediate regions exhibit similar patterns with a steep increase of the coefficients from 2009 to 2014. While the coefficients for rural and intermediate regions in 2018 are still well below the initial levels in 2000, this is not true for urban regions. They experience a nearly steady increase of their GINI coefficient since 2006, with an overall increase of 1.5 percentage points over the whole time period. This also puts a new perspective on our previously found results which show that the overall convergence process was mainly due to growth in urban cities. It appears to be the case that even among the outperforming regions some regions (mainly capital cities) are large outliers. The positive news is that 2015 seems to mark the point, where the negative aftereffects of the financial crisis started to soften.

Lorenzcurves are one way of graphically representing levels of disparities. The comparisons of the curve in 2000 and 2018 for NUTS-3 regions displays encouraging results:

Figure 16 Lorenzcurve in 2000 and 2018 for NUTS-3 regions



Although we still have a rather steep kink near the 95%-quantile, the lorenzcurve moved closer to a more equal distribution especially in the bottom 40% of the distribution. It seems, that although we still have a rather small amount of regions with large GDP p.c. levels, the initially poorest regions are catching up, thus leading to a more balanced income distribution.
Those results lead us to take a closer look at the 10%, 90% as well as the median (between 45-55%) percentile of the income distribution.

5.3 Income concentration

At the core of our interest is how much concentration of income we observe in those percentiles. In this context we want to look at absolute values of GDP, rather than per capita levels. However, the regions are still ranked according to their GDP p.c. levels and thus the selection of regions into the distributions depends on the per capita values. Since in total we have 1,078 regions, each percentile consists of roughly 108 regions.

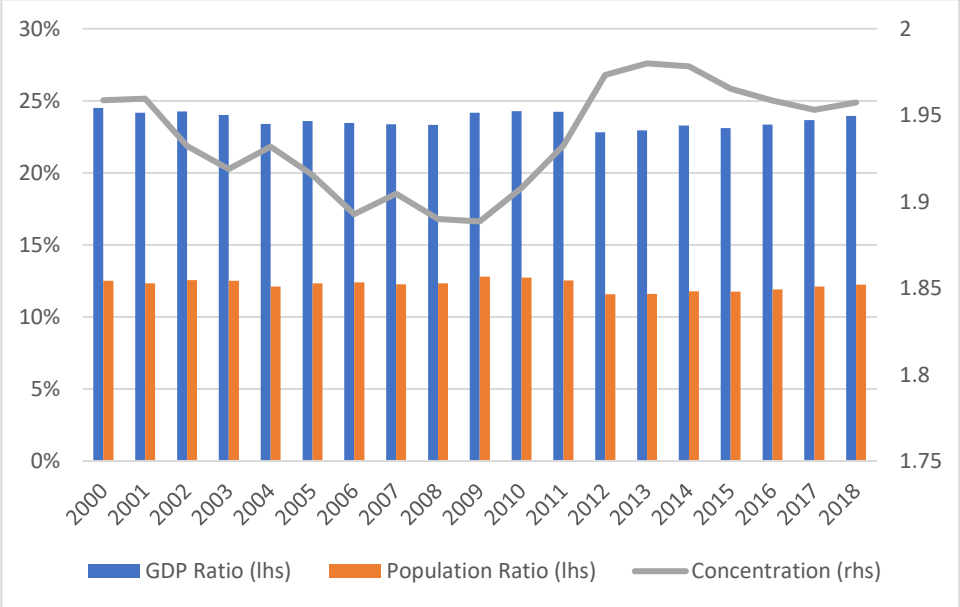
For this analysis it is vital, that the selection of regions that fall in the percentiles is dynamic, meaning that for each year the compositions within the percentile can change. This is contrary to an approach, where the regions are divided into percentiles in the year 2000 and the ranking is then fixed for all following time periods. However, this dynamic approach causes problem: Since the composition of the percentiles could possibly change every year, a change of the regions in a percentile leads to a change of population that this percentile accounts for.

To solve this issue, we introduced our own statistical figure. We divide the percentage that a percentile accounts for in terms of absolute GDP by the percentage that the percentile accounts for in terms of population. Thus, our statistical figure of income concentration is computed by the following formula:

$$Concentration_{it} = \frac{\frac{\sum_{n=1}^{T} \text{Regions GDP}_{it}}{\text{Total GDP}_t}}{\frac{\sum_{n=1}^{T} \text{Regions Population}_{it}}{\text{Total Population}_t}} \quad (4)$$

, where T represents the number of regions in the percentile i.

Figure 17 Income concentration in the 90% percentile

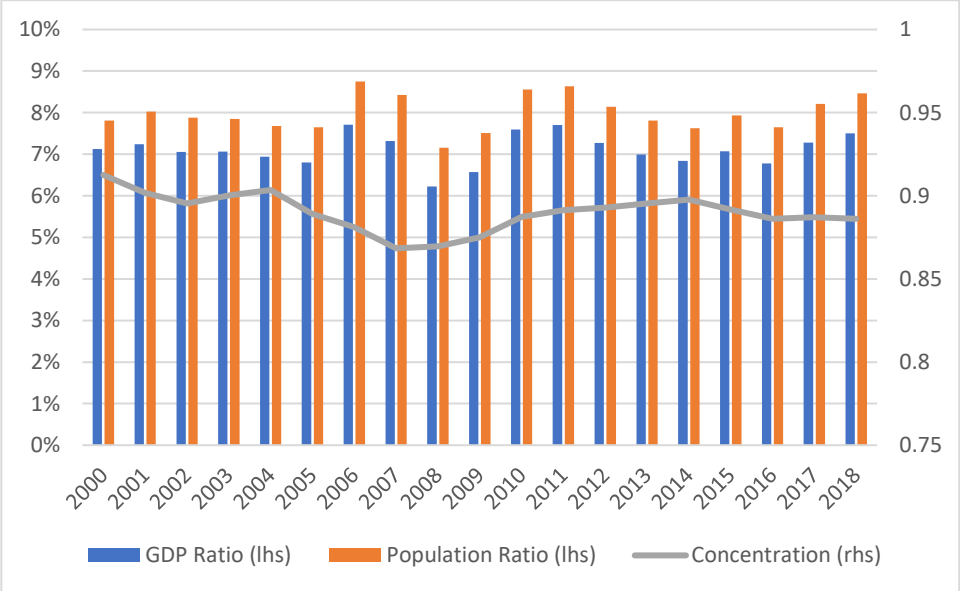


The analysis for the 10% richest regions reveals only some movements in our concentration figure. Initially, the regions in the percentile account for 24.5 % of the total GDP across all countries. This number decreases to 23.9% in 2018. The ratio of population

that the 10% percentile accounts for shows a similar development as the change in the GDP ratio, with a decrease from 12.5% to 12.2% of total population. Thus, our concentration figure states that in 2000 the 10% richest regions account for nearly double the fraction of GDP compared to the fraction of population. This figure has almost the same value in 2018 as in the beginning of the timeline in the year 2000.

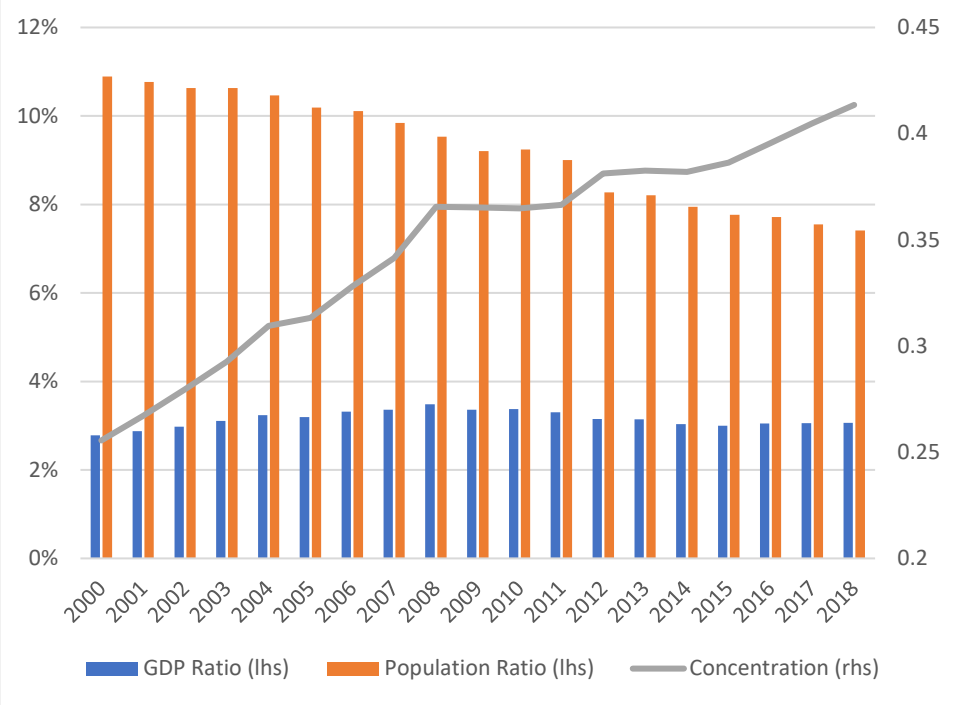
For the median percentile, we see even smaller movements in our figure, with an overall decrease of 0.91 in 2000 to 0.88 in 2018. During the timespan, the median regions account for a minimum value of 6.2% to a maximum value of 7.7% of the absolute GDP, while accounting for 7.1 to 8.6 % of the absolute population. The fact that the concentration indicator is always below one shows that the median regions account for a higher share of population compared to the share of GDP in all time periods.

Figure 18 Income concentration in the median percentile



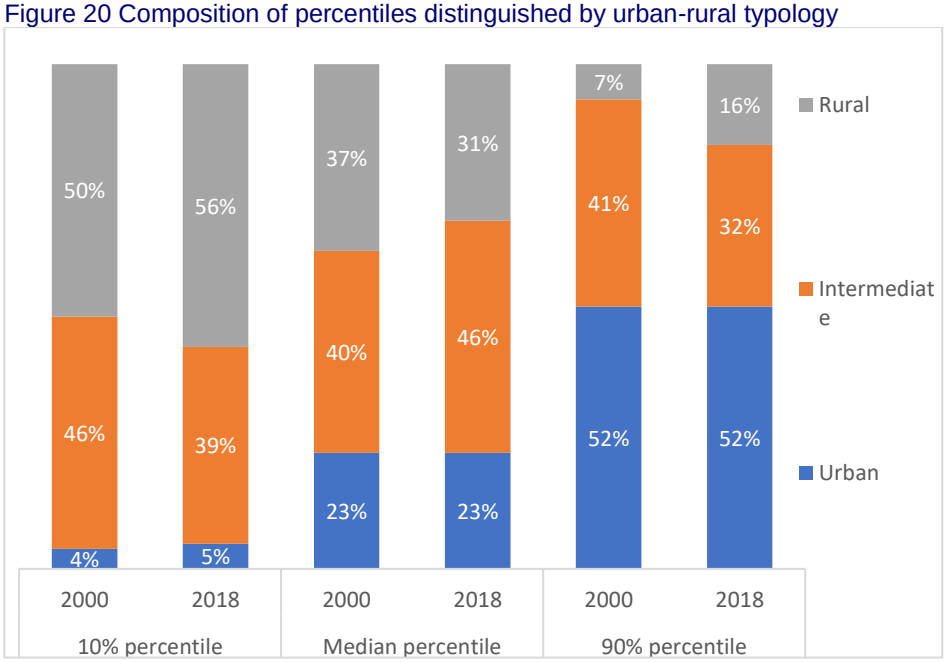
The graph for the 10% percentile paints a completely different picture. The concentration indicator rises steadily from a value of 0.25 in 2000 to 0.41 in 2018. The analysis of the GDP and population ratio allows us to make an interesting deduction for the reasons of this change. During the 18 years on our timeline, the GDP ratio only increased by 0.28 percentage points. However, the population ratio declined by 3.48 percentage points, which leads to an increase in the income concentration indicator.

Figure 19 Income concentration in the 10% percentile



One explanation for the declining population ratio could be that larger, more urban regions improve their GDP p.c. levels and thus fall out of the 10% percentile - which would predominantly leave smaller, rural areas in it. However, the fact that the share of GDP which the percentile accounts for stays fairly constant, implies that the regions account for the same share of GDP while having fewer inhabitants – which is ceteris paribus an improvement. As Figure 20 demonstrates, the majority of regions in the 10% percentile are classified as rural, while the opposite holds true for the 90% percentile. Taking this evidence together, leads to an interesting conclusion: Rural exodus serves as a balancing mechanism, which drives people from regions at the bottom part of the income distribution – which are predominantly rural areas – to regions in higher percentiles. This in turn offsets the destination regions' GDP ratio increases.

Figure 20 Composition of percentiles distinguished by urban-rural typology



Our statistics do not tell us something about the absolute size of migration or if the decline in the population ratio is due to lower birth rates. We are also not able to assess if people migrate ex- or internally. However, taking all European regions together, we are able to observe a pattern where regions in the 10% income percentile are accounting for a decreasing share of population, while the income concentration figure in the median and in the 90% percentile remains more or less the same. The uneven composition of those percentiles in terms of rural and urban regions, makes it likely that migration patterns (“rural exodus”) are indeed driving forces of this balancing mechanism.

6. Case Studies

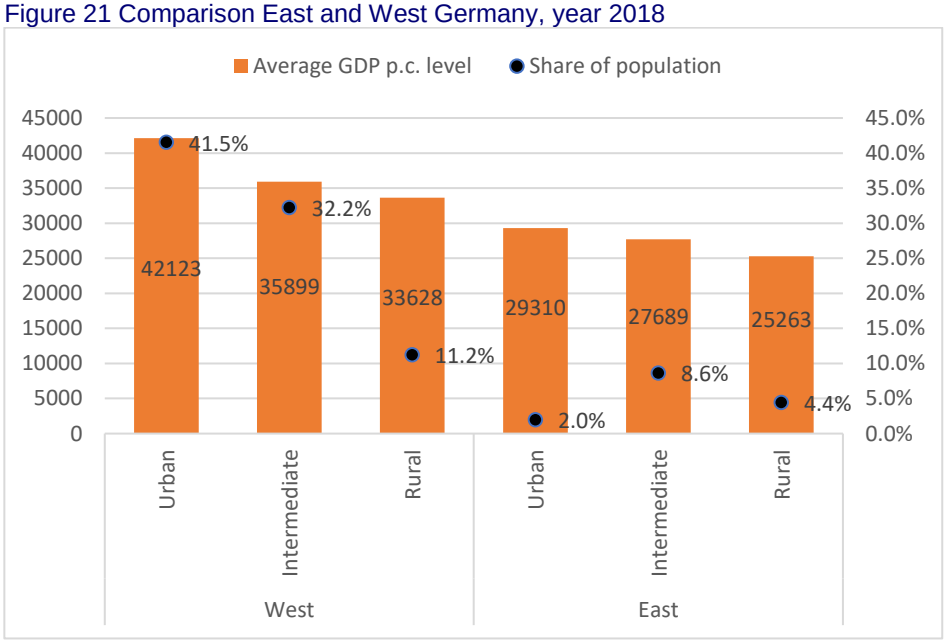
In the following chapter we take Germany and the United Kingdom as two cases for in-depth studies about their internal convergence process. As with the chapters above, we will both present stylized facts as well as regressions results.

6.1 Germany

For Germany the main interest is the assessment of the economic divide between the Eastern and the Western part of Germany.

Figure 21 reflects that there are vast structural differences between the states of the former East Germany and those of the former West Germany. It displays the proportion of the total population that the respective regions represent, as well as the average GDP per capita levels in the year 2018.

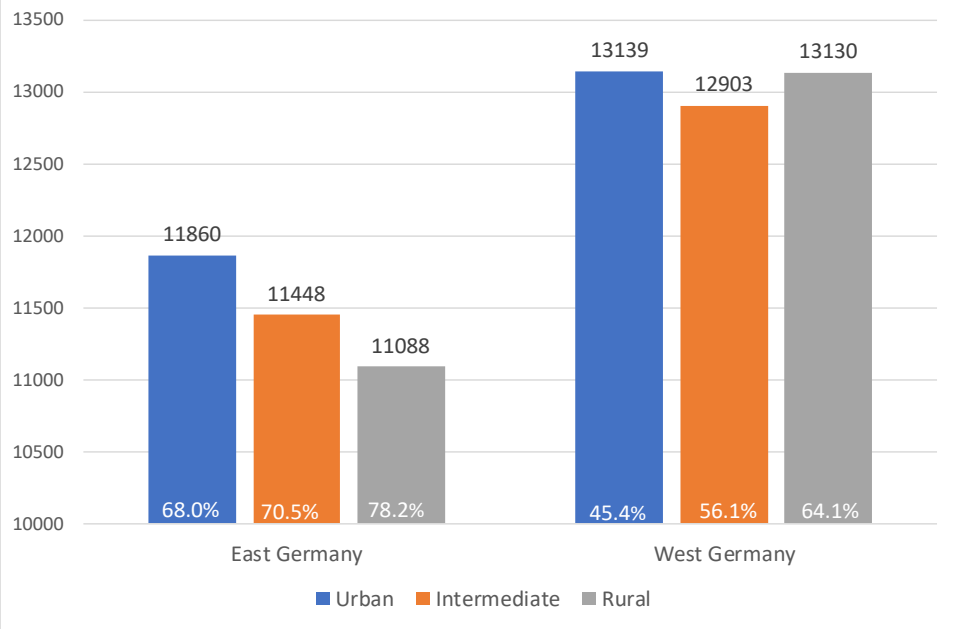
Figure 21 Comparison East and West Germany, year 2018



It is evident, that most of the German population (84.9%) live in the states of former West Germany. Since only 4 regions are classified as an urban region in the Eastern part, only 2.0% of the population are attributed to urban areas.[6] Looking at the average GDP per capita levels also reveals an economic divide. While for both parts, it holds true that the GDP p.c. levels are higher in urban regions than in intermediate or rural areas, the absolute levels in West Germany are still far higher than in the Eastern part. Even the rural areas in the West have a higher GDP p.c. on average than the urban areas in the East.

The next chart displays the absolute and relative gains in GDP p.c. levels from 2000 until 2018 for both East and West Germany.

Figure 22 Germany: Absolute and relative changes in GDP p.c. levels, 2000 to 2018



While the absolute gains in West Germany are all around 13,000 PPS units, the gains in East Germany are far smaller. It also becomes clear, that mainly the rural areas in the eastern part lag behind in their economic development. This changes when the relative gains are considered: The rural areas in East Germany exhibit the highest growth rate, which is a possible indicator for an on-going convergence process, which we will investigate next.

[6] In our dataset Berlin is treated as part of West Germany.

Figure 23 Beta convergence for Germany, overall

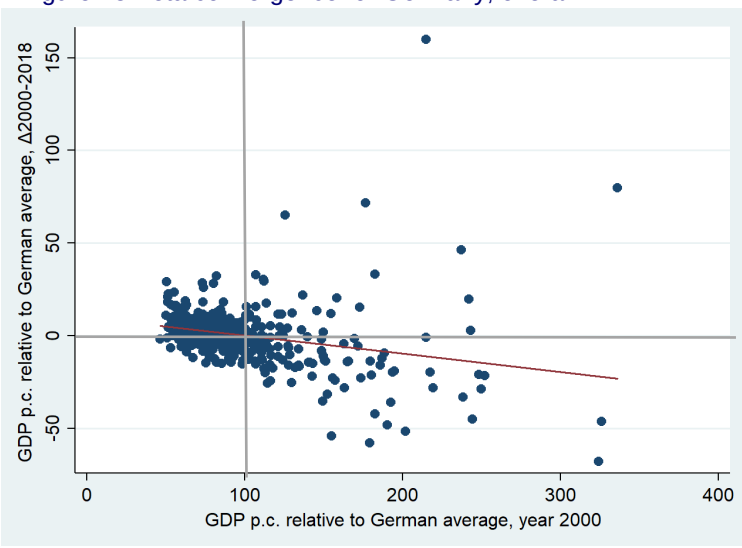


Figure 24 Beta convergence for Germany, urban regions

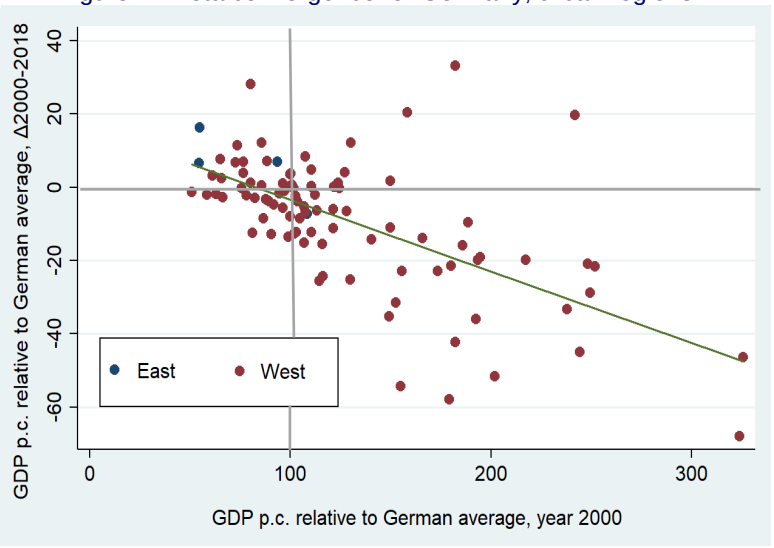


Figure 25 Beta convergence for Germany, intermediate regions

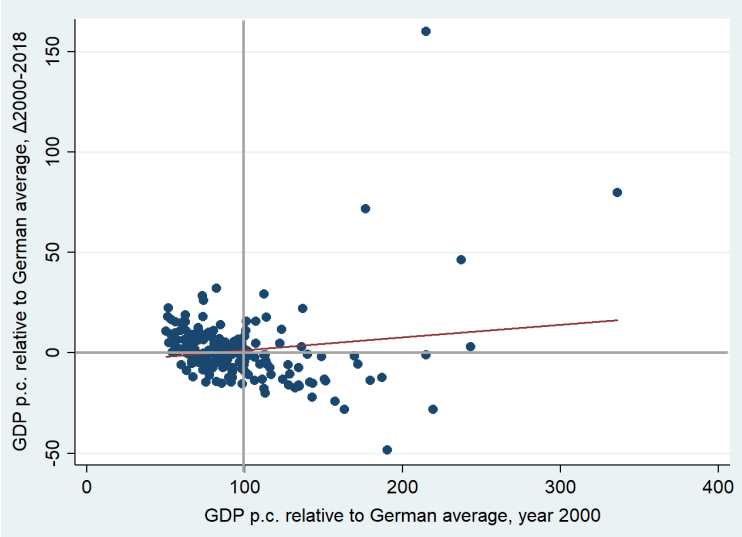
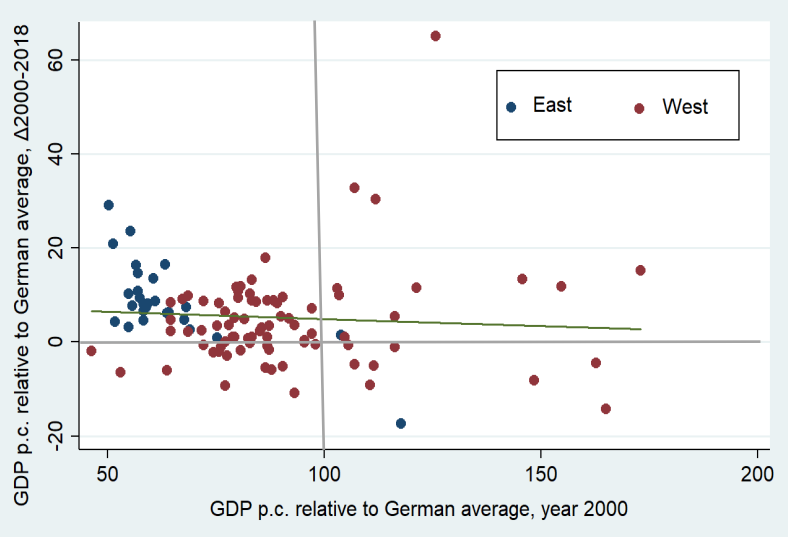


Figure 26 Beta convergence for Germany, rural regions



We can conclude from Figure 23 that overall only a slight tendency of convergence is apparent in the data. The p-value of the regression, however, is still significant at the 1%-level, which indicates that we observe some overall convergence. Figures 24-26 give us some interesting insights into the dynamics: While we see a nearly flat line for rural areas, the coefficient is even slightly upward-sloping for intermediate regions. The good news is that most rural areas improved their relative position – the opposite is true for urban regions. They show a converging trend, which is predominantly driven by losses in the relative position of regions' that had high initial GDP levels in 2000 (represented by the occurrence of more data points in the bottom right-hand side of the graph).

Thus, we can conclude that although we observe no convergence among rural areas and intermediate regions, overall convergence is driven by the increases in GDP p.c. levels over time for rural areas, while many urban areas worsened their relative position.

The development of the GINI index based on the GDP p.c. data also indicates a positive trend:

Figure 27 Evolvement of GINI index, Germany

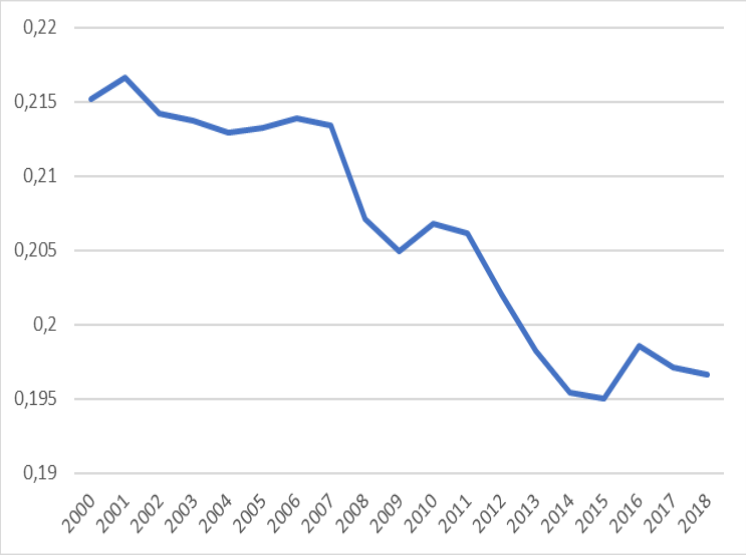
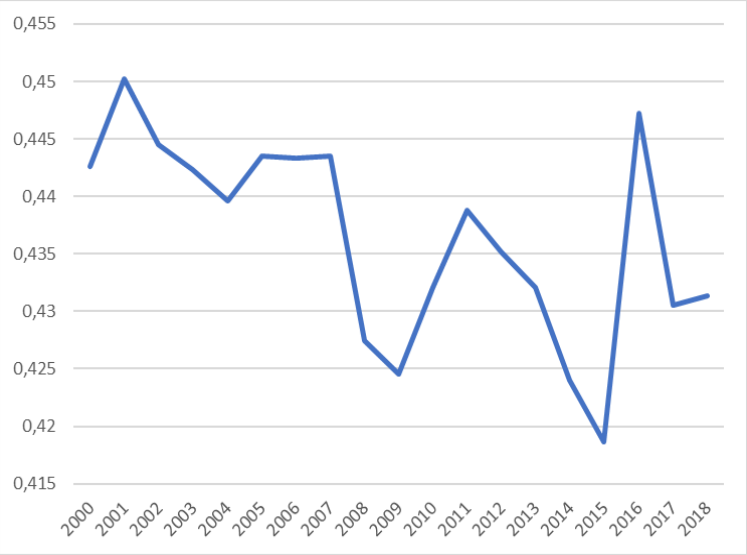


Figure 28 Coefficient of Variation, Germany



Since 2000 we observe a downward trend from a starting point of about 0.215, which declined by nearly two percentage points until 2015. Recently, we observed a slight increase in the index and in 2018 the index reached the value of 0.197.

The increase of the GINI index in 2015 can also be seen in an even greater spike of the CV in the sigma convergence measurement. Although we can observe a lot of movement in the coefficient, which makes it hard to really establish a trend, the figure seems to decline over time. This is in line with the findings of the beta convergence measurement that overall convergence seems to have slowed down but is still continuing in Germany.

Since, Figures 24 and 26 plot the data distinguished by regions located in West and East Germany, we are also able to conclude, that this slight convergence process positively affects regions in the (on average) economically disadvantaged regions in the Eastern Part of Germany, since nearly all blue dots are above zero on the y-axis.

These observations lead to the conclusion that regions in the states of the former GDR seem to catch up relatively to the regions in the states of former West Germany. What is worrying is that the pace of convergence significantly slowed down and even seems to turn to a divergence pattern after 2015. In the next section, we put the spotlight on the UK to investigate if we observe similar patterns.

6.2 United Kingdom

The assessment of the United Kingdom is particularly interesting under the light of the still on-going Brexit negotiations. Prior to the vote on leaving the European Union it was hotly debated, that especially people living in the more rural areas of the UK did not profit from the globalization that came with being part of the EU. Many citizens felt that the interests of the City of London with its big financial sector dominated policy decisions. And in fact, mostly people in rural areas voted for leaving the EU, while citizens in major cities such as London, Liverpool or Manchester supported to remain in it (de Gruyter, 2016).

Figure 29 UK: Descriptive facts

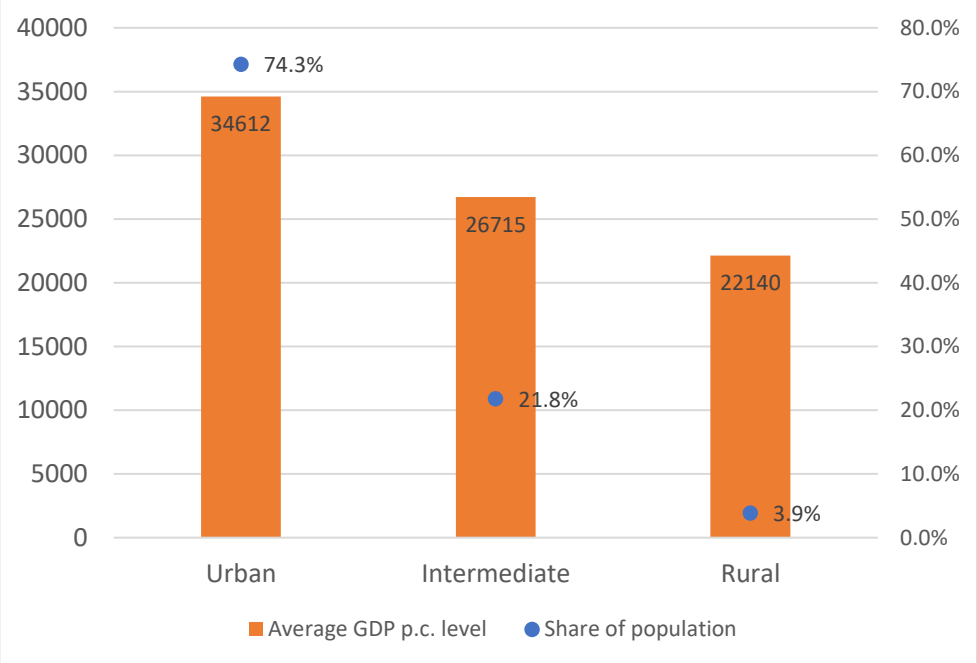
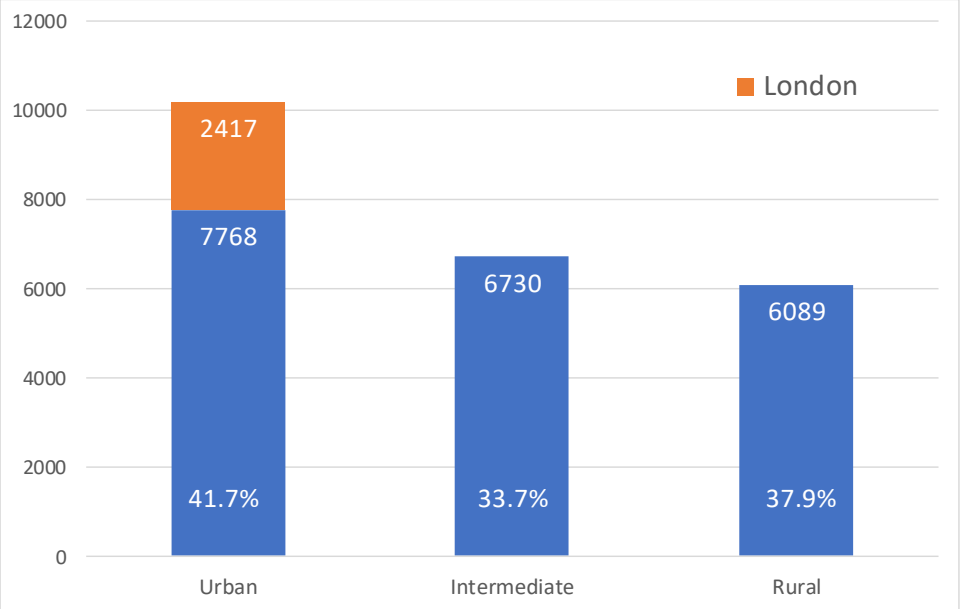


Figure 29 shows that over 74% of the British population live in urban regions, which on average also have a significantly higher GDP p.c. level as intermediate or rural regions.

The vast impact of London on GDP can be seen in Figure 30. London[7] amounts to a significant part of the absolute gain in GDP p.c. levels for urban regions. The urban areas in the UK, with an average gain of more than 10,000, grew in absolute terms nearly double the amount of rural areas.

Figure 30 UK: Absolute and relative changes in GDP p.c. levels, 2000 to 2018



Even when London is excluded (which significantly decreases the relative change of urban areas from 41.7% to 36.0%), urban areas nearly hold up with the speed of growth in rural/intermediate regions in relative terms. This is a first indicator that, in fact, rural areas did not manage to catch up in the last 18 years.

This assumption is backed by the regression results, which display a clear divergence process, which is driven by the large urban outlier regions “Westminster”, “Camden/City of London”, “Tower Hamlets” and “Chelsea & Fulham”. However, even once those regions are excluded in the analysis, the regression line (insignificantly) slopes slightly upward.

[7] We use London equivalently with the regions „Westminster“ and „Camden/City of London“.

Figure 31 Beta convergence for the UK, overall

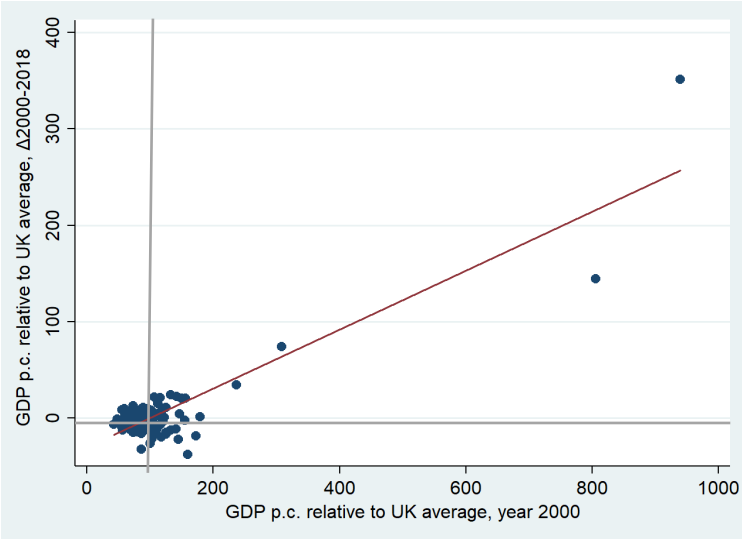


Figure 32 Beta convergence for the UK, urban regions

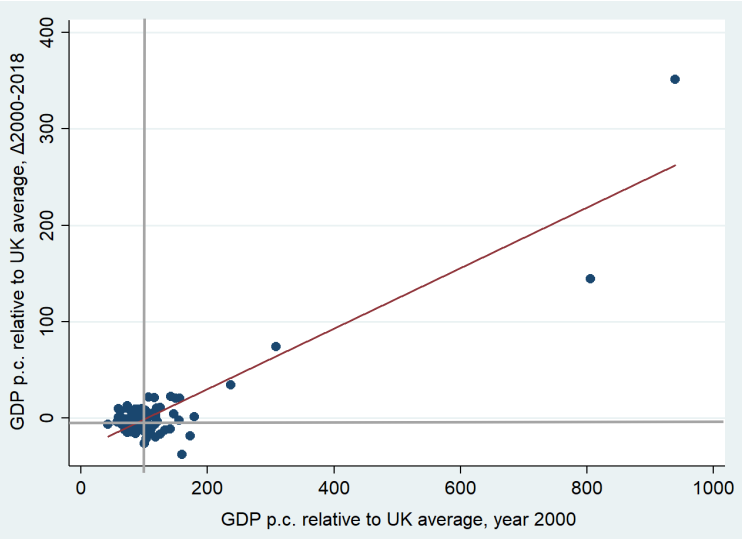


Figure 33 Beta convergence for the UK, intermediate regions

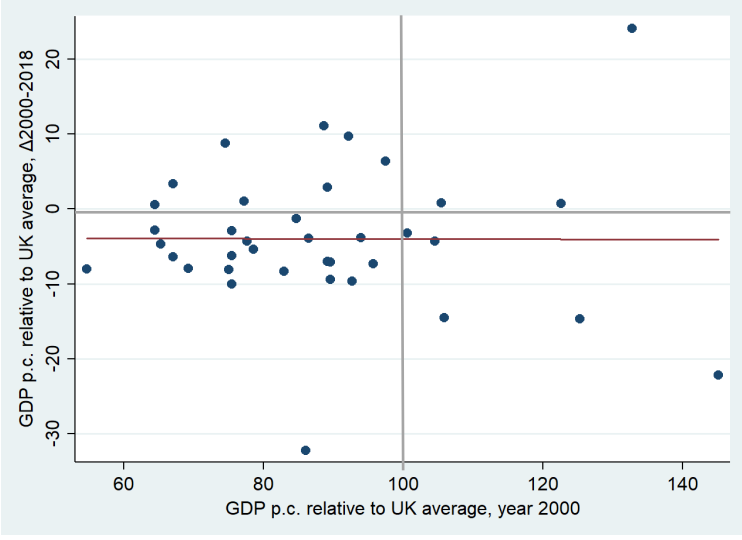
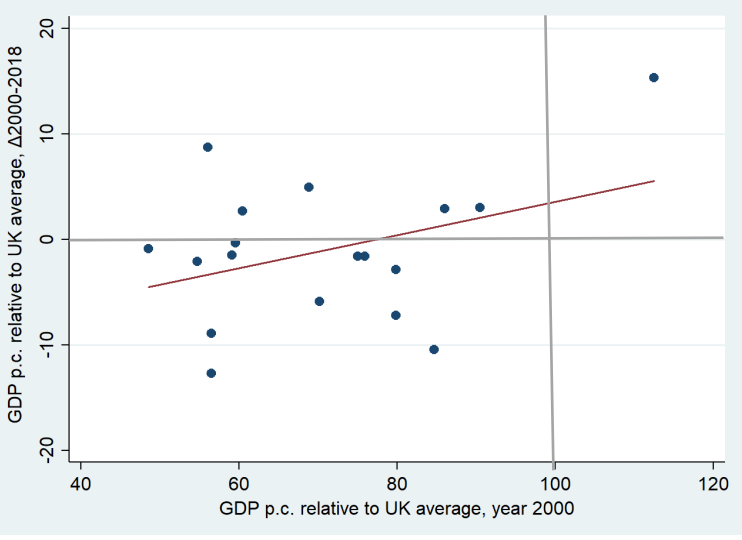


Figure 34 Beta convergence with the UK, rural regions



Similar results apply for intermediate and rural regions, where the curve either slopes upward or is flat. Yet, even more worrying is the fact, that most intermediate and rural areas actually worsened their relative position. Even though their initial position in 2000 was well below the UK average, most dots are positioned below zero on the y-axis.

This is also consequently reflected in the inequality measurements:

Figure 35 Evolvement of GINI index, UK

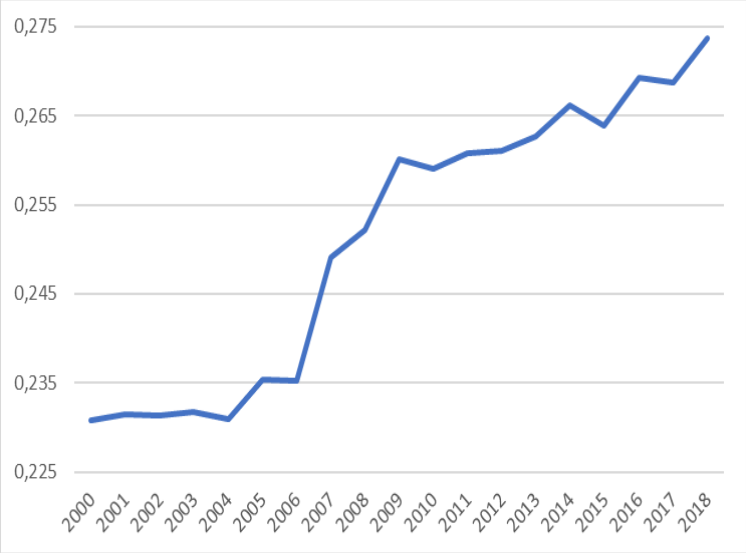
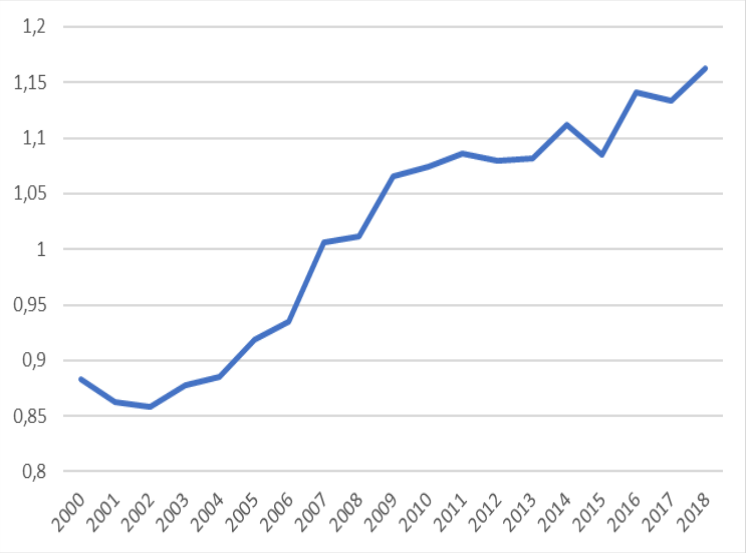


Figure 36 Coefficient of Variation, UK



Both – the GINI index (based on the GDP p.c. data) as well as the Coefficient Variation – show a steadily significant increase after 2004. Especially noteworthy are the results for the Coefficient of Variation which has a value of over 1 from 2007 forward. That means that the standard deviation is actually greater than the mean, which significantly indicates a large unequal distribution.

Most UK citizens already live in urban areas – so our divergence results cannot serve as a full explanation why the majority of people voted for leaving the EU. However, it can indeed explain why people away from major urban cities feel disadvantaged as the economic development of those regions did not hold up with the pace of the UK average. Therefore, the UK exhibits a pattern that distinguishes itself from the one in Germany: Rural areas on average do not show improvements in their relative position and the divide between urban and rural areas consequently seems to widen – with impacts on both economic as well as political developments.

7. Discussion

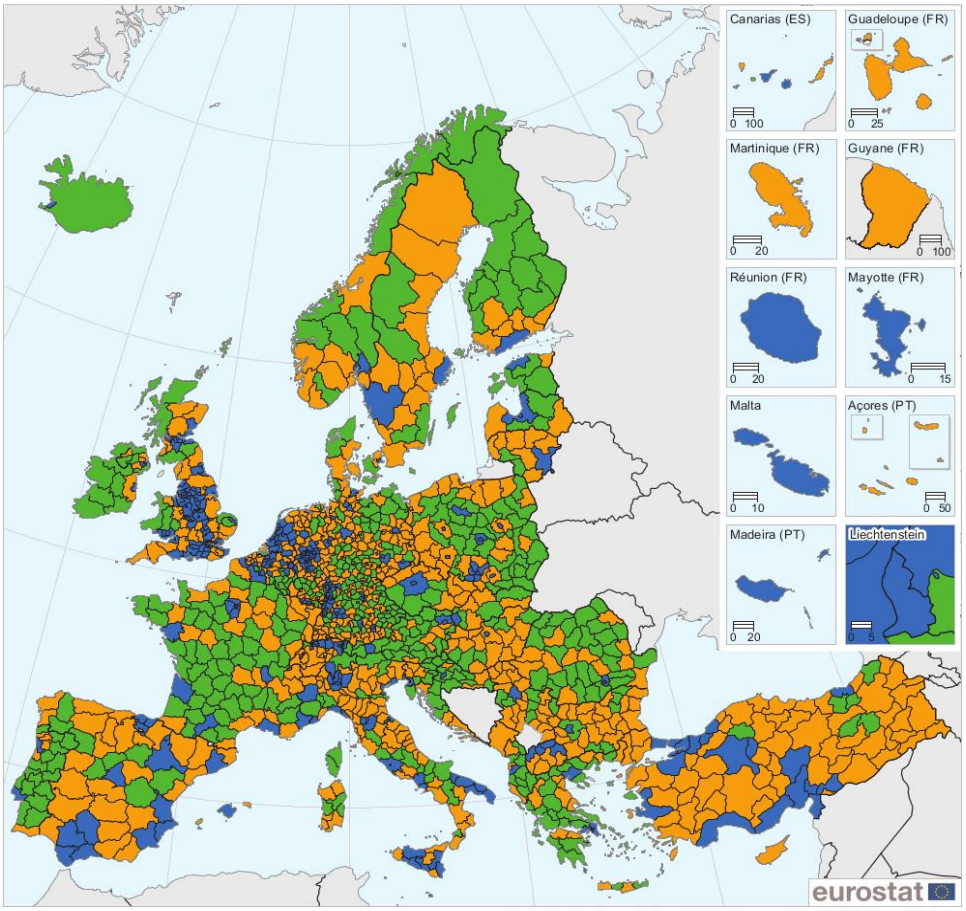
It is important to note the shortcomings of our calculations. Our analysis only considered economic convergence and therefore leaves aside other - such as political - convergence measurements (for an overview see EEAG (2018)).

We focus solely on data on GDP, which leads to a possible bias, since GDP per capita is only a proxy for the actual income available for individuals. Other studies use questionnaires or surveys to obtain data on (household) income rather than production levels to perform convergence evaluations (Heichel et al, 2005). The problem with this approach is that the possible inconsistency and incompatibility of data sources makes it hard to perform relative comparisons across European regions. Additionally, our analysis focused on a large number of regions and thus required widely available regional data. Another point is that using small geographical units (as we are doing with NUTS-3) could potentially create a bias since local GDP could be attributed to commuters. Again, the aim of performing distinguished evaluation for urban, intermediate and rural areas made it necessary to use rather disaggregated data.

A general point of critique comes from the fact that PPS does not account for cost of living differences between rural and urban areas within one country – meaning that it does not correct for local price differences when looking at real household incomes. There is a technical solution for this: “Spatial adjustment factors” are used to adjust prices within the economic territory of a Member State (Eurostat, 2007). One example are the relative regional consumer price levels (RRCPLs) that the Office for National Statistics in the UK calculates as an indication of a region's price level compared with the UK average (ONS, 2018). As these data are not available for all regions in Europe, our analysis had to rely on the concept by Eurostat using calculated price levels for member countries in the form of purchasing power parity exchange rates (PPPs) (Deaton, 2014).

APPENDIX

Display of regions based on the urban-rural typology



Note: based on NUTS 2016 and GEOSTAT population grid from 2011, additional data from Columbia University, Center for International Earth Science Information Network - CIESIN (2015): GHS population grid.
Source: Eurostat, JRC and European Commission, Directorate-General Regional and Urban Policy and Directorate-General Agriculture and Regional Development

Five richest and poorest regions in 2000

Country	Region	GDP p.c. in 2000	in % of EU average
UK	Camden & City of London	213,000	1099.18
UK	Westminster	182,600	942.3
Germany	Wolfsburg	75,400	389.1
Germany	Munich, Landkreis	73,100	377.2
Germany	Frankfurt am Main	72,700	375.1
..	..	..	..
..	..	..	..
..	..	..	..
Romania	Calarasi	3,000	15.48
(N.-)Macedonia	Poloski	2,900	14.96
Romania	Botosani	2,900	14.96
Romania	Giurgi	2,800	14.45
Romania	Vaslui	2,400	12.39

Five richest and poorest regions in 2018

Country	Region	GDP p.c. in 2018	in % of EU average
UK	Camden & City of London	410,000	1406.02
UK	Westminster	301,000	1034.58
Germany	Wolfsburg	146,100	501.59
Germany	Ingolstadt	131,700	452.2
UK	Tower Hamlets	121,200	415.9
..	..	..	..
..	..	..	..
..	..	..	..
Bulgaria	Vidin	7,400	25.48
Bulgaria	Sliven	7,200	24.96
Bulgaria	Silistra	7,000	23.77
(N.-)Macedonia	Severoistocen	6,900	23.69
(N.-)Macedonia	Poloski	5,400	18.37

Regression: Beta convergence on a national level (Fig.5)

Source	SS	df	MS		
				Number of obs	= 24
				F(1, 22)	= 36.87
Model	.004369687	1	.004369687	Prob > F	= 0.0000
Residual	.002607064	22	.000118503	R-squared	= 0.6263
				Adj R-squared	= 0.6093
Total	.006976751	23	.000303337	Root MSE	= .01089

CAGR	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
logGDP2000	-.0232744	.0038328	-6.07	0.000	-.0312232	-.0153257
_cons	.2573867	.036958	6.96	0.000	.1807406	.3340328

Regression: Beta convergence on a regional level (Fig.6)

Source	SS	df	MS		
				Number of obs	= 1,078
				F(1, 1076)	= 602.48
Model	.082614647	1	.082614647	Prob > F	= 0.0000
Residual	.147546131	1,076	.000137125	R-squared	= 0.3589
				Adj R-squared	= 0.3583
Total	.230160778	1,077	.000213705	Root MSE	= .01171

CAGR	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
logGDP2000	-.0160704	.0006547	-24.55	0.000	-.017355	-.0147857
_cons	.181009	.0063839	28.35	0.000	.1684827	.1935354

Regression: Beta convergence for urban regions (Fig.7)

Source	SS	df	MS		
				Number of obs	= 299
				F(1, 297)	= 10.97
Model	.001261239	1	.001261239	Prob > F	= 0.0010
Residual	.034139453	297	.000114948	R-squared	= 0.0356
				Adj R-squared	= 0.0324
Total	.035400692	298	.000118794	Root MSE	= .01072

CAGR	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
logGDP2000	-.004565	.0013781	-3.31	0.001	-.0072771	-.0018528
_cons	.065393	.0137907	4.74	0.000	.0382532	.0925329

Regression: Beta convergence for rural regions (Fig.9)

Source	SS	df	MS		
				Number of obs	= 328
				F(1, 326)	= 307.17
Model	.043416707	1	.043416707	Prob > F	= 0.0000
Residual	.046078283	326	.000141344	R-squared	= 0.4851
				Adj R-squared	= 0.4836
Total	.08949499	327	.000273685	Root MSE	= .01189

CAGR	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
logGDP2000	-.0206546	.0011785	-17.53	0.000	-.022973	-.0183361
_cons	.2253493	.0112397	20.05	0.000	.2032378	.2474608

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