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Decomposing European NUTS2 Regional Inequality from 1980 to 2009: National and European Policy Implications

Abstract

Purpose This paper analyses income inequality for a sample of fourteen European countries and their composite regions using data from the Cambridge Econometrics regional dataset from 1980 to 2009. The purpose of the paper is to provide insight into the dynamics of regional and national cohesion among the EU-14 countries studied.

Design/methodology/approach Initially, inequality is decomposed using the Theil coefficient into between and within country inequality to assess the extent to which convergence has occurred. To investigate the underlying causes of the changes in inequality, the Theil coefficient is further decomposed to assess the contribution of productivity and employment-population ratio differentials to inequality.

Findings The results indicate that while between-country inequality has declined, within-country inequality has increased by approximately 50 percent. Subsequent decomposition indicates that while productivity levels among regions have converged, the employment-population ratios have diverged substantially driving increasing levels of inequality. This suggests that while EU cohesion policies have reduced productivity inequalities they have had little effect in stimulating convergence of employment-population ratios across regions.

Research implications The paper argues that national priorities, particularly in the context of the current European economic crisis, are likely to hinder European Union level policies to reduce income inequality at a regional level. This may result in further increases in regional inequality among European regions.

Originality/value This paper's main contribution is to highlight how national convergence can lead to regional divergence being overlooked. The

value of the paper is that it provides policy insights, based on empirical evidence, for European cohesion policy.

1 Introduction

One of the founding goals of the EU was to promote convergence among the peoples of Europe (European Union, 2010). However, Boldrin and Canova (2001) notes that substantial regional inequalities remain across European regions. In analysing the extent to which inequality has increased/declined since 1980 this paper aims to provide an empirical test as to whether these goals have been achieved. Further to this, by analysing the contribution of productivity and the employment-population ratio to total inequality it is possible to formulate policy interventions which can be targeted at the underlying causal factors of regional inequality.

This paper analyses regional inequality of a sample of European countries. The countries studied are those members of the European Union (EU) prior the enlargement of the EU in 2004 excluding Luxemburg (here after referred to as the EU-14). The data utilised by this paper is derived from the Cambridge Econometrics regional dataset. This data provides information relating to the Gross Value Added (GVA), labour force and population of NUTS2 regions for these countries from 1980 to 2009. This allows for an analysis of EU national and regional cohesion over a continuous time series covering almost a thirty year time span.

There has been a number of studies of EU regional convergence/divergence, with papers such as Gonzale (2011) and Terrasi (1999) focusing on a subset of countries and others such as Gardiner et al. (2004) and Sala-i Martin (1996) analysing the EU as a (more or less) whole. Gonzale (2011) notes the existing level of regional income inequality in the UK and Italy, highlighting the extent of regional disparities in Europe. Boldrin and Canova (2001) note that the degree of income disparity among EU regions has, depending on the measure used, remained constant or even increased since the 1970s. This has occurred despite policy intervention at the EU level through various rounds of European Regional Development funds and European Cohesion funding (Puga, 2002). This raises the question as to what is driving EU regional divergence.

To shed light on this issue, a Theil coefficient is used to estimate the evolution of total income inequality between and within the EU-14 countries. An advantage of the Theil coefficient is that it allows for the identification of the proportion of inequality that exists between different countries and within these countries. In decomposing inequality into between-country and within-country components this paper provides an insight into the underlying structure of inequality within the EU-14 and how this has changed over time. Subsequently, to analyse the drivers of inequality, the Theil coefficient is used to determine the contribution of productivity and employment-population ratio differentials to total income inequality.

The remainder of this paper is structured as follows. Section 2 outlines the expectations of convergence/divergence based on three competing economic growth theories and also presents existing EU policy interventions to promote EU cohesion. Section 3 presents the methodology used in this paper and outlines the Theil decomposition methods employed. Section 4 describes the Cambridge Econometrics dataset and Section 5 presents the results of the analysis of EU14 income inequality. The final section concludes and provides a discussion on proposed policy interventions.

2 Literature Review

2.1 Economic Theory's Implications for Convergence

Differing economic theories suggest alternative outcomes for regional convergence/divergence over time (Gardiner et al., 2004). Some theories are based on the assumption that economic growth rates are determined by differences in resource endowment while others focus on factors of production such as capital accumulation or on the agglomeration of economic activities (Rey and Janikas, 2005). Three competing economic theories are presented here, and the implications for convergence/divergence outlined.

The Solow (1956) growth model is based on the assumptions that capital, labour and exogenous technological progress drive economic growth. The production function presented by Solow (1956) possesses constant returns to scale, allowing the model to be specified in per worker terms. The model suggests that the capital stock per worker determines economic output per worker. As capital is assumed to possess diminishing returns, regions which possess higher levels of capital stock derive lower returns from capital investment relative to regions which possess lower capital stocks. Therefore, provided regions possess the same level of technology and the same exogenous technological progress, it can be expected that regions will converge as capital flows into the poorer regions, seeking higher rates of return, and generates faster economic growth. These higher rates of economic growth result, over time, in poorer regions catching up with richer regions. There is mixed evidence from EU regions on the applicability of the Solow model. Sala-i Martin (1996) suggests that the Solow growth model is applicable to EU regions, finding convergence among regions when using beta convergence techniques. However, this is questioned by Heidenrich and Wunder (2008), who suggest that diverging patterns observed among EU regions using the Gini coeffi-

cient are not consistent with the Solow model. Likewise Puga (2002) asserts that the Solow model may be inadequate in explaining EU regional growth as it cannot account for persisting levels of regional income inequality.

An alternative growth theory, which implies persistent divergence among countries and regions is endogenous growth theory (Romer, 1986). This stream of growth theory endogenesis technological progress and suggests that economic growth is derived from technological advancement which in turn is dependent on the amount invested in innovation, the diffusion of innovation and the effectiveness of protecting innovations (Gardiner et al., 2004). This means the growth model exhibits increasing returns to scale. Differing technological levels across countries/regions can, therefore, explain differences in economic development. As the process of technological advancement is, in a way, self-reinforcing, with leading countries/regions leveraging on past advancements, this theory predicts divergence among countries/regions may persist (Heidenrich and Wunder, 2008). This, as suggested by Gardiner et al. (2004), perhaps explains the divergent pattern of economic activity exhibited by EU regions.

Finally, New Economic Geography (NEG) theory predicts the concentration of industrial production in a number of core regions (Fujita et al., 1999). This concentration in core regions will occur due to the advantages associated with agglomeration economies which produce increasing returns to scale (Puga, 2002). As more economic activity is concentrated in a given region, other firms/workers are attracted to that region based on the market potential of the region. This centripetal force of market access along with the development of deep pool of knowledge and skills generate a self-reinforcing process which attracts economic activity to the core. Centrifugal forces such as congestion and high land rents on the other hand ensure that not all economic activity concentrates in one location, resulting in a number of core regions being established which are surrounded by poorer peripheral regions (Krugman, 1998). This theory predicts that there will be a divergence in regional incomes due to the concentration of industries in core regions and the subsequent under-development of the peripheral regions. Puga (2002) proposes that this theory can explain the divergence in income and employment rates observed among EU regions over time.

2.2 EU Cohesion Policy

EU cohesion policy has focused on regional development and reducing regional income inequality. A key focus of EU regional policy has been to achieve income convergence among European regions (European Union, 2008). Cappelen et al.

(2003) provide a concise overview of historical EU regional policy. The authors note that prior to 1970, regional policy was mainly at the discretion of national governments and was not of major concern to European policy makers. However, in 1975, more focus was placed on regional policy at an EU level. At this time the European Regional Development Fund was established, with the aim of providing a mechanism through which regional imbalances within Europe could be addressed. Throughout each subsequent cycle of revision to regional policy, increased levels of funding were allocated from the EU budget (Puga, 2002). Regions which received the most support were those experiencing industrial decline, those which possessed GDP per capita below 75 percent of the EU average or those which were mainly agriculturally based. (Cappelen et al., 2003)

Regional income convergence remains a critical objective of EU regional policy. From a total cohesion fund of approximately €308 billion, over the time period 2007 to 2013, 81.5 percent will be spent on achieving convergence (European Union, 2008). This 81.5 percent of the fund is available for only the poorest member states in the EU. The remainder of the fund is distributed through two channels: the Regional Competitiveness and Employment fund and the European Territorial Cooperation fund. 16 percent of the funds will focus, in the Regional Competitiveness and Employment objective, on supporting innovation, sustainable development, better accessibility and training projects. The final 2.5 percent is available under the European Territorial Cooperation objective for cross-border, transnational and interregional cooperation.

EU cohesion policy acknowledges that regional and national growth, and, therefore, the potential for convergence or divergence, are functions of productivity, employment growth and population growth. Harmonization of productivity levels across the EU, through the promotion of innovation and technology, is viewed as a key mechanism through which EU convergence can be achieved. However, the role of increasing employment levels is also highlighted. Linked with employment growth is population growth. Lower living standards overall will occur if employment growth falls behind population growth and, therefore, the employment-population ratio is viewed as the second major mechanism through which income convergence can be achieved (European Union, 2010).

According to policy, increased productivity levels are achieved throughout the EU through investment in innovation, the development of high technology businesses and through foreign direct investment (European Union, 2008). Similarly, employment is to be developed through much the same mechanisms, as developing a high technology business sector will not only promote productivity growth but also create jobs (European Union, 2009).

3 Methodology

This paper uses the Theil coefficient to decompose income inequality of the EU-14. Initially, inequality is decomposed into between and within country inequality; providing an insight into the evolution of inequality between European countries as well as within those countries since 1980. Inequality is subsequently decomposed into inequality occurring due to differences in regional productivity and employment-population ratios. This subsequent decomposition allows for an analysis of the key factors driving inequality in Europe and provides evidence for possible targeted policy interventions.

Initially, using the Theil coefficient it is possible to define total inequality as:

$$T_T = \sum_r y_r ln\left(\frac{y_r}{p_r}\right) \tag{1}$$

Where T_T represents the Theil coefficient for the total income inequality between regions, y_r represents region r's share of total income and p_r represents region r's share of total population. Two alternative specifications of the Theil coefficient may be applied in the context of equation (1). These are weighting regions by their income or by their population. In equation (1), and all subsequent Theil equations, this paper weights each region by its income. The rationale for this decision is based on this paper's analysis of income inequality. As income inequality is the subject of the analysis, it is logical to weight these regions by their economic, as oppose to demographic, strength (Terrasi, 1999). This is consistent with Bourguignon (1979) who notes that when using the Theil coefficient to measure income inequality, it is preferential to weight the Theil coefficient using income as opposed to population.

The advantage of using the Theil coefficient over other measures of inequality, such as the Gini coefficient or the standard deviation of income, lies in the ability to decompose total inequality into various components. Initially, this paper decomposes inequality into between country and within country inequality using equations (2) through (4):

$$T_T = T_{bc} + T_{wc} \tag{2}$$

$$T_{bc} = \sum_c ln\left(\frac{y_c}{p_c}\right) \tag{3}$$

$$T_{wc} = \sum_{c} ln \left(\sum_{r} \left(\frac{y_r}{y_c} \right) ln \frac{(y_r/y_c)}{(p_r/p_c)} \right) \tag{4}$$

Where T_{bc} indicates the Theil coefficient for between country inequality, T_{wc} represents the Theil coefficient for within country inequality, y_c indicates country c's share of total income, p_c represents country c's share of total population and all other variables are defined as above.

Following from the decomposition of between and within country inequality, this paper analyses the causes of this inequality by decomposing inequality into the proportion caused by differing productivity and employment-population ratios across regions. This is accomplished through the use of equations (5) through (7):

$$T_T = T_{prod} + T_{emp} \tag{5}$$

$$T_{prod} = \sum_{r} y_r ln \left(\frac{y_r}{w_r} \right) \tag{6}$$

$$T_{emp} = \sum_{r} y_r ln \left(\frac{w_r}{p_r} \right) \tag{7}$$

Where T_{prod} represents the Theil coefficient of inequality due to differences in regions productivity, T_{emp} is the Theil coefficient of inequality due to differences in regional employment-population ratios, w_r is region r's share of the total workforce and all other variables are defined as above.

4 Data

This section describes the construction of the dataset used in this paper and presents descriptive statistics for key variables.

4.1 Constructing the Dataset

This paper uses data from the Cambridge Econometrics data set from 1980 to 2009. The Cambridge Econometrics (2009) dataset draws data from REGIO, which is the official source of EU regional data. The advantage of this dataset is that it provides regional gross value added (GVA) at constant market prices and

purchasing power parities in an unbroken time series for a large number of EU regions. Data on regional population and employment is also obtained from the Cambridge Econometrics dataset.

While the Cambridge dataset covers all 27 of the EU member states, there are significant gaps in data for some of the new accession states. For example, data is only available for former Soviet economies from 1991 onward. As a result these economies are excluded from this analysis to provide the maximum possible time frame for analysis. This results in the dataset being reduced to cover what has traditionally been referred to as the EU-15 countries, those countries which joined the European Union prior to 2004.

A similar problem presents itself for the NUTS2 regions of the former East Germany. For these regions, data is only available from 1991 onwards. Therefore, these regions are also excluded from this analysis, in order to ensure consistency throughout the analysis of inequality from 1980 to 2009. Also, Luxemburg is excluded from the analysis as the country as a whole constitutes one NUTS2 region. This makes its inclusion incompatible with the Theil coefficient decomposition.

The exclusions outlined above result in a dataset on 13 complete European countries and all their composite NUTS2 regions as well as all of former West Germany and the regions of which it is comprised. Hereafter, the composite regions and countries are referred to as the EU-14.

4.2 Descriptive Statistics for EU-14 NUTS2 Regions

Gross Value Added (GVA)per capita is used to measure living standards for each region. GVA is a measure of the value of the goods and services produced within a region. It is calculated as the gross output of the region minus the cost of producing intermediate inputs and supplies. Variation in GVA per capita can be viewed as a direct result of variation in factors that determine regional competitiveness (Fingleton and Fischer, 2010). Over the course of the 29 years analysed by this paper, GVA per capita in a number of the regions has varied dramatically.

Figures 1 and 2 display GVA per capita for the EU-14 NUTS2 regions for 1980 and 2009 respectively. In Figure 1 a large degree of income inequality is apparent between peripheral regions, such as those in Portugal, Spain and Ireland, and core European regions, such as those in West Germany, France and Northern Italy. However, even though the average annualized growth rate of the EU-14 regions from 1980 to 2009 was 1.7 percent a large degree of inequality can still be observed in 2009 GVA per capita levels, displayed in Figure 2. It can generally be noted that regions with the highest levels of GVA per capita in 1980 are also

the highest in 2009. However, there is some evidence to suggest that some of the poorer regions grew rapidly during this time period, overtaking or equalling some of the originally richer regions. The South-East region of Ireland for example grew from being among the poorest regions in the sample to one of the richest. A similar transformation, but to a lesser extent, can be observed in some regions of Spain.

[insert Figures 1 and 2 around here]

Turning next to productivity, where productivity is defined as GVA per worker, a similar picture emerges. Figure 3 displays the productivity for the EU-14 regions for 1980. It can be observed that generally regions which possessed higher income levels in Figure 1 also possess higher levels of productivity. Again, there appears to be a large degree of productivity inequality among European regions, with regions in Ireland, Portugal and Spain all exhibiting low levels of productivity. When comparing these values to the 2009 productivity levels displayed in Figure 4 a high degree of inequality remains. Again, there are a number of regions which outperform others, such as the two Irish regions. However, in general, regions which possessed lower productivity levels in 1980 retained those lower productivity levels through to 2009. This pattern is similar to that observed by Ostbye and Westerlund (2011), who note that while there is evidence of productivity convergence among some European regions (for example Norwegian counties), other areas are experiencing divergence (for example Swedish regions). This pattern of some regions converging while others fail to do so is evident in Figures 3 and 4.

[insert Figures 3 and 4 around here]

The final variable considered in this paper is the employment-population ratio. This is defined as the ratio of the number of persons in the work force to the total population of a region. Figures 5 and 6 display the employment-population ratio for the EU-14 regions for 1980 and 2009 respectively. Again, there is a large degree of variation across regions, with patterns appearing to persist over time. This pattern of regional differences in the employment-population ratio is discussed at length by Puga (2002). Puga (2002) focuses his discussion on the unemployment rate, noting that EU regions have become increasingly polarized. He notes that these substantial differences in the propensity to utilise labour may be a key driver of the increasing inter-regional disparities in economic output observed among European regions.

[insert Figures 5 and 6 around here]

5 Results

This section presents the results of the Theil decomposition of between and within country inequality as well as an analysis of whether this inequality has been driven by productivity differentials across countries/regions and/or whether differences in the employment-population ratio drives inequality.

5.1 Analysing Between and Within Country Inequality

Figure 7 displays the Theil coefficient for total inequality among the regions of the EU-14. Since 1980, this coefficient has displayed an upward trend increasing by approximately 11 percent. This suggests that, despite EU measures to promote cohesion, inequality has increased. This increasing trend in European inequality is also noted by Terrasi (1999) and Heidenrich and Wunder (2008). Heidenrich and Wunder (2008) suggest that inequality in Europe may be increasing due to a dichotomous system whereby convergence may be occurring between countries while the regions within those countries may be diverging. In order to investigate this proposition, it is necessary to decompose inequality into two factors; national inequality and regional inequality. Figure 8 displays the results of this decomposition.

[insert Figure 7 and 8 around here]

It can be observed that from 1980 to 2009 between-country income inequality has fallen. From 1980 to 1988, the level of inequality between the EU-14 countries remained relatively stable, however, from 1988 onwards there was a continual decline in between country inequality. This would appear to contradict with the results presented in Figure 7 until one notes that within country inequality has increased since 1980. Overall, within-country inequality has increased by approximately 50 percent. This finding of increasing within-country inequality and declining between-country inequality is consistent with Puga (2002).

In Figure 9 it can be observed that the proportion of total income inequality attributable to within-country inequality has increased, rising from approximately

62 percent of total inequality in 1980 to approximately 82 percent of total inequality in 2009. As the majority of total inequality is attributable to within-country inequality, this would suggest that for regional policy to be most effective within country inequality must be addressed.

[insert Figure 9 around here]

5.2 The Contribution of Productivity and the Employment-Population Ratio to Inequality

To investigate the drivers of the growing inequality seen in Figures 7 through 9, the proportion of inequality attributable to productivity differentials and differences in the employment-population ratio is analysed. Figure 10 displays the results of this decomposition.

[insert Figure 10 around here]

It can be noted that since 1980 the proportion of inequality attributable to productivity differences across countries and regions has fallen. A downward trend can be observed between 1980 and 2000 indicating that productivity levels across the EU-14 converged over this time. However, since 2000 productivity differentials have increased slightly and stabilized, perhaps indicating the end of this convergence process. As opposed to the convergence observed in productivity levels, income inequality attributable to differences in the employment-population ratio has increased since 1980. This suggests that while workers across the EU-14 are converging in their productive ability, differences are occurring in the concentration of employment.

Figure 11 presents the proportion of total inequality attributable to productivity and employment-population ratio differentials across the EU-14. From 1980 to 2009, the proportion of inequality caused by productivity differentials has decreased. As was observed in Figure 10, this resulted from the convergence in productivity levels. Differences in the employment-population ratio now make up almost 60 percent of total inequality. This is a reversal of the situation in 1980, when productivity differentials accounted for over 60 percent of inequality. As seen in Figure 10, this increase in the proportion of inequality derived from differences in the employment-population ratio is due to divergence in employment-

population ratios across the EU-14.

[insert Figure 11 around here]

This finding of converging productivity levels and diverging employment-population ratios is broadly consistent with Martin (2001) and Baddeley et al. (1998). Baddeley et al. (1998) focus solely on unemployment and conclude from their analysis that unemployment inequalities persist across European regions, suggesting that regions which previously possessed high levels of unemployment will continue to possess high levels of unemployment in the future. Similarly, Martin (2001) finds that, for a sample of EMU regions, while there is evidence of a small degree of convergence among regional productivity levels, there has been sharp divergence in regional unemployment levels. He proposes that this may provide some evidence against models such as the Solow growth model and that theories such as New Economic Geography (NEG), which are proponents of increasing returns, may more accurately represent the growth pattern of European regions. NEG theory predicts regional divergence resulting from the development of a core-peripheral pattern, with higher concentrations of employment and economic activity in the core. As the core attracts workers from other regions this would result in an improvement in the core region's employment-population ratio, while the peripheral region's employment-population ratio would suffer. This may explain the income inequality pattern emerging throughout the EU-14 regions.

6 Conclusions

This paper analyses income inequality in the EU-14 countries through the application of the Theil coefficient. Initially, the proportion of EU-14 inequality attributable to between-country and within-country inequality is analysed. A further Theil decomposition assesses the contribution of productivity and employment-population ratio differentials to total inequality.

The results suggest that EU-14 income inequality has increased between 1980 and 2009. However, the level of between-country inequality has decreased over the same period. The increase in total inequality is driven by widening within country inequality.

Between country convergence and within country divergence indicates that richer regions in poorer countries have caught up with regions in richer countries. It is clear from Figure 2 that the richer regions in poorer countries correspond

largely to capital city regions. This process of national core/periphery divergence is consistent with what would be predicted by New Economic Geography (NEG) theory or endogenous growth theory. NEG theory implies the concentration of economic activity in a number of core regions, which will experience increasing levels of agglomeration and growth. However, this comes at the expense of peripheral regions, which see a migration of economic activity to the core region (Fujita et al., 1999). This suggests that the core regions in each of the countries studied would be expected to form increasingly important economic agglomerations which would drive countries' economic growth while the peripheral regions would experience lower levels of growth due to not receiving the benefits accruing to agglomeration. Similarly, endogenous growth theory does not assume diminishing returns to capital (Romer, 1986). Therefore, this suggests that richer regions, which can invest more in research and development activities and develop higher levels of human capital, will experience faster growth than poorer regions, thus driving divergence. While it is not possible here to identify which of these theories may in fact more appropriately explain the experience of the EU-14 countries, both provide plausible economic arguments for national convergence at the same time as regional divergence.

There are also strong political factors that may hamper cohesion policies at European level, and which may intensify in the context of the current economic crisis in Europe. Martin (1999) argues that a more equal regional distribution of income may come at a cost of lower national growth. There is empirical support for this contention from Boldrin and Canova (2001) and Kim (2008). If national governments perceive such a trade-off it is unlikely, particularly during the current economic downturn, that they will favour policies which contribute to regional income equality. European regional and cohesion policy must overcome this national preference to successfully achieve more even distribution of incomes.

To shed some light on why income inequality is increasing, this paper decomposes total inequality into that caused by differences in productivity and the employment-population ratio across countries/regions. This decomposition highlights that, while productivity levels across EU regions have been converging, there has been increasing divergence in the employment-population ratio. This suggests that, while EU cohesion policy may have contributed to the reduction of productivity differentials across regions, it has had little effect on stemming the continued divergence in regional employment-population ratios.

This suggests that there is a need to re-examine EU regional cohesion policy to try to reduce the inequality present in regional employment-population ratios. However, this is not easily accomplished. In order to reduce inequality in the

employment-population ratio large scale employment would have to be generated in the poorer regions of the EU-14. To what extent this goal is accomplishable is uncertain. While existing policies place a large emphasis on job creation (European Union, 2010) they have had no apparent success in reducing employment-population ratio divergence. It is also necessary to consider that, under NEG theory and endogenous growth theory, it is desirable to produce agglomerations of economic activity as these allow for economies of scale and higher levels of living standards to be generated which would not be possible if the agglomerations did not exist.

The provision of greater economic autonomy to regional levels may result in policies designed to attract large-scale employment from multinational corporations. The Irish example of 'industrialisation by invitation' (Andreosso-O'Callaghan, 2000) demonstrates that peripheral regions in Europe, through policies such as favourable tax rates, may entice mobile investors. It is far from clear however, whether there is an appetite to provide tax-setting powers at regional level. This again is made more unlikely by the current pressure on tax rates in peripheral European regions due to austerity measures.

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