Inequality in energy intensity in the EU-28. Evidence from a new decomposition method

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Improving energy efficiency is a main goal in the EU-28, which is heavily committed to implementing a common energy policy in order to achieve energy savings and to guarantee sustainable development. Energy intensity is one of the most commonly used energy efficiency indicators since changes in energy intensity are seen as a proxy of changes in energy efficiency. In such a scenario, analysing changes in the energy intensity distribution among EU-28 member countries deserves interest because large disparities between countries could prevent the agreement on energy efficiency targets shared and approved by all member countries.

When exploring the energy intensity distribution in the EU-28, some main questions arise for analysts and policy makers. First, energy intensity shows a decreasing trend in the last decades, however EU member countries show different rates of improvement in energy intensity, especially after the enlargement in 2004 when Central and Eastern European countries with high energy intensity accessed the EU. Measuring inequality among EU-28 member countries explains whether countries' energy intensities are converging or diverging in relative terms. Second, inequality in energy intensity differs in relation to the point of the energy intensity distribution at which inequality is measured. Identifying the points at which inequality is highest enables policy makers to formulate country-specific energy efficiency recommendations for the most energy-intensive countries in order to foster the convergence in energy intensity between EU countries. Third, the investigation of inequality from the bottom of the energy intensity distribution to the top is more effective if the causes of inequality in energy intensity are detected. This kind of analysis can be developed by breaking down the inequality into components explaining the determinants of inequality at each point of the energy intensity distribution. To answer to previous questions, we use the Zenga inequality index, an inequality index which is applied to energy intensity for the first time. Furthermore, we suggest a decomposition of the Zenga index of inequality in energy intensity which explains the causes of inequality in energy intensity among countries. We break down the Zenga index of inequality in energy intensity by separating the effect of final energy intensity from that of energy transformation and revealing the effect of their interaction. This additional information enables analysts to examine the causes of inequality from the bottom of the distribution to the top.

We investigate inequality in energy intensity among EU-28 member countries from 2007 to 2012. In our analysis, we find that the energy intensity in countries toward the bottom of the energy distribution is on average 40 per cent lower than the energy intensity in countries toward the top. This relative gap in energy intensity is nearly stable from 2007 to 2012. This explains that, even though energy intensity has decreased in the EU-28 over the period considered, the energy intensity disparities between countries are almost unaltered, at least in relative terms. We find that the higher efficiency in energy transformation in the countries at the bottom of the distribution plays an important role in determining inequality between the least energy-intensive countries and the other countries. Our results show that the high inequality at the top of the distribution is due to the interaction of the disparity in final energy intensity with the disparity in energy transformation. More specifically, the effect of the high final energy intensity in the most energy-intensive countries is enhanced by the fact that the most energy-intensive countries transform energy less efficiently than the other countries.

From an energy policy perspective, our results suggest that improvements in energy transformation efficiency in the most energy-intensive countries can lead to considerable reductions in energy intensity inequality in the EU-28. The fact that gains in energy transformation efficiency could play a major role in reducing energy intensity inequality is important because it means that there is room for improvements in energy intensity also in countries having a considerable proportion of their economic activity in energy-intensive industries.

The informative potential of our method is useful in drawing policy implications since policy makers can identify the most unequal portions of the energy intensity distribution by exploring inequality from the bottom of the energy intensity distribution to the top. The decomposition of inequality explains the causes of inequality at each point of the energy intensity distribution, adding a substantial improvement in understanding the determinants of inequality from the bottom of the distribution to the top. Our examination of inequality in the EU-28 energy intensity distribution shows that inequality is higher when the comparison is between the least energy-intensive countries covering more than 80 per cent of total GDP and the most energy-intensive countries covering less than 20 per cent of total GDP. In the near future, EU policy makers may focus their attention on inequality between these two groups of countries in order to check if inequality between the two groups increases or decreases over time.

Our last remark concerns the use of the intuitive interpretation of the Zenga inequality index to check the achievement of reductions in energy intensity inequality. Since the Zenga index of inequality in energy intensity explains that relative gap in energy intensity between the least energy-intensive countries and the most energy-intensive countries, policy makers could set an expected

relative gap in the energy intensity distribution and monitor the progress towards the achievement of this target over time.