Climate Protection Potential of Digital Transformation - the Role of Production Relocation

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Digital technologies are a critical enabler for attaining the sustainability goals of the Green deal in many different sectors" (European Green Deal; European Commission 2019). This sentence from European Green Deal shows the high hopes that politicians are putting in digitisation to achieve the climate goals. On the one hand, information and communication technologies (ICT) or more general digitalisation is a potential source of energy efficiency improvements (see e.g. GeSI & Accenture 2015) as ICTs improve the quantity and quality of information leading to a reduction of relative energy consumption (e.g., smart manufacturing).

On the other hand, ICTs consume energy themselves and improvements in performance per watt may not offset the higher demand for computing power in a more a more digitalised world. A priori, the net effect of digitalisation is therefore unclear. Although, the empirical literature on digitalisation and energy consumption at the industry level is still rather scarce, there is some evidence on a positive link (meaning less energy consumption) between investments in ICT and energy demand at the sectoral level (Schulte et al. 2016, Bernstein and Madlener 2010, Collard et al. 2005).

However, there are certain drawbacks of these studies. The most recent data used in these studies ends in 2007, and therefore ignoring the fast pace of digitalisation in the 2010s. Furthermore, as digitalisation advances it is easier to outsource energy intensive production processes to foreign countries. So the measured positive impact of digitalisation might just be driven by the ICT induced relocation of energy intensive production processes to foreign countries instead of actual energy savings.

The contribution of this paper is twofold. Firstly, as in Schulte et al. (2016), we use a translog cost function for estimating the impact of ICT on energy demand at the sectoral level for nine OECD countries based on the share of energy costs in total variable costs, but using more recent data for the period 2000 to 2014. Secondly, we use World Input Output Tables (WIOD) to incorporate the energy consumption of the whole value chain to control for the relocation of energy-intensive production processes to foreign countries. These results give a more detailed

insight in the overall impact of ICT on energy demand and climate change and policies can be implemented more efficiently and based on a more founded understanding of all effects ICT has on energy usage.

Our empirical analyses confirm that the negative association between ICT and energy demand of Schulte et al. (2016) still holds in the more recent time period 2000 to 2014 in our cross-country cross-industry panel data set for nine OECD countries and 28 industries.
However, the size of the effect is smaller and the results are less robust than in the paper by Schulte et al. (2016). A one percent increase in ICT capital is associated with a 0.110 percent decrease in energy demand which is about half of the effect measured by Schulte et al. (2016) of 0.235 percent. The net effect of digitalisation, measured as the growth rate of ICT capital services stemming from EU KLEMS, is still positive, meaning that digitisation helps to achieve the climate goals.

As the relationship between ICT and energy demand becomes insignificant in the specifications including the energy demand of the whole value chain, we find initial evidence that some of the positive effects of ICT on energy demand might be explained by the relocation of energy intensive production processes and not efficiency improvements of ICT.
The results for the inclusion of the energy demand of the whole value chain need to be carefully interpreted as we cannot rule out that our (insignificant) results might be driven by data quality issues. Therefore, further research and especially huge improvements with respect to the data availability of energy prices and industry-level ICT data is needed to confirm our results.

References

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