How is Mobile Broadband Affecting CO2 Emissions Globally?

Harald Edquist
Ericsson Research
harald.edquist@ericsson.com

Introduction and research question:

In 2021, it appears almost impossible to imagine a world without smartphones. Thus, mobile broadband (MBB) without doubt is one of the most important innovations of the early 21st century. MBB has spread rapidly in most countries of the world and have had an important effect on how we lead our lives. Moreover, MBB has had large impact on economic development through faster distribution of information and new ideas, increased competition and distribution of services such as steamed music (Edquist et al. 2018). What is less known is the impact from MBB on climate change and particularly CO2.

Reducing CO2 emissions is an important sustainable development goal. During most of the 20th century CO2 emissions were neglected by politicians and policy makers. Many did not understand that CO2 emissions were causing climate change. The effects from CO2 emissions became more evident as the Intergovernmental Panel of Climate Change (IPCC) started to issue its first assessments reports in 1990 (Houghton et al. 1990). It concluded that there is a greenhouse effect that keeps the earth warmer. It also concluded that CO2 had been responsible for over half the enhanced greenhouse effect in the past and that it is likely to remain so in the future.

To avoid further global warming, it is evident that CO2 emissions must be radically reduced in the future. In the last decades the economic impact of information and communication technology (ICT) has increased substantially with the spread of computers, smartphones and tablets. This has allowed a large part of the world population to connect over the Internet. ICT is believed to have a large potential in reducing CO2 emissions, but there are only a few studies that has investigated the association between ICT and CO2 emissions at the global level.

Añón Higón et al. (2017) uses an ICT index based on 5 different components. They find that the relationship between ICT and CO2 emissions is an inverted U-shaped relationship based on a panel of 142 countries for the period 1995–2010. Thus, initially additional ICT investment increase CO2 emissions, but CO2 emissions start to reduce when a threshold level of ICT development has been reached. Hernnäs (2018) extents the analysis for the period 2000–2016 and find similar evidence when ICT is measured as unique mobile subscribers per inhabitant. There is to my knowledge no paper that has investigated the impact of mobile broadband on CO2. Thus, the purpose of this paper is to investigate the following questions:

Is there an association between the introduction of mobile broadband and CO2 emissions globally?

To what extent has the diffusion of mobile broadband affected CO_2 globally?

Methodology:
The method used in this paper will be based on econometrics. In order to test if there is a direct impact when MBB is introduced a difference-in-difference specification is used:

$$\ln CO2cap_{i,t} = B1 + B2*D_{i,t} + B3*\ln GDPcap_{i,t} + B4*T_t + (\alpha_i+\varepsilon_{i,t}) \quad (1)$$

where $CO2cap_{i,t}$ is carbon dioxide per capita at time t in each country i. $D_{i,t}$ is a dummy variable which takes the value 0 before MBB is introduced and 1 when MBB is introduced. $GDPcap_{i,t}$ is real GDP per capita at constant 2017 national prices (in 2017 US$). T_t is a set of year dummy variables that control for economic shocks. Finally, α_i is a set of unobserved country specific effects and $\varepsilon_{i,t}$ is the error term.

Over time MBB may also have a continuous impact. As argued in the literature section, it can be driven both by negative impact on CO_2 from energy savings, smarter transport etc. However, there might also be positive impact from ICT due to rebound effects. To capture this association the following model is used:

$$\ln CO2cap_{i,t} = B1 + B2*MBBpen_{i,t} + B3*\ln GDPcap_{i,t} + B4*X_{i,t} + B5*T_{i,t} + (\alpha_i+\varepsilon_{i,t})$$

where $MBBpen_{i,t}$ is MBB penetration measured as the share of MBB connections in total connections for a particular country i. $X_{i,t}$ is additional control variables.

Expected results:

ICT and MBB can have both positive and negative effects on CO_2 (Erdmann and Hilty 2010). The direct effects are often negative and defined as the impacts of the lifecycle of ICT hardware and software. The indirect effects are the potential for MBB to lower emissions. For example, MBB supports more efficient use of energy, better industrial processes and reduced demand for transportation. This implies that MBB drives dematerialization and productivity resulting in less resources being used and thus resulting in lower CO_2 emissions.

The rebound effects are the changes in demand that is the result of productivity gains. Already in the 19th century, the English economist William Stanley Jevons observed that the consumption of coal soared, despite the improvement of the steam engine (Jevons 1865). Thus, increased productivity leads to increased demand that may increase the total consumption in the economy. These effects are known as rebound effects and may have both positive and negative impacts on CO_2. It remains to be seen which of the effects that dominates.

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