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Brief

# Digital Diffusion and Covid Vaccine

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## Abstract

**FEEM Policy Brief**

Digitalization is a complex phenomenon, affecting Europe in several manners. This brief comments on the link between digitalization and first results in vaccination programs against the Covid-19 pandemic across EU27+UK. In several cases, it has been noted that without digitalization, the response to the pandemic event would have hit harder the population's welfare. There are several ways to measure diffusion. Many studies used the percentage of the population having access to internet services. Others used the number of hours used in the internet-related activity. In this work, we will employ the number of digital gadgets within a nation averaged by the population. To present the structural impact that the diffusion of Digital gadgets has had on the selected nations, we will present its relation with the Human Development Index and the specialization rate of the workforce.

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# 01 Digitalization in the pre-Covid aftermath and recovery relation

Digitalization is the transformative phenomenon that allows human activities to be completed partially or entirely on a digital platform (McQuail, 2010). The diffusion of personal computers, handphones, and servers introduced new ways to organize knowledge. Planning operations could be enforced faster, and policies could be monitored easier. Besides the evidence in everyday life, the pandemic event of 2020 highlighted the relevance of the digitalization process. Without widespread internet access, distance schooling is impossible to plan (Nguyen et al., 2021; Vuorikari et al., 2020); planning for vaccinations hastily requires a lighter effort using an online booking system along with databanks (Frascella et al., 2020). Material Indicators of digitalization diffusion reflect the European response to Covid-19. In this brief, I will present two indexes of digitalization measures referring to digital gadgets diffusion. According to national estimates, one relates the average mass per person, while the other refers to the number of gadgets per person to the national level. To clarify the relation to welfare and skill development, I coupled the indicators to the Human Development Index and the level of Specialization in the workforce. Finally, I will plot the relation that emerges between the percentages of population vaccinated the first time in March.

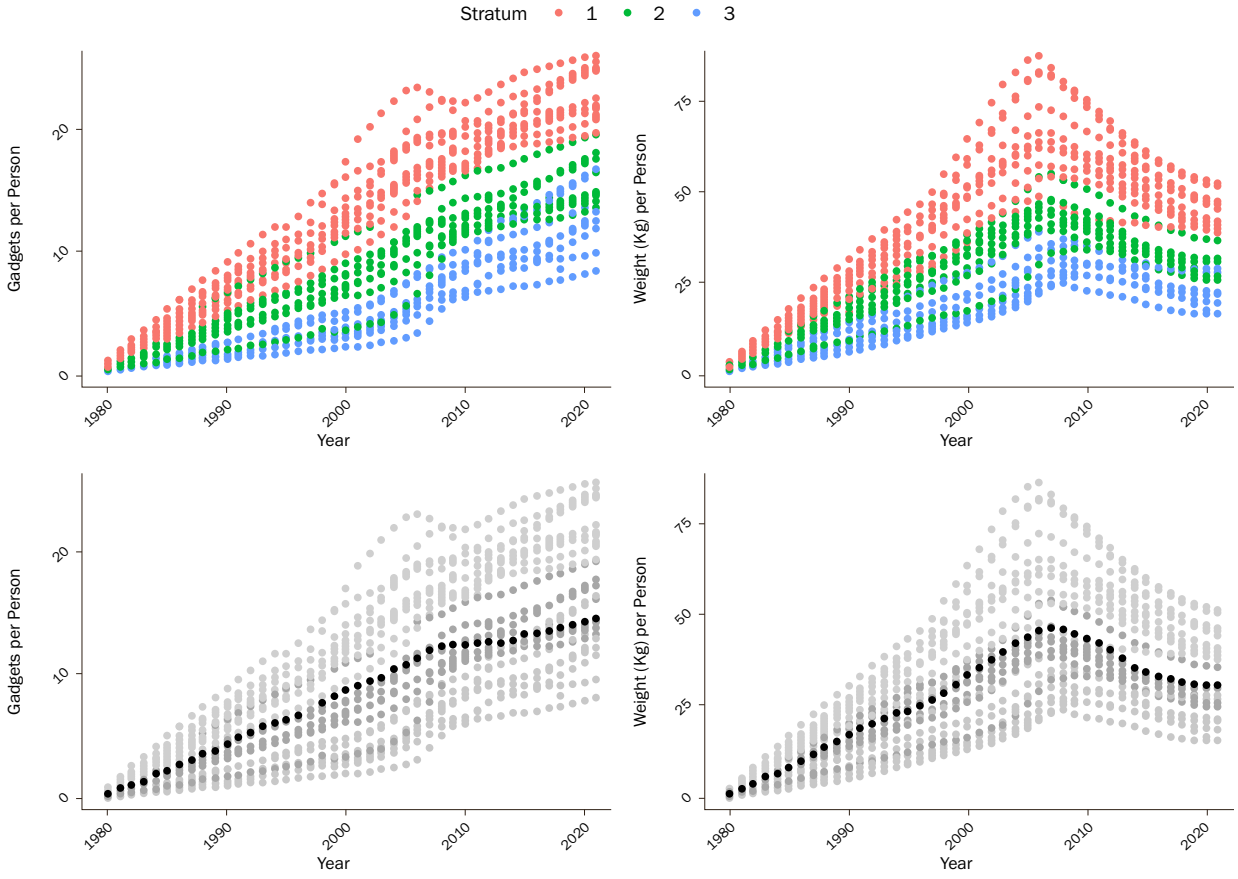
**Table 1: Digital Gadgets and UNU Key reference**

| UNU Key | Definizione |
|---|---|
| 0301 | Small IT equipment (e.g. routers, mice, keyboards, external drives & accessories) |
| 0302 | Desktop PCs (excl. monitors, accessories) |
| 0303 | Laptops (incl. tablets) |
| 0304 | Printers (e.g. scanners, multi functionals, faxes) |
| 0305 | Telecommunication equipment (e.g. (cordless) phones, answering machines) |
| 0306 | Mobile Phones (incl. smartphones, pagers) |
| 0307 | Professional IT equipment (e.g. servers, routers, data storage, copiers) |
| 0308 | Cathode Ray Tube Monitors |
| 0309 | Flat Display Panel Monitors (LCD, LED) |
| 0401 | Small Consumer Electronics (e.g. headphones, remote controls) |
| 0402 | Portable Audio & Video (e.g. MP3, e-readers, car navigation) |
| 0403 | Music Instruments, Radio, Hi-Fi (incl. audio sets) |
| 0404 | Video (e.g. Video recorders, DVD, Blue Ray, set-top boxes) and projectors |
| 0405 | Speakers |
| 0406 | Cameras (e.g. camcorders, photo & digital still cameras) |
| 0407 | Cathode Ray Tube TVs |
| 0408 | Flat Display Panel TVs (LCD, LED, Plasma) |

## The indicators

The digitalization phenomenon can be measured using various indicators. Recent studies employed the rate of the population having Internet (Gonzalez-Garcia et al., 2018; Pérez-Castro et al., 2021; Solomon & van Klyton, 2020), average internet use (Al-mutawkkil et al., 2009; Gerpott & Ahmadi, 2015). While these are examples of top-down measures, we will use a demand-side, bottom-up approach, hence the number of digital gadgets per person. In other words, digitalization could be framed as the accumulation of goods that allow individuals to transfer daily activities on a digital platform. According to a methodology called inflow-driven (Wiedenhofer et al., 2019), in-use stock variation could be measured as the sum of gadgets produced and imported minus exports and waste. The starting point of the observation is either calibrated using econometric exercises or using meta-analysis information. Data adopted in this work refers to the research project called ProSum; its results pictured the diffusion of electrical equipment commodities in European Union from 1980 to 2020 (Huisman et al., 2017). Among these commodities, it is possible to find digital gadgets too. Using UNU (United Nation University) keys classification, it is possible to organize in-use stock aggregating items listed in table 1. The resulting stock could be measured in terms of the number of Gadgets and average weight.

**Figure 1. Average number of gadgets vs average weight; Italy highlighted Black**



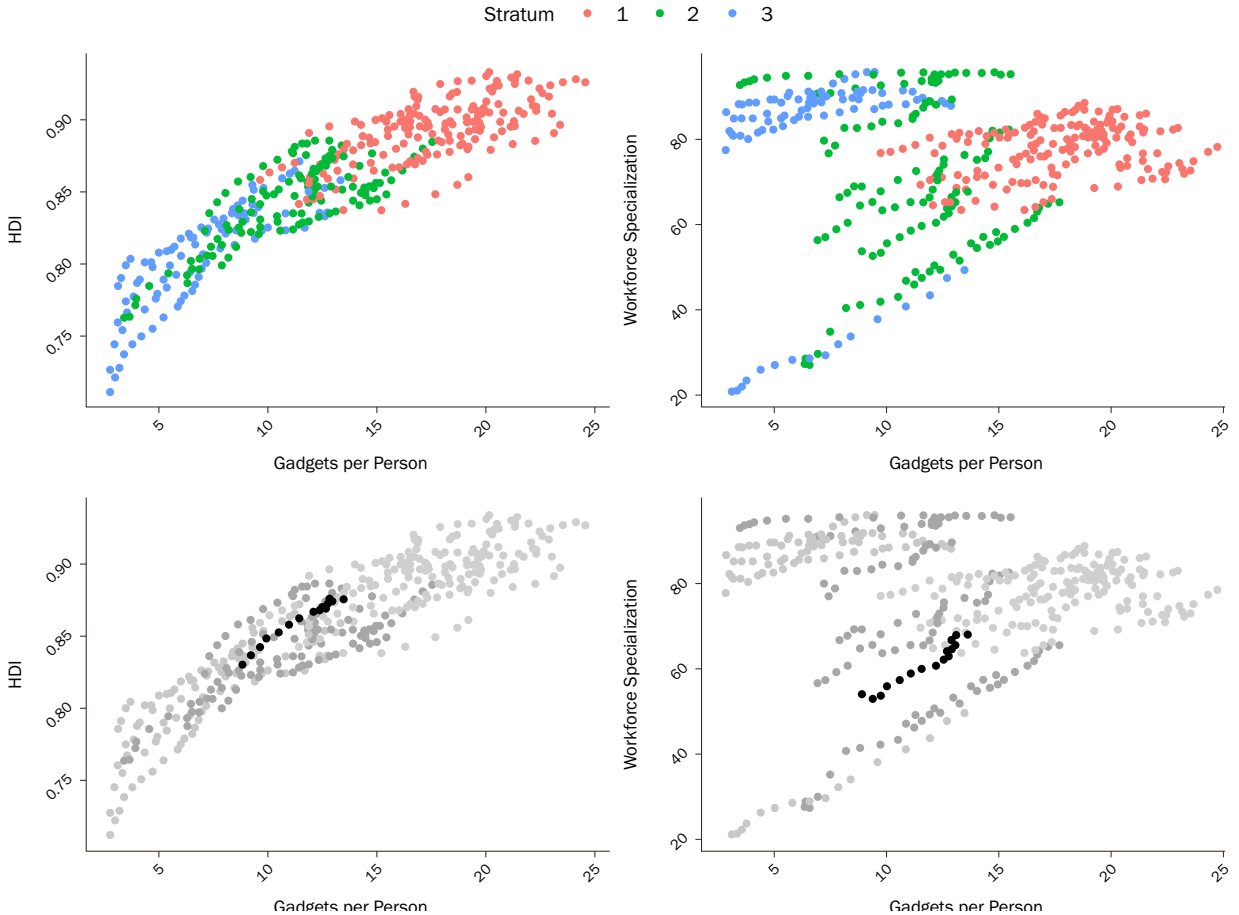
In the first figure, we plotted the average number of gadgets on the left and the average weight per person on the right according to Stratum:

1. Above 35.784 Euros: Austria, Netherland, Ireland, Sweden, Belgium, Denmark, Germany, United Kingdom, Finland, France, Luxemburg
2. Between 23.068 and 30.289 Euros: Spain, Slovenia, Cyprus, Czech Republic, Malta, Portugal, Slovakia, Italy, Greece
3. Below 23.068 Euros: Poland, Hungary, Estonia, Croatia, Lithuania, Latvia, Bulgaria, Romania

The first refers especially to Nordic and highly developed nations, parts of the first tertile of the economic activity in Europe. Among these, we find Sweden, Denmark, Germany, and the Netherlands. The second Stratum groups the nations in the second tertile of economic activity, where we find Italy, highlighted in this work as the black dots over grey. Lastly, the third stratum groups nations on the third tertile of the economic activity. In this Stratum, we find countries participating in the Visegrad group and eastern European Union. It is visible in figure 1 the differences in strata and accumulation of digital gadgets.

Furthermore, I opted to use Gadgets instead of average weight per person due to the drastic change in 2005. However, gross numbers of commodities are reflecting the growth in accumulation. I will therefore use such an indicator to compare digitalization and pre-Covid welfare dynamics. Afterward, the number of gadgets per person will be related to the vaccination rate per Nation in March.

**Figure 2. Digitalization against Human Development Index and Specialization of Workforce: Italy below in Black**



## The pre-Covid world

Pre-Covid Europe was already affected by the digital transformation. The relation with welfare has already emerged before 2020. Figure 2 synthesized the connection between the Human Development Index and the number of Gadgets per person. On the right side of the same image, it is possible to see the relationship between workforce specialization and the number of gadgets. I have underlined the performance of Italy furthermore in black in the plots below. Data refer to a reconstruction of EU27 plus United Kingdom. It is possible to see that the relations with digital gadgets are almost linear. Nations that stem from the third decile of the distribution have appreciated improving livelihood conditions thanks to the diffusion of digital products.

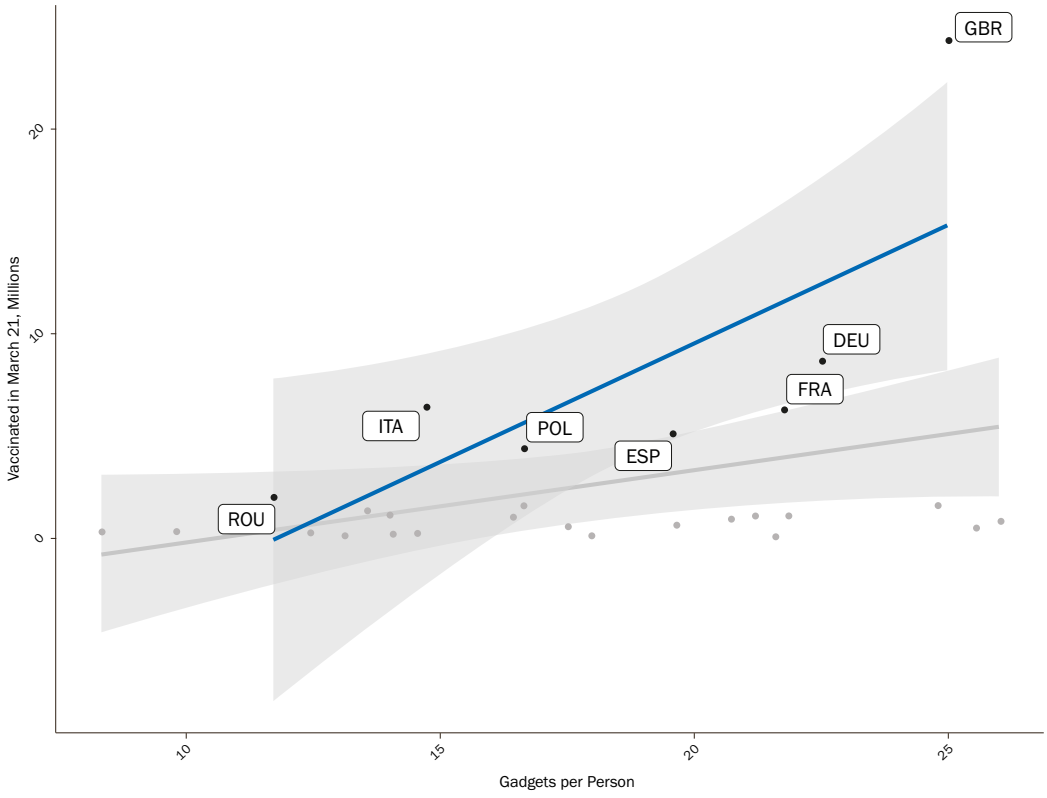
Similarly, the level of workforce specialization grows according to the diffusion of said objects; for a detailed analysis, further factors must be considered, such as literacy rates and unemployment levels. For example, the first Stratum has reached a stable specialization level between 60% and 80% since 1980. However, nations with a level lower than 70% have improved their condition linearly with the diffusion of such products. It is possible that access to digital systems created new professional profiles and simplified the specialization level of specific categories. The service economy was positively affected by the digital transformation, allowing for increased levels of productivity of the manufacturing process (Marin & Mazzanti, 2013). According to Adam Smith, the nation's wealth is driven by the division of labor (Smith, 1791). The impact of digitalization would, in his opinion, be a driver of national wealth.

Considering the impact during the pandemic, it is possible to see that where the diffusion of digital products was higher, the speed of vaccination and management of public services was more accessible. The scholastic system responded with distance lectures. The service sector organized itself with smart working practices. It mitigated the socio-economic effects of the pandemic measures. The economic crisis had increased the vulnerability to absolute poverty. The lockdown and curfew measures have negatively affected mental and physical health (Fiorenzato et al., 2021; Sabat et al., 2020). Digital products have reduced the harmful effects of isolation and aided in keeping a decent level of morale across nations. In the moment of organizing vaccination, it allowed more accessible forms of organizations.

## Hasting the Response

Nations endowed with servers and well-serviced websites for booking have perceived an average vaccination rate higher than those with fewer gadgets during the first three months. Looking at figure 3, it is possible to note that the number of vaccinated grows according to the diffusion of digital gadgets. Furthermore, the nation high on the right, with the most significant level of vaccination, is United Kingdom (GBR): with more than 35% of the vaccinated population. I highlighted Italy as well (ITA), with around 15 Gadgets per person has vaccinated more than 5 million inhabitants up to March.

**Figure 3. Vaccination rate in March Against number of Gadgets in 2020**




By observing the European nations altogether with the United Kingdom, there exists a positive relation between vaccinated rates and digital diffusion (while considering population mass). Other factors should be considered, such as organizational effectiveness, internal capability to produce vaccines, and the resources to distribute them that could require a specific study. However, the presence and use of digital instruments have allowed a higher incidence of vaccination in highly populated nations. Compared to its partners, Italy presented a similar diffusion compared to Poland, Spain, France, but not Germany.

## In synthesis

Digitalization is a transformative process currently shaping Europe. It has allowed responding to the pandemic crisis in various methods. For example, mental fatigue was easier to manage while keeping distance using internet-based communication services. It allowed maintaining social activity alive and possibly functioning. Schooling and university activities were still operational to some degree during lockdowns. For work safety, entire work sectors could be managed at a distance using smart-working practices; several service jobs will probably be drastically changed after this year. For booking purposes, websites were organized to ease the stress from hotlines. Several methods could relate to the aid of digitalization changes during Covid-19. The measure I used allowed seeing the bottom-up dimension, a perspective from the individuals. Using product diffusion, we could experience a view that previous approaches could not consider.

The run to vaccinate the entire population is still not over. Digitalization was an advantage point for several nations. Increased diffusion of digital gadgets has induced consolidated benefits to socio-economic trends across European partners. Digitalization will probably play a predominant role in the next phase of recovery from the second systemic crisis of the twentieth century.

# 02 Policy Conclusion

The diffusion of digital gadgets is a bottom-up measure of digitalization. The positive relationship between the human development index and the specialization of the workforce indicates that it is related to European welfare. A deeper study of the long-term effects and limits of such technological shift could improve the knowledge over the utility of digitalization. Furthermore, where the diffusion was structurally higher, the speed of vaccination was higher, indicating that at some level, the distribution of digital gadgets affected the results of vaccination programs.

The effectiveness of digital gadgets is, however, connected to the top-down measures of internet access. The relation is almost irrelevant when portions of the population do not directly own digital platforms. Digital Poverty is a present issue in European Union; the lack of Computers and other digital gadgets in households affected the performance of distance schooling. Furthermore, the capability to use them properly is a requirement to achieve potential benefits. Among cited cases, an e-mail system could aid the planning of large-scale medical programs. Therefore, policies intended to subsidize the diffusion of digital gadgets and reduce the so-called Digital Poverty are ever more relevant. The involvement of soft computer skills in schooling could create the basis for the digitalization of policies as in the vaccination agenda examples. Furthermore, spillovers in terms of skill development could improve the effectiveness of schooling and reduce functional illiteracy in the long-term (Baskakova & Soboleva, 2019).

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