

The grey digital divide and welfare state regimes: a comparative study of European countries

The grey digital divide in European countries

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Abstract

Purpose – Technology access, digital skills, and digital services are increasingly prerequisites for public life and accessing public services. The digital divide in contemporary societies matters for efforts to digitalize the welfare state. Research has already mapped individual determinants of digital exclusion and the existence of an age-related digital divide. However, far less attention has been paid to variations in digital inclusion between countries and to their potential explanations related to political systems. This study explores the influence of variations in welfare regimes on the digital divide among seniors (aged 65+) in Europe.

Design/methodology/approach – This article presents time-series cross-sectional analyses of the relationship between welfare state regimes and digital inclusion among seniors in European countries. The analyses are based on data from Eurostat, the World Bank, and the UN E-Government Survey.

Findings – The authors find extensive variation in the digital inclusion of citizens between welfare regimes and argue that considering regime differences improves the understanding of these variations. The findings indicate that the age-related digital divide seems to be least evident in countries with more universalistic welfare regimes and most evident in countries where seniors rely more on their families.

Originality/value – This is the first comparative study of the association between welfare state regimes and digital inclusion among seniors.

Keywords Digital divide, Digital inclusion, Seniors, Welfare regimes

Paper type Research paper

1. Introduction

Due to declining mortality and fertility, Europe is increasingly “grey”. According to [European Commission \(2015\)](#) predictions, seniors (i.e. aged 65 years and over) in the European Union (EU) will constitute 28% of the population by 2060. The phenomenon, signified by an increasing median age of the population as the share of seniors increases while the share of younger citizens decreases, is called population ageing. Population ageing challenges the welfare state, which represents a form of government that promotes the economic and social well-being of citizens ([Britannica T. Editors of Encyclopaedia, 2020](#)), in several respects. Age has been found to be the main risk factor for disease in developed countries ([Niccoli and Partridge, 2012](#)), so a growing proportion of seniors in the population will put additional strain on healthcare and other aspects of welfare systems ([Prince et al., 2015](#)).

There is relative consensus that the single most important action to secure high-quality welfare programs in relation to population ageing is to extend the working life ([Economic Policy Committee and European Commission, 2006](#)). Another way to address this is to introduce digital technologies in welfare services and institutions. This digitalization wave has already touched many health and social care services targeting seniors ([Hardey and](#)

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Loader, 2009), such as the online delivery of pension services (Breit and Salomon, 2015), but as noted by Eichhorst and Rinne (2017, p. 7), “the full dimension of the digital transformation is only just emerging”.

However, digitalizing welfare services entails both challenges and opportunities. One major challenge is that digital exclusion results in unequal access to digital welfare services in the population. Moreover, welfare service users tend to belong to societal groups that are more likely to be digitally excluded. Seniors in particular are often on the wrong side of the digital divide – a multidimensional phenomenon that reflects inequalities in digital utilization (Liao *et al.*, 2022) – and prone to stereotypes (Alexopoulou, 2020a; Mariano *et al.*, 2020).

Although digital inclusion, digital exclusion, and the digital divide have been subjects of extensive research over the last three decades, previous research has emphasized individual-level variations in and determinants of the digital divide (Van Dijk, 2020). Structural or aggregate-level aspects of the digital divide remain under-studied (Helbig *et al.*, 2005). Some authors have argued that the digital divide may be associated with the structure of the welfare state (Birdsall, 2000; Perrons, 2008). Birdsall (2000) argued that a universal welfare state might help combat the digital divide through comprehensive public policies that seek to expand the information society to encompass all citizens. In less universalistic welfare systems, in contrast, socioeconomic inequalities are expected to be reproduced in the digital domain, as governmental efforts to reduce digital inequalities may be less comprehensive (Räsänen, 2006; Peacock, 2007).

This study contributes to multiple aspects of the field of digital divide research. First, it emphasizes the importance of age in ICT research, a somewhat neglected topic according to Tams *et al.* (2014, p. 284) “IS research has yielded only limited insight into the role of age in phenomena involving ICTs”. Second, this study explores the influence of welfare regimes on the digital inclusion of seniors, a topic largely neglected in earlier research. This focus means that the study advances our understanding of how contextual factors – what Bellini *et al.* (2019) call the background environment – influences digital inclusion.

The study’s aims are: (1) to map differences in multiple aspects of seniors’ digital inclusion between European countries with diverging welfare regimes; and (2) to investigate the explanatory value of welfare regime variations for understanding variations in seniors’ digital inclusion between European countries. Digital inclusion is seen by the authors as one of several dimensions of social inclusion, a concept denoting “the process of improving the terms on which individuals and groups take part in society” (Alin, 2017, p. 18). Following this definition, digital inclusion signifies the terms on which individuals and groups participate in digital aspects of society [1]. Social inclusion gained prominence in the social policy discourse in late 1980s Europe in order to replace social exclusion (Wilson, 2006) and poverty (Aasland and Fløtten, 2001).

The paper is organized as follows. Section 2 presents the theoretical background, focusing on two areas: welfare regime theory and the digital divide. In section 3, we present our research model, linking welfare regime theory to the digital divide. Section 4 presents the methods and measures of the study, followed by the results in section 5. The article ends with sections 6–9 discussing the study’s results, implications, limitations, and conclusions.

2. Theoretical background

2.1 Different paths in different welfare regimes?

There has been ongoing academic debate about the existence of different welfare regimes since the publication of Esping-Andersen’s (1990) ground-breaking *The Three Worlds of Welfare Capitalism*. The three ideal types so logically presented by Esping-Andersen were explained using statistical data. This made the book a benchmark for scientific subjects of a social nature ranging from housing (Hoekstra, 2003) to the loneliness experienced by seniors (Nyqvist *et al.*, 2018).

Esping-Andersen (1990) defined a welfare state regime as a specific arrangement of the institutional determinants of social rights and stratification by means of the state, market, and family. Other scholars see the welfare regime as “the entity of social policies and institutions that guarantee a person the maintenance of a livelihood without reliance on the market” (Kammer *et al.*, 2012, p. 457). This definition follows Esping-Andersen’s notion of de commodification, which is explained below in detail. As Offe (1994, pp. 90–91) noted, a welfare state

must operate upon the basis of a socially and politically validated conception of ‘how much is enough under given circumstances’. . . . The practice of the welfare state is embedded in a widely shared set of background assumptions concerning some operationally appropriate notion of social justice which specifies the (social and substantive) limits up to which, but not beyond which, social security enhancing policy arrangements are called for, and who is to carry the burden of such provision . . .

This quotation shows that a salient social contract underlies every welfare regime. Larsen (2008) went further, adding that not only do institutions – which developed thanks to specific historical conditions – matter, but that institutions also frame the adjacent public opinion on social matters. In Larsen’s (2008, p. 148) words.

The institutional structure of the different welfare regimes influences or – using another terminology – frames the way the public perceives the poor and unemployed. Thus, the political preferences of individuals are not exogenous, as in rational choice theory, but are highly influenced by the institutional structures.

In short, cross-national differences in attitudes, beliefs, demonstrated values, habits, and routines regarding welfare policy can somewhat be explained by prevailing differences in the institutional structures of various welfare regimes. Actually, these differences not only seem to affect the “deservingness” criteria described above, but could also constrain other social policies, including digital policies and the level of digital assistance targeting seniors to help them become independent technology users. This has been validated by the welfare literature, which maintains that welfare regimes dominated by universal rather than selective benefits and services produce quite different public debates and perceptions of recipients (Larsen, 2008) and, by extension, may lead to the development of more or less generous policies.

Returning to Esping-Andersen’s (1990) views, countries can be sorted into three ideal-typical welfare state regimes differing greatly from one another. He offered a typology of 18 welfare states from the Organization of Economic Cooperation and Development (OECD). One of Esping-Andersen’s basic arguments was that it is incorrect to analyze welfare states only in terms of actual spending; instead, he suggested three alternative criteria:

- (1) *de commodification*, which means the extent to which an individual’s welfare depends on the market, particularly in terms of pensions, unemployment benefits, and sickness insurance;
- (2) *social stratification*, which signifies the role of welfare states in maintaining or breaking down social stratification by providing more opportunities to individuals; and
- (3) the *private–public mix*, which describes the relative roles of the state, family, voluntary sector, and market in welfare provision.

Like any theory, Esping-Andersen’s prompted criticism, which was well summarized by Bamba (2007). Early on, Ferrera (1996) argued for the existence of a fourth, distinct “Southern” welfare regime characteristic of Spain, Italy, Portugal, and Greece. Ferrera rejected the idea that this Southern cluster constituted a subcategory of the continental/corporatist model. In his view, the Southern regime has certain identifiable features:

fragmented welfare provision, a healthcare system that delivers limited and partial coverage, clientelism, patronage networks, and reliance on the institution of the family.

For the present aims, we attempted to formulate a comprehensive typology of welfare regimes. Our point of departure was the welfare regime typology of [Ferrera \(1996\)](#), which, however, excluded two European countries: Malta and Cyprus. According to [Gal \(2010\)](#), these countries were coded as having a Southern European welfare model. Furthermore, we added an additional welfare regime that neither Esping-Andersen nor Ferrera proposed in their initial typologies: the Central and Eastern European welfare regime, characterized by a low public financial capacity to support social policies ([Aidukaite, 2010](#)). Moreover, these countries lag in trust as regards political participation and spend less on social protection than do some other countries ([Fenger, 2007](#)). By combining these classifications of welfare regime types, we created a typology that covered all EU Member States (see [Table 1](#)).

Table 1.
Categorization of
countries in different
welfare regimes

Liberal welfare model	Conservative welfare model	Social democratic welfare model	Southern European welfare model	Central and Eastern European welfare model	
United Kingdom Ireland	Germany France Belgium Netherlands Luxembourg Austria Switzerland	Sweden Denmark Norway Finland	Italy Spain Portugal Greece Cyprus Malta	Bulgaria Romania Estonia Latvia Lithuania	Czech Republic Croatia Poland Slovakia Slovenia Hungary

Source(s): [Ferrera \(1996\)](#), [Gal \(2010\)](#), and [Lauzadyte-Tutliene et al. \(2018\)](#)

It is worth recalling that there is no unanimity regarding the inclusion of countries in specific clusters. For instance, the Netherlands and Switzerland are often considered hybrid cases and put into different regimes, in agreement with individual scholars' standpoints ([Arts and Gelissen, 2002](#)). Despite this, typologies have retained their relevance and many recent studies still classify countries as belonging to various welfare regimes (e.g. [Castles and Obinger, 2008](#); [Bertin et al., 2021](#); [Sivonen and Kukkonen, 2021](#); [Strid et al., 2021](#)).

2.2 Levels of the digital divide

The literature identifies three levels of the digital divide ([Van Dijk, 2005](#); [Scheerder et al., 2017](#)), which was initially considered primarily a problem of material–physical access, for example, the ability of an individual to buy a computer, establish a home Internet connection, or have a telephone line, i.e. the first-level digital divide (cf. [NTIA, 1998, 1999](#)). Research broadened its view to consider a second-level digital divide, namely, the divide in digital skills (cf. [Attewell, 2001](#); [Hargittai, 2002](#)). The proficiency divide in utilizing digital resources to achieve online and/or offline outcomes or opportunities was later considered the third-level digital divide ([Wei et al., 2011](#); [Van Deursen and Helsper, 2015](#)). A related concept is digital effectiveness, which is the result of adequately resolving user limitations regarding proper access, cognition, and behavior towards technology ([Bellini, 2018](#)). This study focuses on the framing comprising the first-, second- and third-level digital divides.

The third-level digital divide, also known as the utility gap ([Gómez, 2018](#)), clearly connects digital inequalities to citizen participation in public life by discarding the binary division

between the online and offline spheres of society. The third-level digital divide is important in relation to the welfare state. It presupposes that individuals able to use digital communication technologies will get more out of their encounters with state institutions (Van Deursen and Helsper, 2015) and will more effortlessly exercise their rights (“digital citizenship”; Mossberger *et al.*, 2003) than will the digitally disadvantaged. This is more obvious in digitally advanced countries such as the Netherlands, where digital channels of communication have been encouraged by policy-makers as a way of improving contacts between citizens and government (Van Deursen and Helsper, 2015).

More specific than the digital divide, the “grey digital divide” concept was developed by Millward (2003) to describe the low Internet use of older adults and their exclusion from this medium (cf. the “ageing-related digital divide”; Mubarak, 2015, p. 90). From its name, the concept highlights that older people encounter relatively more difficulties in employing the internet or technology more broadly. The grey digital divide has the same levels as the broader digital divide concept, referring to the obstacles that older people encounter in terms of access (first-level divide), skills (second-level divide), and opportunities (third-level divide).

3. Research model: connecting welfare state regimes to the digital divide

As discussed above, research on the effects of the digital divide and welfare regimes on social equality thus far forms two bodies that rarely intersect. We have relatively good knowledge of the micro-level variations in the digital divide (cf. Srinuan and Bohlin, 2011; Aissaoui, 2021) and of the effects of diverging welfare regimes on different aspects of equality (cf. Sachweh and Olafsdottir, 2012; Esping-Andersen, 2015; Van Lancker and Van den Heede, 2021), but we have limited knowledge of how these two areas interrelate.

Some argue that combating the digital divide is essential for welfare states, given the rising social inequality expected to follow the ongoing digitalization of societies as automation threatens to increase unemployment in various sectors (Buhr, 2017). Buhr (2017, p. 18) argued that while welfare states’ core function is to counteract inequalities through redistribution and to protect against certain risks, they are simultaneously and to varying degrees “based on social stratification, which more or less privileges gainful employment”. This duality poses a challenge for welfare states facing digitalization, which may increase inequality as jobs increasingly require digital skills. According to Buhr (2017, p. 18), stratified welfare states that rely more strongly on welfare distribution through employment are more likely to produce “a digital divide between those who have the necessary skills to find their way around the digital environment and those who do not have those skills and are therefore more exposed to the dangers of work casualization”.

We find similar arguments in studies of how the information society has developed in social democratic welfare regimes. Castells and Himanen (2002) argued that the universalistic welfare state in Finland was essential for producing a technologically and economically dynamic information society while retaining high social equality at the turn of the new millennium. The key features of the Finnish welfare state contributing to the development of the country’s information society were said to be free university education and a technological orientation throughout the education system.

Syvrtsen *et al.* (2014) connected the universalism of the social democratic welfare regime and what they called “universally available communication systems” (p. 17). Such communication systems are characterized by a striving for the universal and equal availability of information and means of communication. According to Syvrtsen *et al.* (2014), central to the development of this universal communication system was the early adoption of universal education in the 19th century and public broadcasting monopolies obliged to make news and vital information available to all of society. Again we see evidence of welfare state traditions laying an important foundation for equality in the realm of digital technology.

These arguments are consistent with the findings of comparative welfare state research, as welfare regimes and their modes of economic redistribution have been found to substantially influence economic equality (cf. [Palme, 2006](#)). Furthermore, comparative studies have identified strong connections between welfare regimes and equality of educational participation ([Pechar and Andres, 2011](#); [West and Nikolai, 2013](#)). Investigations of country variations in digital exclusion show income and education inequalities to be strong predictors of variation in digital divides across countries ([Martin and Robinson, 2007](#); [Fuchs, 2009](#); [Cruz-Jesus et al., 2016](#); [Lin et al., 2017](#)). While little earlier research has investigated the direct link between welfare regimes and digital divides, a substantial literature links welfare regimes to income (cf. [Van Lancker and Van den Heede, 2021](#)) and educational equality ([West and Nikolai, 2013](#)), and equality to digital inclusion ([Srinuan and Bohlin, 2011](#); [Aissaoui, 2021](#)).

A second mechanism linking welfare regimes to the digital divide is digital policy. To our knowledge no comparative studies have examined differences in digitalization policy adoption between welfare regimes, although a relevant literature analyzes the ideological underpinnings of policy adoption in the digital arena. [Sarikakis \(2004\)](#), among others, highlighted how Internet development has been strongly shaped by ideology. While the most prominent ideological direction in Internet policy is market and competition oriented, there is evidence of inter-country variation in the ideological orientation of digital policy. [Yu \(2006\)](#) found a fundamental difference in the understanding of the digital divide and in proposed policy solutions between: (1) an understanding of the digital divide as primarily a technological issue, promoting market-oriented policy solutions that seek to expand access to technology by stimulating market competition; and (2) an understanding of the digital divide as embedded in wider social inequality, promoting more public intervention in the digital area.

Other research has found that such policy interventions are primarily evident in universalistic welfare regimes ([Birdsall, 2000](#); [Cava-Ferreruela and Alabau-Munoz, 2006](#); [Falch, 2007](#); [Syvertsen et al., 2014](#)). As [Syvertsen et al. \(2014\)](#) argued, social democratic welfare regimes have a tradition of adopting universalistic policies in the realm of information and communication technology. According to [Birdsall \(2000\)](#), this is also the case in the context of new information technologies. He expects universalistic welfare states to promote comprehensive public policies that seek to expand the information society to encompass all citizens. In less universalistic welfare systems, in contrast, socioeconomic inequalities are expected to be reproduced in the digital domain as governmental efforts to reduce digital inequalities are less comprehensive. There is evidence of such policy differences in the area of broadband policy, as social democratic welfare regimes such as Sweden and Denmark stand out from other EU countries concerning public funding ([Falch, 2007](#)) and public ownership of broadband infrastructure ([Cava-Ferreruela and Alabau-Munoz, 2006](#)).

Two mechanisms apparently link welfare regimes to the digital divide. First, universalistic welfare regimes are thought to hold an advantage over more stratified welfare regimes in their tradition of egalitarian policies, producing societies with less severe disparities in education, financial security, and information access. A more equal society is thought to have stronger preconditions for producing equality in new domains, following a long tradition of universalism and egalitarian welfare policies. Second, different welfare regimes seem to adopt diverse digital policies. While universalistic welfare regimes are expected to adopt universal digital policies (striving for universal access to, skills in, and benefits of digital technology), more stratified welfare regimes are expected to produce digital policies that make greater demands of individuals to adopt and engage with digital technology of their own volition. Broader social inequalities are therefore expected to be reproduced in the digital arena in societies with less universal digital policies.

Based on these mechanisms, our research questions are as follows: (RQ1) “How does digital inclusion among seniors vary between countries with different welfare regime types?” and (RQ2) “Do countries with more universalistic welfare regimes, primarily social democratic welfare regimes, have greater digital inclusion among seniors?”

4. Method and measures

This article presents analyses of the relationship between welfare state regimes and the digital inclusion of citizens in European countries. The EU is a suitable geographical area for this comparative study as there is substantial variation across Member States regarding both welfare regime types and the digital inclusion of citizens. Furthermore, the EU represents what [Lipset \(1959, p. 73\)](#) called a unified “political culture area” (p. 73). There is no substantive variation in factors omitted from our study that could influence the outcome (e.g. level of democracy, ongoing wars and conflicts, or recent colonial rule).

In addressing the first research question, we use descriptive statistics and ordinary least squares (OLS) regression. OLS is a generalized linear modeling technique commonly used in social sciences; it predicts the values of a continuous response variable using one or more explanatory variables, estimating the strength of the relationships between these variables ([Hutcheson and Sofroniou, 1999](#)). The descriptive analyses present the share of citizens 65+ years old in European countries with different welfare state regimes who used the internet, had sufficient digital skills, and used public e-services between 2009 and 2018. In answering the second research question, explanatory analyses and time-series cross-sectional analysis (TSCS) is employed on a dataset covering 2009–2018, each case in the dataset being associated with a European country in a specific year. The analytical period is restricted by the availability of public survey data on seniors’ digital inclusion, yet covers a period of extensive digitalization of European societies. Since TSCS in OLS regression analysis invites a number of potential errors, not least panel heteroscedasticity ([Beck, 2001](#)), we used heteroscedasticity-consistent (or robust) standard errors, using the HCSE macro in SPSS ([Hayes and Cai, 2007](#)).

The variable measuring a country’s welfare state regime type distinguishes among the social democratic, conservative, liberal, Eastern European, and Southern European welfare regimes. Measures of three aspects of the digital divide, i.e. Internet use, digital skills, and e-service use, were taken from the Eurostat database “Community survey on ICT usage in households and by individuals” ([Eurostat, 2017](#)). Internet users as a share of seniors is measured as the share of the population aged 65+ years old who used the internet at least once in the three months preceding the survey. Digital skills are measured as the share of seniors with basic or better digital skills. The digital skills measure is a composite index based on activities performed on the internet in these areas: information, communication, problem solving, and content creation ([Eurostat, 2020](#)). E-service use is operationalized as the share of seniors who used the internet to obtain information from public authorities in the 12 months preceding the survey.

Three control variables (old age dependency ratio, level of economic development, and ICT infrastructure) were included in the regression models. The limited research on inter-country variations in the digital divide has found differences between countries related to sociodemographic factors such as age structure ([Niehaves and Becker, 2008](#)), economic development ([Guillén and Suárez, 2005](#); [Kraemer et al., 2005](#)), and technological development, not least in the development of ICT infrastructure (e.g. broadband expansion; [Zhao et al., 2014](#)). Accordingly, the first control variable measures the age structure of the European countries using data on the old age dependency ratio (OADR) from the World Bank. This variable measures the relative size of the population of retirement age (65+ years old) versus the share of the population of working age (16–64 years old).

The second control variable captures the level of economic development of the country, measured as the gross domestic product (GDP) per capita. This variable was retrieved from the Quality of Government Database (Teorell *et al.*, 2020). The third control variable captures the expansion of ICT infrastructure in European countries as measured by the UN E-Government Survey (United Nations E-Government Survey, 2018, 2020). As this survey was conducted biannually during the investigated period, measures of ICT infrastructure for years when no data from the UN survey were available were imputed. This imputation measured the ICT infrastructure of missing years as the mean value of the data from the preceding and subsequent waves of the survey. Descriptive data for all the variables are presented in Table 2.

Table 2.
Descriptive statistics

	<i>N</i>	Min	Max	Mean	Std. deviation	Source
Old age dependency ratio	223	15.80	35.60	26.94	4.33822	Eurostat
GDP/capita, EUR	223	8,500	69,530	28,064.98	14,985.28	World Bank
ICT infrastructure	219	34	89	66.36	12.693	UN E-Government Survey
Internet access (65+ years)	222	2	96	43.39	24.27	Eurostat
Digital skills (65+ years)	62	3	51	23.03	14.35	Eurostat
E-service use (65+ years)	223	1	81	22.24	17.67	Eurostat
Welfare state regime	223	1	5	3.2960	1.49	See Table 1

5. Results

5.1 Internet use and welfare state regimes

To better understand the relationship between Internet use and welfare state regime, it is critical to know how seniors' Internet use varies between countries with different welfare regime types, and how this relationship developed over the 2009–2018 period. Figure 1 presents the mean share of citizens aged 65+ years who used the internet at least once in the last three months in countries sharing the same welfare regime. The analysis shows that countries with a social democratic welfare regime consistently had the largest share of senior Internet users throughout the decade ending in 2018. In 2009, the average share of at least occasional senior Internet users in this group of countries was 58%, increasing to 86% on average by 2018. Liberal and conservative welfare regimes form a middle segment in which the average share of senior Internet users increased from 30 to 40% in 2009 to 65–75% in 2018. Lastly, the Central and Eastern European and the Southern European welfare regimes form a bottom segment with similar rates and trajectories of senior Internet use. On average, countries with these welfare regimes had an Internet use diffusion of about 10% of seniors in 2009, increasing substantially to around 40% by 2018. The analyses indicate consistent and systematic differences in the diffusion of Internet use among seniors in European countries with different welfare regimes. While the size of these differences decreased somewhat over time, as the diffusion of Internet use increased in all countries, the analyses indicate that the structure of the welfare regime affected the diffusion of Internet use in the population and among seniors.

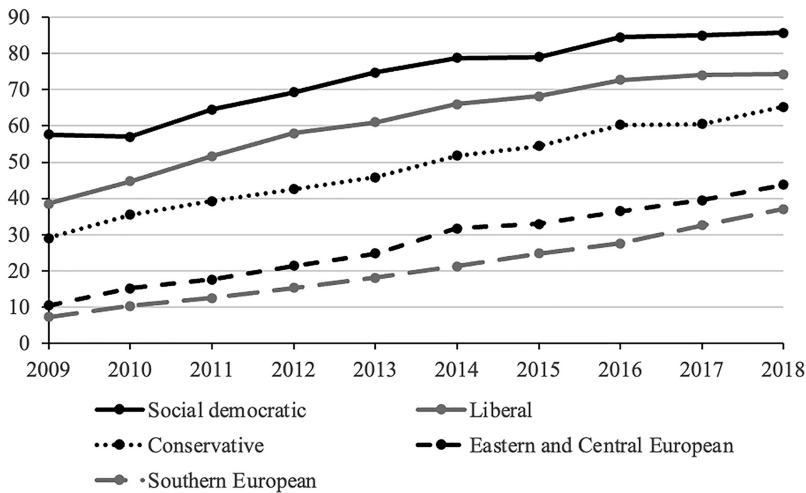


Figure 1. Internet users as shares of seniors in European countries in different welfare regime categories

5.2 Digital skills and welfare state regimes

Although citizens' access to and use of ICTs are absolute necessities for digital inclusion, they might not be sufficient to close the grey digital divide. Digital skills are pivotal to utilizing the potential of ICTs to perform chosen tasks and achieve desired goals. In the analyses presented below, data from Eurostat on seniors' digital skills are related to countries' welfare regimes. Figure 2 shows the average share of seniors with average or above average digital skills among countries with the same welfare regime. For this variable, data are only available for three years, i.e. 2015–2017. The analysis indicates that digital skills were substantially less broadly diffused among seniors than was Internet use. Furthermore, and like the diffusion of Internet use among seniors, we find that the welfare regimes are clustered in three groups. Seniors in countries with social democratic welfare regimes have more digital skills than do seniors in countries with other welfare regimes. In these countries, on average about half of the senior population had basic or better digital skills. In countries with conservative or liberal welfare regimes, the corresponding share was around 30%. Lastly, in countries with a Central and Eastern European or a Southern European welfare regime, on average only around 10–13% of seniors had basic or better digital skills.

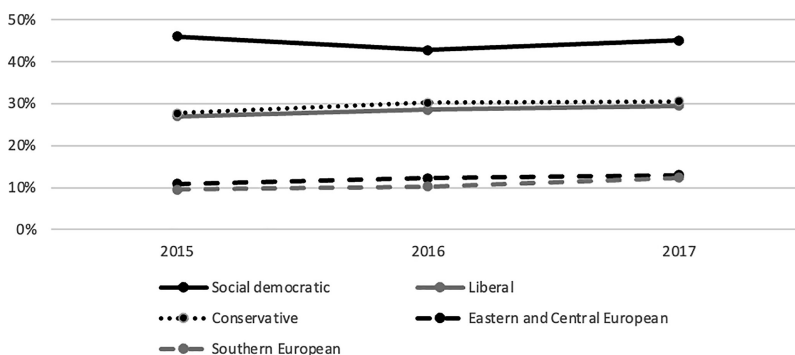


Figure 2. Shares of seniors with basic or better digital skills in European countries in different welfare regime categories

5.3 E-service use and welfare state regimes

As the digitalization of societies has progressed, public services are increasingly accessible online as e-services. Among the most pressing issues related to the digital divide is equal access to public services. To create a measure of e-service use by the populations of European states, we relied on Eurostat data. The statistics presented below indicate the average shares of seniors in countries with different welfare regimes who used the internet to obtain information from public authorities between 2009 and 2018. The analyses (Figure 3) again show that countries with a social democratic regime stand out. We find a similar clustering of welfare regimes as in previous analyses (see Figures 1 and 2). Countries with a social democratic welfare regime stand out, as 36% of their seniors used e-services in 2009, a share that increased dramatically to 63% by 2018. Countries with a conservative or liberal welfare state regime form a middle group, as the share of their seniors using e-services increased from 16 to 21% in 2009 to 26–37% by 2018. Countries with a Central and Eastern European or Southern European welfare regime form the grouping with the lowest dispersion of e-service use among seniors. In these countries, on average only 4% of seniors used e-services in 2009, a share that increased to 12 and 17% in countries with a Southern European and Central or Eastern European welfare regime, respectively, by 2018.

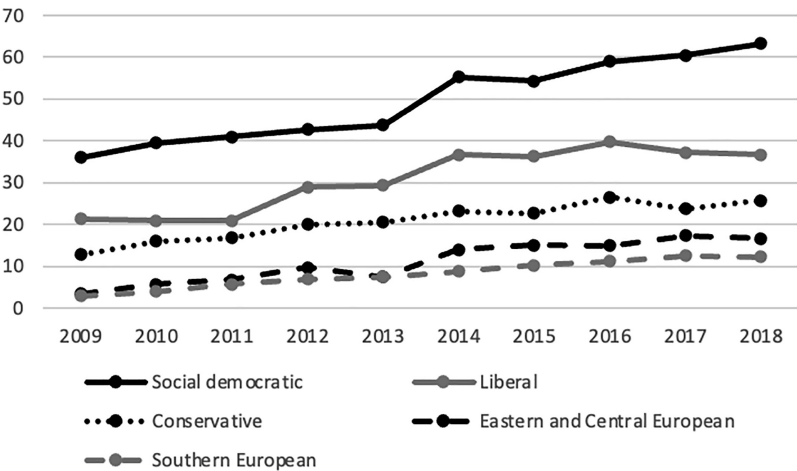


Figure 3.
Digital service users as
shares of seniors in
European countries in
different welfare
regime categories

Taken together, the analyses indicate an association between welfare regime and the digital inclusion of seniors. This pattern persists across all three analyzed dimensions of the digital divide, i.e. Internet use, digital skills, and e-service use. Furthermore, the analyses also indicate that a more universalistic welfare regime (i.e. the social democratic regime) is associated with greater digital inclusion among seniors. While offering a clear picture of the patterns of variation in ICT use and digital skills between countries with diverging welfare systems, these analyses do not consider any other contextual factors that might influence the digital inclusion of citizens of European countries. These analyses therefore provide a shaky basis for any conclusion as to the influence of welfare regimes on digital inclusion. To better understand the relationship between welfare regime and the digital divide, explanatory statistical analyses that introduce statistical controls for factors proven to influence digital inclusion are presented in the next section.

5.4 Explanatory analyses

The OLS regression models presented in Table 3 seek to explain variations in the levels of Internet use (models 1 and 2), digital skills (models 3 and 4), and e-service use (models 5 and 6) among seniors in European countries between 2009 and 2018. The regression analyses assess the effects on the digital inclusion of seniors of two sets of independent variables: (1) the three control variables measuring ICT infrastructure, demographic age structure (OADR), and economic development (GDP/capita); and (2) the countries' respective welfare state models, using the conservative welfare state model as the reference category. The positive effect of a specific welfare model should be interpreted as indicating that the welfare model produces a higher value of the dependent variable than does the conservative welfare model; the reverse is the case for a negative effect.

The analyses presented in models 1 and 2 concern Internet use. Model 1 presents the effects solely of the three control variables on Internet use. We find a strong positive effect of ICT infrastructure (+0.633, $p < 0.001$), unsurprisingly indicating that countries with stronger ICT infrastructure had much higher Internet use among their seniors. Furthermore, we find a moderately strong positive effect of economic development (+0.291, $p < 0.001$), indicating, in line with earlier research, that Internet use was higher among seniors in more economically developed nations. Overall, the first model can account for around 70% of the variation in seniors' Internet use between countries. When variables measuring welfare state regime models are added to the analysis in model 2, the picture changes, as the effect of ICT infrastructure is suppressed (+0.432, $p < 0.001$) and the effect of economic development ceases to be statistically significant. These results indicate that the effects of ICT infrastructure and economic development can be partly accounted for by differences between welfare state regimes: there seem to be associations between welfare regime and the level of ICT infrastructure and economic development.

Turning to the effects of welfare state models, we find a moderately strong positive effect on Internet use diffusion in the senior population of liberal (+0.188, $p < 0.001$) and social democratic (+0.167, $p < 0.001$) welfare regimes, and a negative effect in the senior population of the Southern European welfare regime (−0.251, $p < 0.001$). These results mirror the descriptive analyses presented above, showing that countries with social democratic and liberal welfare regimes generally had the highest diffusion of Internet use and that countries

	Internet use		Digital skills		E-service use	
	(M1)	(M2)	(M3)	(M4)	(M5)	(M6)
<i>Control variables</i>						
OADR	−0.008 (0.287)	0.183*** (0.282)	0.200 (0.555)	0.140 (0.401)	0.016 (0.215)	0.099 (0.203)
GDP/capita	0.291*** (0.000)	0.169 (0.000)	0.490*** (0.000)	−0.045 (0.000)	0.431*** (0.000)	0.159 (0.000)
ICT infrastructure	0.633*** (1.053)	0.432*** (0.874)	0.385* (2.291)	0.143 (1.917)	0.435*** (0.864)	0.332*** (0.806)
<i>Welfare state model</i>						
Liberal	–	0.188*** (3.632)	–	0.263 (6.982)	–	0.162*** (2.685)
Social democratic	–	0.272*** (2.544)	–	0.399** (3.577)	–	0.518*** (2.435)
Eastern and Central European	–	0.020 (3.603)	–	−0.332* (4.088)	–	0.075 (2.917)
Southern European	–	−0.251*** (2.846)	–	−0.365*** (3.935)	–	−0.112** (1.864)
N	219	219	62	62	219	219
R ²	0.734	0.822	0.715	0.731	0.632	0.793
Adjusted R ²	0.730	0.816	0.700	0.697	0.626	0.786

Note(s): Robust standard errors using the HCSE macro in SPSS (Hayes and Cai, 2007) are shown in parentheses. Statistical significance of beta-coefficients is represented as follows: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. The conservative welfare state model is used as the reference category

Table 3.
OLS regression models
explaining three levels
of digital inclusion of
seniors in European
countries, 2009–2018

with Southern European welfare regimes had the lowest diffusion during the studied period. Furthermore, these results indicate that welfare regimes influence Internet use even when the effects of ICT infrastructure, demographic age structure, and economic development are controlled for.

The third and fourth models explain variation in seniors' digital skills among European countries. The results of the third model, assessing the effects solely of the control variables on digital skills, resemble the results regarding Internet use. We find strong positive effects of ICT infrastructure ($+0.385$, $p < 0.05$) and economic development ($+0.490$, $p < 0.001$) on seniors' digital skills. When variables measuring welfare regime types are added to the analysis in the fourth model, both these effects become non-significant, further indicating that there is shared variance between the control variables and welfare state regime type. We find a strong positive effect of a social democratic welfare regime ($+0.399$, $p < 0.001$) and a strong negative effect of a Southern European welfare regime (-0.365 , $p < 0.001$). So far the results for digital skills mirror those for Internet use; however, we find no significant positive effect of a liberal welfare regime and a strong negative effect of an Eastern European welfare state regime (-0.332 , $p < 0.05$) on seniors' digital skills.

The last two models (5 and 6) explore the effects of the control variables and welfare regime types on seniors' e-service use. In the fifth model we again see strong positive effects of ICT infrastructure ($+0.435$, $p < 0.001$) and economic development ($+0.431$, $p < 0.001$). In the sixth model, to which variables measuring welfare regime type are added, the effect of ICT infrastructure is suppressed somewhat ($+0.332$, $p < 0.001$) and the effect of economic development becomes non-significant. Consistently across all three measures of digital inclusion, we find evidence of shared variance between these two control variables and welfare regime types. These results may give some insight into the mechanisms linking welfare state regimes to digital inclusion, as they indicate that countries with certain welfare regime types may have stronger ICT infrastructure and more highly developed economies than do other countries.

Turning to the effects of welfare state regime types on seniors' e-service use, we find that a social democratic welfare regime has a strong positive effect ($+0.518$, $p < 0.001$) and that a liberal welfare regime has a moderate positive effect ($+0.162$, $p < 0.001$). Furthermore, we find that a Southern European welfare regime has a negative effect (-0.112 , $p < 0.01$).

Consistently across all three measures of digital inclusion, and in answer to the first research question of this study, these analyses indicate the importance of welfare regimes for understanding the age-related digital divide in European countries. Even as statistical controls are included for technological, demographic, and economic factors proven to substantially influence the digital inclusion of citizens, we find persistent indications that seniors' digital inclusion is associated with the structure of the welfare regime. Furthermore, the results give an idea about the second research question, as we find consistent positive effects of a social democratic welfare regime and consistent negative effects of a Southern European welfare regime.

6. Discussion

This study set out to contribute to research on the grey digital divide by exploring the influence of European countries' welfare regimes on the digital inclusion of seniors. The analyses are based on data from Eurostat, the World Bank, and the UN E-Government Survey. Through descriptive analyses, we found persistent divergences in different aspects of the digital inclusion of seniors between countries with different welfare regimes. The pattern formed by the data revealed that the digital inclusion of seniors was strongest in countries with a social democratic welfare regime, and weakest in countries with a Southern European welfare regime. This pattern indicates that the level of universalism of a country's

welfare state seems to be important for the level of digital inclusion, as suggested but never before systematically tested in the literature. The above-described pattern was further established through multivariate OLS regression analyses with statistical controls introduced for three factors shown in earlier research to explain inter-country variations in seniors' digital inclusion.

These findings are consistent with arguments made in the literature on welfare state regimes. This literature suggests that welfare systems may influence the equality and inclusivity of digitalization through two separate paths, i.e. welfare regime structure and digital policies. First, universalistic welfare regimes are thought to offer greater opportunities to foster equality in the “digital society” as a result of their long tradition of universalism and egalitarian welfare policies, producing societies with less severe disparities in education, financial security, and information access. Second, the literature argues that welfare regime traditions may influence what policies are adopted in the digitalization realm. While universalistic welfare regimes are expected to adopt universal digital policies that strive for universal access to, skills in, and benefits of digital technology, more stratified welfare regimes are expected to produce digital policies that place greater demands on individuals to adopt and engage with digital technology of their own volition. While our results are consistent with these expectations from earlier literature, our analyses merely identify the existence of a relationship between welfare regime types and seniors' digital inclusion; the specific mechanisms presented above are not analyzed here.

To finish, what the reader should recall is that the digital divide takes different manifestations depending on the welfare regime in which it appears. People and organizations that know how to use computers and the internet have a relative advantage in life (Ballano *et al.*, 2014). The recent outbreak of the COVID-19 pandemic showed once more that the digital divide is a matter of “life and death for people who are unable to access essential healthcare information” (United Nations, 2020) and other important welfare services. Older people usually fall into this category. The novel virus has compelled several countries to change their healthcare systems to emphasize telehealth-based care (Ramsetty and Adams, 2020) in order to uphold social distancing measures. However, this change did not always benefit older people, some of whom could not take advantage of this opportunity (cf. Giansanti and Velcro, 2021). The digital divide is here to stay, but there is still hope for change given that the “COVID-crisis opened up a window to at least reflect upon our political-economical predicaments” (De Vos, 2021, p. 8).

7. Implications

The current findings have several implications for practitioners and academic researchers, which will be analyzed briefly in this section.

7.1 Implications for practitioners

First, the results indicate that the digital divide is contextually dependent, and that the welfare regime of a country is an important aspect of the context that merits consideration. Policies and actions to address the digital divide – specifically the digital exclusion of seniors – should be adopted and implemented with consideration of the national context and particularly its welfare regime.

Second, the results may be interpreted as signifying that welfare institutions have a crucial role in this new digital era to enhance the digital/social inclusion of seniors.

7.2 Implications for academia

First, we identified a lack of research on the relationship between welfare regimes and the digital divide, a lack that should be addressed by future research. One central question for

future research is whether welfare regime traditions influence the adoption and implementation of policies to address the digital divide.

Second, the present findings indicate that welfare regime type may be an important factor to consider in case selection for comparative studies in digital divide research.

8. Limitations

This study is limited in scope to EU Member States. While this limitation bolsters the study's validity by limiting the influence of omitted exogenous factors, it hampers its generalizability. A global comparison would make broader generalizations possible but at the expense of much greater uncertainty given the broader scope.

Furthermore, our operationalization of welfare regime models limits variation in the main independent variable over time. While the general welfare regimes of countries tend to remain constant over long periods, welfare systems adapt and change continuously. Such nuances in the welfare system configurations of countries are not captured or analyzed here. While this study can identify broad general patterns in the relationship between welfare regimes and citizens' digital inclusion, it cannot identify potential time-variant effects of welfare system changes on digital inclusion.

Lastly, our operationalization of digital inclusion is based on specific measures for each level of the digital divide that correspond to the descriptions of these levels offered in the relevant literature. Greater reliability of these measures would have been achieved if indices could have been created based on a broad set of measures of each level. Unfortunately, such measures are unavailable in public data covering all EU Member States.

9. Conclusions

This paper offers fresh insight into the digital divide literature by making two contributions: first, we showed that the digital divide is somehow associated with the type of welfare state regime; second, we proposed a specific operationalization of the welfare regimes and the levels of digital divide, allowing us to make comparisons between different welfare regimes. While this study has presented analyses that test the central claim of this literature, namely, that welfare state regimes seem to matter for digital divides, the mechanisms identified in this literature have faced little scrutiny. This means that we cannot draw definitive conclusions about whether the welfare structure (first mechanism), the implemented digital policy (second mechanism), or both play the key role(s) in the digital divide.

We therefore suggest that future research further investigates the mechanisms linking welfare regimes to the digital divide to deepen our understanding of how the broader structure of welfare states relates to digital inclusion. Previous studies (e.g. [Saint-Arnaud and Bernard, 2003](#)) have suggested that regime stability over time is an indicator that current choices are greatly dependent on past choices (i.e. path dependency) and that this may deter convergence in the future. Could this argument mean that welfare regimes that did not greatly emphasize digitalization early on will always lag in digital terms? This syllogism merits further testing via in-depth case studies.

A recent research ([Alexopoulou, 2020b](#)) found that in Greece the digital divide for seniors is handled in accordance with a digital familialist regime. Family members in Greece help seniors use digital devices and services by lending them access to technology. Surprisingly, although senior Greeks might not be independent digital users, this does not make them socially excluded, since they get support from their close family circle. The same situation could also apply to other countries in the Southern welfare regime where the family is an institution for solving the daily problems of senior relatives, including problems of digital participation.

Note

1. Bellini (2018) presented a narrower definition, seeing digital inclusion as a specific and initial stage of the human–ICT relationship: (1) *inclusion* of someone, in digital society, with basic skills and environmental opportunities; (2) *equality*, i.e. improvement of skills and opportunities in line with those of other people; and (3) *effectiveness*, i.e. autonomy in doing what one wants/needs to do with one's digital skills and opportunities.

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