Do digital natives telework more than digital immigrants?

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1. Introduction

In the past forty years, information and communication technologies (ICTs), which widely refer to PCs, laptops, Internet services, and mobile phones/tablets, have significantly evolved and were incorporated in multiple dimensions of people's daily lives. This rapid technological development occasioned generational differences in terms of individual exposure and interaction with ICTs, leading to the definition of 'digital immigrants' and 'digital natives'. Digital immigrants are people who were born before the 1980s and learned how to use ICTs at a certain point in their adult lives. By contrast, digital natives are individuals born in the 1980s or later, and thus, who potentially had exposure and access to ICTs during their childhood and formative years. Because digital natives have a closer relationship with ICTs, their opportunities and willingness to conduct ICT-based activities are expected to be higher than those of older generations (Lyons 2015).

Teleworking (defined in this paper as the practice of working from home possibly employing ICTs) has received significant attention in the transport literature due to its potential to reduce commute-related travel (telecommuting) but also its risk to induce urban sprawl by reducing the need for workers to live close to employment opportunities (Mokhtarian 2009). More recently, as public health measures associated with the COVID-19 pandemic required workers from all over the world to work from home, telework studies are back in the spotlight (Vyas & Butakhieo 2021).

Prior to the COVID-19 pandemic, the expectation that telework uptake could gain traction was taken with scepticism, as this practice had a minor increase if compared to the fast dissemination of ICTs. As reported by the Australian Bureau of Statistics and the Household, Income and Labour Dynamics in Australia (HILDA) survey, in Australia, the share of households with Internet access steadily increased from 55% to almost 90% between 2004 and 2017, while the share of workers who performed at least a portion of their work at home (teleworkers) saw a minor increase from 20 to 26% over the same period (ABS 2018, DSS 2019). This discrepancy is often justified by the argument that telework adoption is a much more complex socio-technical phenomenon than the dissemination of ICTs (Nakrošiene et al. 2019). For instance, while technology savviness may increase individual ability to work remotely, managerial culture may create major barriers and hinder the opportunity of doing so (Laumer & Maier 2021).

To better understand the role of generational technology savviness in telework uptake, the current study compares digital immigrants and digital natives' engagement in at-home work activities. Generational differences are analysed using longitudinal data extracted from the

HILDA survey (DSS 2019). HILDA is a household-based panel survey that records socio-demographic characteristics and activities of households over the years. In this study, we consider the data from 2001 to 2018 to capture significant changes in ICT penetration over time.

First, we conduct an exploratory analysis to examine at an aggregate level whether there are significant differences between generational cohorts in terms of telework participation and amount of time spent working from home. Then, we estimate an individual level (disaggregate) bivariate model (choice to work from home and proportion of time spent working at home for one week) to further investigate the relationships between teleworking participation, generational cohort, and socio-demographic characteristics over time.

2. Exploratory Data Analysis

To maintain the panel characteristics of HILDA data, only individuals who were employed and had at least 6 years of recorded survey participation between 2001–2018 were considered. To distinguish the effects between age and cohort, we divided individuals into cohorts (based on the year they were born) and three overlapping age groups: (1) Ages 25–35 years, (2) Ages 30–41 years, and (3) Ages 36–46. This enabled us to compare individuals with similar ages but pertaining to different cohorts. For example, we are able to compare workers from Cohort C (1972–1976), Cohort D (1977–1980), and Cohort E (1981–1985) while they were between 25 and 35 years old. Similarly, for ages 30–41 years, we compare Cohort B (1967–1971), Cohort C, and Cohort D; and for ages 36–46, we compare Cohort A (1963–1966), Cohort B, and Cohort C. Telework uptake is represented by two variables share of teleworkers (teleworkers/total workers), and proportion of work time spent teleworking (at-home work time/total work time). This second variable was computed considering only the sample of teleworkers.

Figure 1 depicts the trends of both variables of interest and results from pairwise comparisons between cohorts. A Mann–Kendall trend (MK) test was applied to examine whether each trend has a monotonic upward or downward movement associated with aging (H_0: There is no monotonic trend). In cases where a statistically significant ($p<0.05$) monotonic trend was identified, Sen's slopes were calculated to determine the magnitude of the changes ($\text{Sen}'s\ \text{slope} = Median\ (x_j - x_i / j - i)$; where i and j are indices of observations). To identify the differences between cohorts, pairwise comparisons of Sen's slopes were conducted using Mood's median test (H_0: $\text{Sen}'s\ \text{slope}_{Cohort\ 1} = \text{Sen}'s\ \text{slope}_{Cohort\ 2}$).

This analysis indicates that, for individuals born in 1972 or later, the likelihood of teleworking increases monotonically between the ages of 25 and 41 years. Further, younger generations show steeper slopes of telework adoption, which indicates a potential moderating effect of tech-savviness in accelerating telework uptake through the course of one's career. We also observe a monotonic increase associated with age of the proportion of work time spent teleworking. However, the steepest increase is observed for Cohort D, which is the youngest cohort of digital immigrants.

Although we can observe statistically significant (95% confidence level) differences between cohorts, for individuals born in 1972 or later, age (which is a proxy to career stage) seems to have a greater impact on the likelihood to telework and the proportion of time teleworked than the generational cohort. Considering the limitations and potential for multiple confounding factors in the aggregate analysis, we estimate a disaggregate model (for the same two variables) in which we quantify the effects of age and cohort while controlling for socio-demographic characteristics and time.

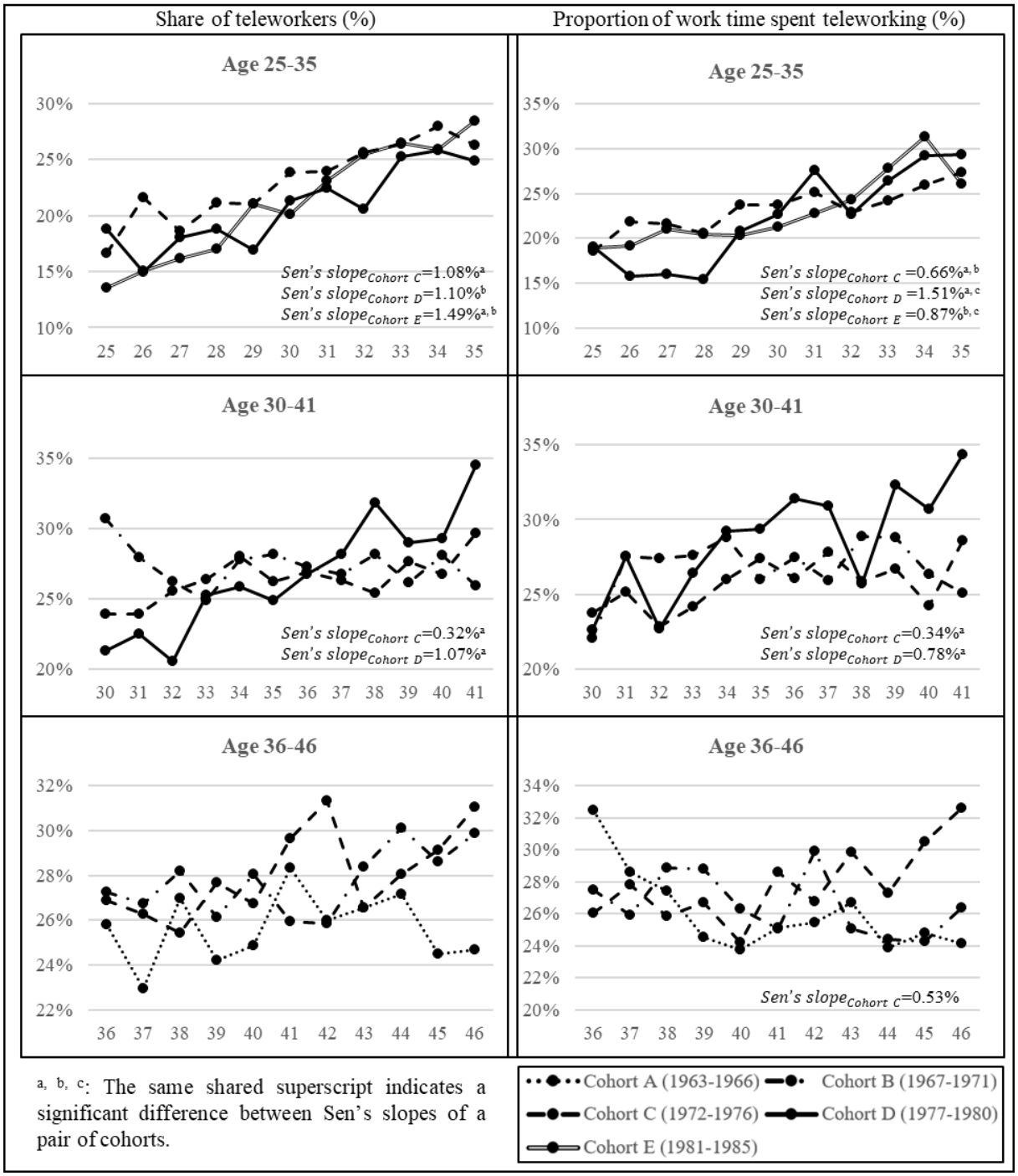

Figure 1: Evolution of the share of teleworkers (%) and average duration of teleworking of teleworkers (%)

3. Confirmatory Data Analysis

In addition to age, HILDA data contain socio-demographic information on gender, occupation, employment status, and education, which are important predictors of telework engagement described in the literature (Lavieri et al. 2018). In this section, these data are used to investigation telework participation and compare digital immigrants, represented by Cohort C (workers born between 1972–1976 from the age of 25 through 41 years) with digital natives represented by Cohort E (workers born between 1981–1985 from the age of 25 through 35 years). Workers from Cohort C and age group 25- 35 years are considered the base category, to which we compare Cohort C (36-41 years) and Cohort E (25-35 years).

HILDA records workers' occupations according to the code of Australian and New Zealand Standard Classification of Occupations. We aggregated these occupations into four categories: (1) in-person jobs (jobs that require physical interaction, such as hospitality industry), (2) desk jobs (e.g. clerical and administrative workers), (3) high-autonomy jobs (e.g. design arts, media, and ICT professionals), and (4) drivers. After cleaning the data, 18,120 observations based on 2,247 individuals were obtained as the sample for the confirmatory data analysis.

As shown in the left side of Figure 1, telework penetration rates are below 35%, which implies that for the majority of workers in the sample the proportion of time teleworking is zero. To accommodate this excess of zeros, the binary variable representing telework choice serves as a selection variable, and only workers who telework are considered as valid observations for the second (continuous) outcomes variable (proportion of time teleworked in a week). The formulation and estimation of the two-part model follow the work by Farewell et al. (2017), which includes correlated random effects to account for the longitudinal nature of the data.

3.2. Results

For the sake of brevity, the table with the coefficients of the two-part model is omitted. We discuss the main results drawn from the interpretation of the statistically significant (95% confidence level) coefficients. First, socio-demographic characteristics such as gender, education, income, and employment status (part-time vs. full-time, and self-employed vs. employee) show effects that are consistent with those already reported in the literature (see, for example, Lavieri et al. 2018). Second, the variables controlling for years show that telework adoption has been significantly increasing in recent years. There is an initial increase in 2014, which is accentuated in 2016. Third, age positively contributes to the likelihood of teleworking, but it does not seem to affect the proportion of time spent teleworking. Fourth, as expected drivers have the lowest likelihood of teleworking, followed by in-person job workers, desk job workers, and high-autonomy job workers. In terms of proportion of time teleworking, desk job workers seem to spend more time teleworking than those who have high-autonomy jobs. Finally, after controlling for all the above variables, we observe that digital natives (Cohort E) are, in general, less likely to engage in teleworking than digital immigrants (Cohort C). However, interactions between cohort and years show an increase in telework adoption by digital natives in 2014-15, which becomes even more accentuated in 2016-2018. In terms of proportion of time spent teleworking, cohort effects are only captured through interactions. In general, self-employed digital immigrants spend more time teleworking than self-employed digital natives. However, self-employed digital natives with high-autonomy jobs are the group of workers with the highest proportion of work time spent at home.

4. Conclusion

This research was motivated by the assumption that technological proficiency resulting from generational differences may impact the adoption of telework. Overall, occupation type and age, which can be considered a proxy to career stage, seem to be much stronger predictors of teleworking engagement than generational cohorts. Additionally, after controlling for multiple covariates, we conclude that digital natives, represented by individuals born between 1981 and 1985 are less likely to work from home than digital immigrants, represented by those born between 1972 and 1976. There may be multiple explanations for such findings, which call for future research. For example, it is possible that younger generations are not teleworking from home, and instead working from multiple alternative locations, which are not captured in our data set. Another hypothesis is that those born in the 1980s are not 'true digital natives' and still

share many similarities with individuals born in the 1970s. It is possible that significant differences resulting from childhood exposure to ICTs will become evident only in younger generations. For example, individuals born in the 1990s experienced the Internet boom during their childhoods, while those born in the 2000s experienced the start of the smartphone era.

A major limitation of this paper arises from the definition and measurement of telework. The data used does not provide information on whether individuals use ICTs in their work activities. Further, as mentioned earlier, only work activities performed at home are classified as telework in our data. Therefore, our analysis does not consider individuals who may be teleworking from cafes or other locations. As internet access has become ubiquitous in the past five years through 4G and Wi-fi connections, excluding out-of-home teleworking engagement may result in a myopic description of teleworkers.

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