Predictors of Mode Switching in a Probability-based Mixed-Mode Panel

David Bretschi, Bernd Weiß
GESIS - Leibniz Institute for the Social Sciences
PO Box 122155, 68072 Mannheim, Germany
david.bretschi@gesis.org

I. Introduction

In recent years, several longitudinal studies have transitioned to a self-administered mixed-mode design, using the Internet as one of the modes of data collection (Olson et al., 2020). However, panel studies showed that a substantial proportion of respondents refused to participate in the web mode or preferred alternative mode options. For instance, over 20 percent of the Internet users declined to respond by the web mode in the recruitment of the GESIS Panel (Pforr & Dannwolf, 2017), and around ten percent of Gallop panel members with Internet access explicitly asked to receive questionnaires by mail (Rookey, Hanway, & Dillman, 2008). A substantial proportion of Internet users also declined to respond online after the web mode was introduced as the first option in running panel studies and participated in alternative modes instead (Fitzgerald et al., 2019; Jäckle, Lynn, & Burton, 2015). Learning more about the mechanisms that drive panelists to switch survey modes when offered in an ongoing panel study can help design effective web-push methods to increase online participation.

This study aims at investigating mechanisms of mode switching in a running mixed-mode panel. We are interested in how characteristics related to the Internet affect the willingness of panelists to switch from the mail mode to the web. Data were used from a web-push Intervention in a German probability-based mixed-mode panel, where panel members of the mail mode could complete the questionnaire of a single wave via the Internet (short-term mode switch). Those short-term switchers subsequently received the option to switch to the web mode for upcoming waves (long-term mode switch). We measured potential mode switching mechanisms in two waves before the web-push intervention to answer the following research questions:

1 How do characteristics of Internet use affect the willingness of panel members in the mail mode to switch to the web mode in the short-term?

2 How are the characteristics of Internet use related to short-term mode switchers‘ decision to switch to the web mode in the long-term?

Based on assumptions of the benefit-cost theory (Schnell, 1997; Singer, 2011), we expect that panel members will less likely switch to the web mode, the higher they perceive the costs of doing so. Previous research has shown that Internet use, Internet skills, and attitudes toward the Internet may be related to whether people participate in online panels (Herzing & Blom, 2018) or use different online activities such as political or health participation (Lutz, Hoffmann, & Meckel, 2014). We suggest that these characteristics also determine how panelists perceive the costs of mode switching.

A. Internet use

How panelists use the Internet could affect how they evaluate the costs of mode switching in panel surveys. However, the usage of the Internet is a diverse phenomenon that can be distinguished in different dimensions. A basic differentiation is made between Internet use in terms of frequency of use and the variety of several online activities (Blank & Groselj, 2014; Scheerder, Deursen, & Dijk, 2017). Our first two hypotheses are based on the assumption that the costs of mode switching increase with a lower frequency and variety of Internet use:

1.1: The less frequently panelists use the Internet, the less likely they are to switch to the web mode.

1.2: The less the variety of Internet use, the less likely panelists are to switch to the web mode.

In the context of web surveys, we consider as a third dimension of Internet usage the number of web-enabled devices respondents use and which allow them to participate in web surveys (Antoun, 2015). Regarding this dimension, we hypothesize:

1.3: The less web-enabled devices panelists of the mail mode use, the less likely they are to switch to the web mode.

B. Internet skills

Respondents need a basic level of Internet skills to participate in web surveys to which invitations are sent by mail, e.g., to open a browser, find the correct URL, key in login credentials, and to navigate through the online questionnaire. Accordingly, basic Internet skills can be seen as a cost aspect for panelists, with lower skills increasing the costs of switching. In terms of Internet skills, we hypothesize:

2: The less the Internet skills of panelists, the less likely they are to switch to the web mode.

C. Attitudes toward the Internet and Technology

Blank and Dutton (2012) identify net risk as a component of trust toward the Internet, which describes how people see risk

in using online activities. We assume that respondents' attitudes toward net risk are an issue of costs in their decision to switch to the web mode. Accordingly, we formulate the hypotheses:

3.1: The more panelists perceive risk in using the Internet, the less likely they are to switch to the web mode.

We see an affinity to technology as another potential characteristic of respondents that is related to the perceived costs of switching to the web mode. Thus, we derive the following hypothesis:

3.3: The lower panelists' affinity to technology, the less likely they are to switch to the web mode.

II. Data

To answer our research questions, we used data from the GESIS Panel, a German probability-based mixed-mode panel operated by GESIS - Leibniz Institute for the Social Sciences (GESIS, 2019). In the October/November wave 2018, the panel consisted of 5736 members from three cohorts that were recruited from random samples in Germany. The data collection of the GESIS Panel takes place on a bi-monthly basis and is administered in web-based surveys (web mode: around 67% of respondents) and paper-and-pencil surveys sent via postal mail (mail mode: about 33% of panel members). The mode assignment happened at the end of a face-to-face recruitment interview. Internet-using respondents had been presented the web mode as the default option for participation. If respondents were unwilling or unable to participate in web surveys, they could join in the mail mode. After respondents become members of the regular panel, they have not been actively offered an option to switch survey modes.

In the October/November wave 2018, a web-push intervention was implemented in the GESIS Panel, offering all panelists of the mail mode to complete the survey via the Internet. Those respondents who completed the survey online were asked whether they were willing to switch to the web mode for the upcoming waves. The research questions of this study refer to these two outcomes short-term and long-term mode switching. Short-term mode switching was defined as panel members of the mail mode who fully or partially completed the survey via the web mode in the October/November wave 2018. Overall, 380 (27.8 %) out of 1365 panelists who were invited to the web mode and indicated to use the Internet for private purposes switched to the web mode in this single wave. Once respondents completed the survey online, they were asked whether they agreed to switch to the web mode for a long-term mode switch. Overall, 266 (70%) out of 380 panelists agreed to switch to the web mode permanently (long-term switchers).

To investigate mode switching, we measured explanatory variables in two GESIS Panel waves (June/July and August/September) prior to the October/November wave 2018. The frequency of Internet use was measured as a discrete variable about how frequently respondents are online. The variety of Internet use was quantified by an additive index of ten types of online activities. The number of devices was measured with an index of how many of four devices respondents use that allow them to participate in web surveys. To examine Internet skills, we adapted items from the Internet Skills Scale (ISS) developed by Deursen, Helsper, and Eynon (2016). We ran a second-order confirmatory factor analysis (CFA) of three dimensions of the ISS as first-order factors with maximum likelihood estimation using the R package lavaan (Rosseel et al., 2019). Based on the CFA model, a second-order factor score was estimated as an indicator of Internet skills and included in our analyses. To investigate attitudes toward the Internet, items were adapted from the Oxford Internet Survey (OxIS). We used translations of three items identified by Blank and Dutton (2012) as indicators of net risk. Additionally, we adapted three items of the OxIS, which we propose to measure affinity to technology. A CFA was calculated to test and identify factors for net risk and affinity to technology. Additionally, a selected set of control variables was used in our analyses to reduce potential confounding bias in the estimations.

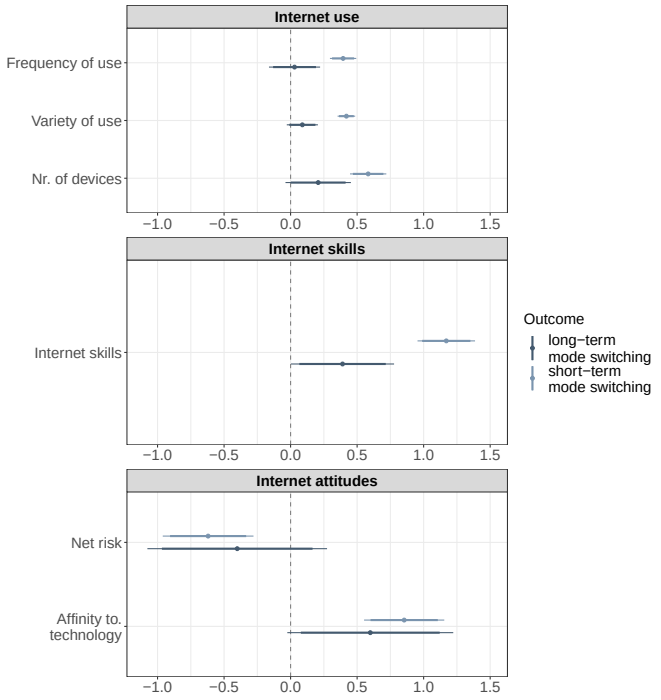

Figure 1: Coefficients and Confidence Intervals of Bivariate Logistic Regression Models

III. Results

We begin our analysis by examining the bivariate association between the explanatory variables and the outcomes short-term and long-term mode switching. Figure 1 provides an overview of coefficients with 95 and 90 percent confidence intervals from a series of logistic regression models for both outcomes. Concerning short-term mode switchers, the figure illustrates that

all Internet-related characteristics show an expected significant association to panelists' willingness to use the web mode in a single wave. Among those short-term switchers, only Internet skills is significantly related to long-term mode switching at the 95 percent level ($coef.$ = 0.39, p = 0.048) and affinity towards technology at the 90 percent level of confidence ($coef.$ = 0.60, p = 0.06).

To test our hypotheses, we fit a multivariate logistic regression model for the outcome short-term mode switching, now including all explanatory variables and adjusting for a set of control variables. Results are presented in the first model of table 1. In contrast to the bivariate analyses, most explanatory variables of the multivariate model show no significant relation to respondents' behavior anymore. We found that only variety of Internet use and Internet skills retain a statistically significant association with short-term mode switching, supporting our hypotheses 1.2 and 2.

Table 1: Coefficients and Confidence Intervals of Multivariate Regression Models for the Outcomes Short-Term and Long-Term Mode Switching

	Short-term Mode Switching	Long-term Mode Switching
Internet Characteristics		
Frequency	0.014	−0.050
	[−0.119; 0.147]	[−0.300; 0.200]
Variety	**0.301**	0.047
	[0.214; 0.387]	[−0.116; 0.209]
Nr. of devices	0.114	0.126
	[−0.060; 0.288]	[−0.183; 0.435]
Internet skills	**0.459**	0.520
	[0.145; 0.772]	[−0.129; 1.168]
Net risk	−0.097	−0.021
	[−0.528; 0.333]	[−0.792; 0.749]
Affinity to. technology	0.141	0.282
	[−0.245; 0.527]	[−0.487; 1.052]
Recruitment Cohorts		
Cohort 2016	−0.117	0.262
	[−0.463; 0.229]	[−0.360; 0.885]
Cohort 2018	0.256	0.174
	[−0.067; 0.579]	[−0.389; 0.738]
Controls		
Age (in years)	0.004	0.013
	[−0.067; 0.076]	[−0.111; 0.136]
Age squared	0.000	0.000
	[−0.001; 0.001]	[−0.001; 0.002]
Education: medium level	−0.196	0.255
	[−0.561; 0.170]	[−0.443; 0.952]
Education: high level	0.212	0.562
	[−0.125; 0.549]	[−0.059; 1.184]
Household income	0.010	−0.054
	[−0.071; 0.091]	[−0.199; 0.091]
Household size	**0.298**	**0.311**
	[0.158; 0.438]	[0.062; 0.560]
Gender	0.088	0.021
	[−0.192; 0.367]	[−0.475; 0.516]
Mode choice in recruitment	−0.322	−0.029
	[−0.766; 0.121]	[−0.858; 0.800]
Exp. group 1	−0.322	−0.143
	[−0.652; 0.008]	[−0.755; 0.469]
Exp. group 3	0.047	−0.332
	[−0.271; 0.366]	[−0.894; 0.230]
Intercept	**−4.301**	−2.084

	Short-term Mode Switching	Long-term Mode Switching
	$[-6.308; -2.294]$	$[-5.607; 1.438]$
Mcfadden's adjusted R^2	0.137	−0.012
Mcfadden's R^2	0.161	0.070
Obs	1365	380

Bold coefficients are significant at $p < 0.05$

The multivariate model of table 1 reveals that none of the explanatory variables are significantly associated with the decision of a long-term mode switching at the 95-percent confidence level. According to these findings, no sufficient evidence was found that the decision to make a long-term switch depends on any of the tested Internet characteristics.

IV. Summary and Conclusions

This paper investigated mechanisms of mode switching in a running mixed-mode panel. The study was designed to determine whether different dimensions of Internet use, Internet skills, and attitudes toward the Internet affect the willingness of panel members to switch from the mail mode to the web mode in a short-term and long-term perspective.

Regarding short-term mode switching, we found evidence in bivariate analyses that frequency of Internet use, variety of online activities, and the number of devices are positively associated with the willingness to participate in web surveys in a single wave. However, when fitting a model with indicators for all presumed mechanisms and control variables, only the variety of Internet use showed a statistically significant effect. We speculate that the three dimensions of Internet use moderate and mediate their effect on short-term mode switching between them, with variety of Internet use having the strongest direct effect on the outcome. A major finding of this study was that basic Internet skills are an important mechanism of short-term switching to the web mode. Internet skills help to explain mode switching in addition to Internet use. This result is in line with previous research, which showed that even basic Internet skills are not determined by the frequency of Internet use (Deursen & Diepen, 2013; Deursen, Dijk, & Peters, 2011). Our findings are inconclusive for attitudes towards the Internet. Bivariate analyses showed an expected association, where panelists are more likely to switch to the web mode in a single wave if they see lower risks in using online activities, and with a higher affinity to use technology. However, the multivariate models did not reveal a statistically significant effect of both characteristics. So there remains a lack of evidence that these attitudes affect respondents' willingness to switch to the web mode.

With regard to long-term mode switching, only Internet skills showed a significant association in the bivariate analysis, and no explanatory variable was found significant in the multivariate model on the five-percent level. Considering the reduced statistical power by the smaller sample size, it is noteworthy that the number of devices and the affinity to technology showed a significant bivariate relationship in the expected direction on the ten-percent level. This is also true for Internet skills in the multivariate model.

Overall, the bivariate analyses show that Internet-related characteristics are important variables to predict short-term mode switching. While Internet use and Internet skills seem to help explain the decision process of short-term mode switching, our analysis indicates that other mechanisms drive those panelists in their decision to switch modes permanently. This study has several limitations, such as that Internet characteristics are measured by self-reporting and that we dealt with a special population of panel members. However, as a growing number of longitudinal studies introduce the Internet as a mode of data collection, the question arises on how to effectively convince respondents to use this mode. The findings of this study may contribute to a better understanding of the mechanisms of mode switching and to the future development of effective web-push methods for ongoing panel surveys.

References

[1] C. Antoun, "Who are the internet users, mobile internet users, and mobile-mostly internet users?: Demographic differences across internet-use subgroups in the u.s.," in *Mobile Research Methods: Opportunities and challenges of mobile research methodologies* (D. Toninelli, R. Pinter, and P. de Pedraza, eds.), ch. 7, p. 99–117, Ubiquity Press, sep 2015.

[2] G. Blank and W. H. Dutton, "Age and trust in the internet: the centrality of experience and attitudes toward technology in britain," *Social Science Computer Review*, vol. 30, no. 2, pp. 135–151, 2012.

[3] G. Blank and D. Groselj, "Dimensions of internet use: amount, variety, and types," *Information, Communication & Society*, vol. 17, no. 4, pp. 417–435, 2014.

[4] A. van Deursen and S. van Diepen, "Information and strategic internet skills of secondary students: A performance test," *Computers & Education*, vol. 63, pp. 218–226, apr 2013.

[5] A. J. van Deursen, J. A. van Dijk, and O. Peters, "Rethinking internet skills: The contribution of gender, age, education, internet experience, and hours online to medium- and content-related internet skills," *Poetics*, vol. 39, pp. 125–144, apr 2011.

[6] A. J. van Deursen, E. J. Helsper, and R. Eynon, "Development and validation of the Internet Skills Scale (ISS)," *Information, Communication & Society*, vol. 19, pp. 804–823, aug 2016.

[7] D. Fitzgerald, R. Hockey, M. Jones, G. Mishra, M. Waller, and A. Dobson, "Use of online or paper surveys by australian women: Longitudinal study of users, devices, and cohort retention," *Journal of Medical Internet Research*, vol. 21, p. e10672, mar 2019.

[8] GESIS, "Gesis panel - standard edition," 2019.

[9] J. M. E. Herzing and A. G. Blom, "The influence of a person's digital affinity on unit nonresponse and attrition in an online panel," *Social Science Computer Review*, vol. 37, pp. 404–424, may 2018.

[10] A. Jäckle, P. Lynn, and J. Burton, "Going online with a face-to-face household panel: Effects of a mixed mode design on item and unit non-response," *Survey Research Methods*, vol. 9, no. 1, pp. 57–70, 2015.

[11] C. Lutz, C. P. Hoffmann, and M. Meckel, "Beyond just politics: A systematic literature review of online participation," *First Monday*, vol. 19, pp. 1–36, jun 2014.

[12] K. Olson, J. D. Smyth, R. Horwitz, S. Keeter, V. Lesser, S. Marken, N. A. Mathiowetz, J. S. McCarthy, E. O'Brien, J. D. Opsomer, *et al.*, "Transitions from telephone surveys to self-administered and mixed-mode surveys: Aapor task force report," *Journal of Survey Statistics and Methodology*, 2020.

[13] K. Pforr and T. Dannwolf, "What do we lose with online-only surveys? estimating the bias in selected political variables due to online mode restriction," *Statistics, Politics and Policy*, vol. 8, no. 1, pp. 105–120, 2017.

[14] B. D. Rookey, S. Hanway, and D. A. Dillman, "Does a probability-based household panel benefit from assignment to postal response as an alternative to internet-only?," *Public Opinion Quarterly*, vol. 72, no. 5, pp. 962–984, 2008.

[15] Y. Rosseel, "lavaan: An R package for structural equation modeling," *Journal of Statistical Software*, vol. 48, no. 2, pp. 1–36, 2012.

[16] A. Scheerder, A. van Deursen, and J. van Dijk, "Determinants of internet skills, uses and outcomes. a systematic review of the second- and third-level digital divide," *Telematics and Informatics*, vol. 34, pp. 1607–1624, dec 2017.

[17] R. Schnell, *Nonresponse in Bevölkerungsumfragen-Ausmaß*. Opladen: Leske + Budrich, 1997.

[18] E. Singer, "Toward a benefit-cost theory of survey participation: evidence, further tests, and implications," *Journal of Official Statistics*, vol. 27, no. 2, p. 379, 2011.