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Evaluating an Alternative Frame for Address-Based Sampling in Germany: The Address Database From Deutsche Post Direkt

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Abstract

In Germany, the population registers with addresses of individuals can be used for address-based sampling. However, unlike countries with a centralized register, municipalities in Germany administer their registers themselves. This not only makes sampling for a nationwide survey more costly and cumbersome but may also result in gaps in the gross sample, as selected municipalities may refuse to allow their registers to be used for sampling purposes. If substitute municipalities are not available, other sampling methods are required. The present study tested the feasibility of using the address database from Deutsche Post Direkt (ADB-DPD) as an alternative frame for address-based sampling in Germany. We simultaneously conducted two almost identical surveys in the German city of Mannheim with gross samples of equal size ($N = 3{,}000$). One sample was drawn from the city's population register, the other from the commercial ADB-DPD. Our findings suggest that the ADB-DPD performs well both in terms of survey response and up-to-dateness. Due to relatively low costs and the fast provision of addresses, the ADB-DPD could be particularly attractive for survey projects with limited budgets and tight schedules. However, these benefits come at considerable cost. First, the use of the ADB-DPD is limited to self-administered surveys. More importantly, in the net sample of the DPD survey, women and young persons were considerably underrepresented. This indicates coverage issues about which DPD provided no further information. Based on our analyses, we offer practical insights into the feasibility of using the ADB-DPD for sampling purposes and suggest avenues for future research.

Keywords: address-based sampling, alternative sampling frame, population register, sample evaluation, sample composition

In many countries, researchers rely on official population registers for address-based sampling. Registers used for personal surveys should ideally include addresses of individuals (as opposed to households). This not only avoids the necessity of selecting target persons within households or dwellings but also allows researchers to personalize their contacts from the beginning, which is known to be beneficial in terms of survey response (Dillman, Smyth, & Christian, 2014).

However, some countries, for example, the United States, the United Kingdom, and France, either lack official population registers completely, or their registers include only addresses of households (Link, Battaglia, Frankel, Osborn, & Mokdad, 2008; Poulain & Herm, 2013). In these instances, survey researchers have to settle for suboptimal registers or, when no register is available at all, use alternatives for address-based sampling. In the United Kingdom, for instance, Royal Mail's Postcode Address File (PAF) has been used as a sampling frame for several national and cross-cultural surveys, for example, the European Social Survey (European Social Survey, 2017). In a similar vein, survey managers in the United States often rely for address-based sampling on address lists updated via the U.S. Postal Service's Computerized Delivery Sequence File (CDS; Harter et al., 2016), even though this sampling frame is known to suffer from systematic undercoverage (e.g., rural household units are more likely to be excluded; Amaya, Zimmer, Morton, & Harter, 2021).

Although register-based sampling is generally regarded as the gold standard for drawing representative samples of the residential population (Lohr, 2009), registers also have their own challenges. In a survey among sampling experts in countries participating in four cross-European surveys, respondents mentioned undercoverage and inaccuracies as the main problems they encountered when using their countries' population registers for sampling purposes (Maineri et al., 2017). Another obstacle mentioned by the sampling experts was access to population registers, which varies considerably across countries: More than half of the sampling experts reporting the use of a register-based sample stated that commercial survey organizations do not have access to population registers for sampling purposes (Scherpenzeel et al., 2017).

In Germany, researchers and survey organizations can access population registers with addresses of individuals for the purpose of address-based sampling for academic surveys. At first glance, this seems to be a comfortable situation. However, unlike most countries with an official population register, Germany does not have one centralized register, but rather local population registers administered by the over 5,000 municipal registration authorities (Federal Ministry of the Interior

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and Community, n.d.). Sampling for nationwide personal surveys in Germany is therefore usually carried out in two stages. In the first stage, municipalities are selected based on a stratified random sample. In the 2014 German General Social Survey (ALLBUS), for instance, 148 municipalities were selected in the first stage (Wasmer et al., 2017). To build the gross sample in the second stage, it is necessary to contact all selected municipalities and request them to provide a random sample of addresses. It is easy to imagine how time-consuming this process can be. Moreover, most municipalities charge a fee for drawing and transmitting a random sample from their registers. In sum, the lack of centralization of the German population registers makes sampling more demanding and a rather costly process in terms of time and funds. Using the German population registers to draw a sample may thus not be feasible for research projects with small budgets or tight schedules.

Most importantly, access to the respective population registers depends on autonomous decisions on the part of each municipality. According to Section 46, Paragraph 1 of the Federal Act on Registration (BMG),[1] information from the population register may be released only if it is in the public interest to do so. As this gives municipalities a certain leeway, some of them refuse to provide the desired addresses if the research purpose is not deemed to be in the public interest for one reason or another. Although the proportion of municipalities that refuse to release information for research purposes appears to have been rather low in the past,[2] we expect municipalities to behave differently in light of the European Union General Data Protection Regulation (GDPR), which came into effect on May 25, 2018. We assume that municipalities might now be more reluctant to supply personal data because of (a) uncertainties related to the GDPR and (b) higher public awareness of data privacy. If a municipality refuses to provide addresses, a substitute is used. However, substitution is methodologically problematic, especially if no structurally equivalent surrogate municipality exists (e.g., for the capital of a federal state). Nonresponse at municipality level may result in selection error that can have a stronger effect than nonresponse at individual level. To avoid this, alternative methods are required, which often include using other sampling frames (for that particular municipality) or other sampling procedures, such as random-route sampling. However, these alternatives often suffer from coverage errors and/or unknown inclusion probabilities that may lead to biased estimates.

With the present study, we tested an alternative sampling frame available in Germany —namely, the address database from Deutsche Post Direkt (DPD), which is referred to in what follows as the ADB-DPD. DPD is a subsidiary of Deutsche Post AG, the leading postal service provider in Germany. It specializes in address marketing and administers the largest commercial address database in Germany—

1 http://www.gesetze-im-internet.de/englisch_bmg/

2 In the 2014 German General Social Survey (ALLBUS), for instance, only six of the 148 selected municipalities did not provide addresses (Wasmer et al., 2017).

the ADB-DPD—which comprises over 77 million active and 143 million inactive private addresses throughout the country, with its population of roughly 83 million people (Deutsche Post Direkt, 2020). However, as DPD does not provide information on the coverage of its frame and on how addresses are obtained, knowledge on the feasibility of using it for survey sampling is lacking. Thus, we carried out the present study to explore the following two research questions:

- Is the ADB-DPD a viable *alternative* to register-based sampling, in particular for projects that cannot afford to draw a random sample from the population registers?
- Is the ADB-DPD a viable *complement* to register-based sampling in the case of those municipalities that refuse to provide addresses from their population registers?

In the next section, we describe the methods employed in our study and introduce the criteria used to assess the performance of the ADB-DPD. After presenting our results, we reflect on the feasibility of using the ADB-DPD for address-based sampling in Germany.

Data and Methods

The Surveys

We fielded two parallel surveys between November 2019 and February 2020 in the city of Mannheim. Mannheim is located in the federal state of Baden-Wuerttemberg in southwestern Germany and belongs to the prosperous Rhine-Neckar Metropolitan Region, which has a high proportion of specialized jobs, especially in technology and pharmaceuticals. The city is characterized by a large university student population (accounting for approximately 10% of the city's inhabitants, compared with a share of 3% of the population of Germany as a whole) as well as by ethnic diversity, with roughly 45% of the residents having a migration background (City of Mannheim, n.d.).

For the first survey (referred to in what follows as the "register survey"), we drew 3,000 individual addresses from the city's population register; for the second survey (the "DPD survey"), the same number of addresses was drawn from the ADB-DPD. For both surveys, simple random samples of all persons aged 18 years and older were drawn from each sampling frame.[3] Before we contacted our target persons for the first time, our field service provider checked the addresses for

3 Like the population registers, the ADB-DPD also allows for stratifying the sample according to age and sex. However, we have no information on the validity of the sociodemographic information in the ADB-DPD and, more importantly, on how this information is collected.

Table 1 Experimental design and groups

			Incentive		
Group #	Sampling frame	Mode sequence	1st contact	2nd contact	Group size
1	Population Register	Concurrent	0 €	0 €	375
2	Population Register	Concurrent	1 €	0 €	375
3	Population Register	Concurrent	2 €	0 €	375
4	Population Register	Concurrent	0 €	2 €	375
5	Population Register	Sequential	0 €	0 €	375
6	Population Register	Sequential	1 €	0 €	375
7	Population Register	Sequential	2 €	0 €	375
8	Population Register	Sequential	0 €	2 €	375
9	ADB-DPD	Concurrent	0 €	0 €	375
10	ADB-DPD	Concurrent	1 €	0 €	375
11	ADB-DPD	Concurrent	2 €	0 €	375
12	ADB-DPD	Concurrent	0 €	2 €	375
13	ADB-DPD	Sequential	0 €	0 €	375
14	ADB-DPD	Sequential	1 €	0 €	375
15	ADB-DPD	Sequential	2 €	0 €	375
16	ADB-DPD	Sequential	0 €	2 €	375

duplicates, and omitted 20 cases that were included in the address files from both sources.

Apart from differences in the cover letter (explained in more detail in the next section), both surveys were identical in terms of recruitment, field time, and questionnaire. We carried out a self-administered mixed-mode survey (web and postal mail), and randomly allocated target persons from each sampling frame to one of eight experimental groups, representing combinations of mode-choice sequence (sequential vs. concurrent) and small prepaid monetary incentives offered on the first or second contact. In both surveys, all groups had the same sample size (for an overview, see Table 1). However, as these experiments go beyond the scope of the present paper, we shall not report their findings here.

The survey was introduced to the target persons as a community survey dealing with the quality of life in Mannheim. However, it also included other topics such as political attitudes, personality traits, and the perception of surveys. The questionnaire took roughly 30 minutes to complete. Target persons received a

stamped addressed envelope in which to return the paper questionnaire. To account for the rising share of respondents answering surveys via mobile devices, the web-based questionnaire was optimized for smartphones.

Operationalization

To assess the performance of the ADB-DPD, we drew on the following criteria:

Feasibility: This criterion included measures that are relevant for survey planning and budgeting, as well as requirements for and restrictions on survey implementation and fieldwork as a consequence of relying on the ADB-DPD for sampling purposes. More specifically, these measures were: (a) the speed of address provision, (b) the costs of drawing a sample, (c) the feasibility of survey modes, and (d) restrictions on fieldwork.

Up-to-dateness: Here, we added up the proportions of target persons for whom (a) the invitation letter could not be delivered by the postal service, due to an incorrect address, death, or relocation; (b) the invitation letter could be delivered, but we subsequently found out (e.g., from relatives) that the target person had died or moved away (and the postal service was not aware of this).

Survey response: Participation in the two surveys was measured using the American Association of Public Opinion Research (AAPOR) Response Rate 2 (RR2; AAPOR, 2016).

Sample composition: Comparing the composition of the net samples for both surveys indicates whether the ADB-DPD suffers from coverage problems by systematically excluding or underrepresenting certain parts of the target population. To this end, we first analyzed the composition of the net samples in terms of sex and age. For these two variables, we also had information on their distribution in the target population (City of Mannheim, 2020). For the purpose of comparison with the official data, we recoded age into five groups (18–24, 25–29, 30–64, 65–79, 80 and older). Sex was coded dichotomously (1 = female, 0 = male).

Second, we compared the two samples in terms of migration background, formal education, marital status, employment status, place of birth, and second residence. To measure migration background, each respondent was asked whether they, their mother, or their father had immigrated to the current territory of the Federal Republic of Germany after 1955. We created a dummy variable indicating whether this was the case for any of the three persons. Formal education was also coded as a dummy variable, with the value 1 indicating that the respondent had a higher education entrance qualification (*Abitur* or *Fachabitur*). We created similar dummies indicating whether the respondent reported that they were married, employed, had lived in Mannheim since birth, and/or had a second residence in Germany. For these variables, we compared the two net samples (with the register survey as a reference), as no official statistics are available for Mannheim.

In addition, we compared the net samples with respect to a set of substantive variables. These variables, which covered a wide range of topics commonly asked in general social science surveys, were:

- *self-reported political interest* measured on a 7-point scale ranging from 1 (*not at all*) to 7 (*very strong*)
- *external political efficacy* operationalized as agreement with the statement "Politicians care about what people like me think," measured on a 7-point scale ranging from 1 (*do not agree at all*) to 7 (*completely agree*)
- *Abstention from voting* measured with the question whether the respondent would vote if there were a federal election on the following Sunday (1 = would abstain, 0 = would vote, missing value = not entitled to vote).
- *Intention to vote Conservative* measured with the voting intention question; a dummy variable indicates whether the respondent stated that they would vote for the Christian Democratic Union (CDU) party (1 = vote for CDU; 0 = vote for another party; missing value = would abstain or is not entitled to vote).
- *Interpersonal trust* measured with the question: "Generally speaking, do you think that most people can be trusted or that you cannot be too careful in dealing with other people?" (1 = most people can be trusted, 0 = cannot be too careful).
- *Institutional trust* measured with three items—trust in the federal government, trust in the media, and trust in political parties—with each item measured on a 7-point scale ranging from 1 (*do not trust at all*) to (*trust completely*).
- *Big Five personality traits* measured with the BFI-10 short scale (Rammstedt & John, 2007). Respondents answered the 10 items on a 7-point scale ranging from 1 (*disagree strongly*) to 7 (*agree strongly*). For each Big Five dimension (Openness to Experience, Conscientiousness, Extraversion, Agreeableness, Neuroticism), we computed the mean of the two items that measured it.

Results

Feasibility

Speed of Address Provision

DPD was able to provide the requested addresses within five working days. Due to the centralized setup of the ADB-DPD, addresses from a larger set of municipalities (throughout Germany) would probably have been provided in a similar timely fashion. To draw a nationwide sample from the population registers, German survey managers usually estimate that it will take up to three months to receive addresses from all selected municipalities.

Costs of Drawing a Sample

For up to 10,000 individual addresses, DPD charged 84 euros per 1,000 addresses (as of October 2019), irrespective of whether these addresses shared the same place of residence or were spread all over Germany. However, the minimum contract value was 1,000 euros per delivery. As our survey used the same addresses twice (i.e., for the initial contact and for a reminder), DPD regarded this as two deliveries and charged an additional fee (of 250 euros, as of October 2019) for data storage and for checking the up-to-dateness of the addresses prior to the second delivery. Thus, for a nationwide survey that fully relied on the ADB-DPD for address-based sampling with a gross sample of 10,000 target persons and three scheduled contact attempts, the cost of sampling would have amounted to 3,500 euros (3 x the minimum contract value, plus the additional fee for the second and third deliveries/contacts) as of October 2019. Based on our own experiences and on an estimate from an experienced survey manager at a German fieldwork agency, the costs for drawing a sample of similar size from the local population registers would have amounted to approximately 30,000 euros for acquiring the addresses alone. Consequently, using the ADB-DPD to draw a sample of residents from all over Germany is considerably cheaper and the data are provided much faster compared with the population registers. However, if researchers were to use the ADB-DPD as a substitute for individual, noncompliant municipalities, the costs for drawing a random sample of the residents of these municipalities would also amount to 3,500 euros (for three contacts), even if just 500 addresses from five municipalities were needed. This is due to the fixed minimum contract value per delivery. Thus, for small substitute samples of a limited number of municipalities, the relative costs per case are considerably higher.

Feasibility of Survey Modes

In terms of feasibility, the ADB-DPD had a major downside: We did not receive the addresses directly but had to engage a print service provider that, in turn, concluded a contract with DPD for receiving and processing the addresses. Although this did not negatively affect our fieldwork management,[4] it considerably limits the feasibility of using the database, as sampling via the ADB-DPD is not feasible for face-to-face surveys. Rather, the use of the ADB-DPD is limited to self-administered surveys with postal mail invitations. Moreover, it was not possible to further reduce survey costs by engaging our own staff (e.g., student assistants) to prepare the invitation and reminder letters, as all operative work with survey materials had to be done by the contracted print service provider.

4 To administer responses, each address was assigned an 8-digit string code by our print service provider. These codes were printed on the paper questionnaire and were also used as passwords to access the online questionnaire.

Restrictions on Fieldwork

When purchasing addresses, researchers are bound by DPD's terms and conditions. This has two important implications. The first relates to the content of the cover letter. DPD required that a rather lengthy text passage (770 characters including spaces) on data protection issues be prominently placed on the first page of our cover letter. This text was pre-written, its content could not be changed, and it was framed for the most common purpose for which the ADB-DPD is used, namely, advertising. This prescribed text could not instead be integrated into accompanying material such as the data privacy sheet. Its inclusion in the cover letter not only reduced the space available for providing relevant information about the survey. It also caused us to fear that target persons would doubt the integrity of the survey, especially because the (standardized) text suggested that the letter served advertising purposes. Finally, we had to submit all materials to DPD (e.g., the cover letter, the data privacy sheet, the questionnaire) in advance to obtain approval to mail them to our target persons. However, this did not prolong the preparation time before fieldwork, as we submitted our materials and received the approval on the same working day.

The second restriction on fieldwork was that we were limited in terms of when we could recontact our target persons (by sending reminders). More precisely, it was not possible to contact the same addresses again until four weeks after the initial contact. In the meantime, DPD checked whether any recipients had requested a deletion (using the procedure outlined in the aforementioned prescribed text passage). For survey managers, this means that a subsequent contact attempt cannot be carried out until four to five weeks after the previous one.[5] This increases the duration of fieldwork and likely diminishes the effect of incentives and other motivational material provided on the first contact attempt.

Up-To-Dateness

The proportion of target persons for whom the invitation letter could either (a) not be delivered due to an incorrect address, death, or relocation, or (b) be delivered, but we subsequently found out (e.g., from relatives) that the target person had died or moved away was 10.1% for the register survey and slightly lower (9.3%) for the DPD survey. According to a two-sample test for the equality of proportions, this difference did not fall below conventional thresholds for statistical significance ($t = 1.01$, $p > .05$).

5 As we used only one reminder in our study, we did not investigate whether a third delivery of the same addresses would have been possible. Thus, we suggest that researchers who plan to purchase addresses from DPD and to contact their target persons more than twice should clarify this matter with the company in advance.

Survey Response

The overall response rate across the two surveys was 24.3% (RR2; AAPOR, 2016). The response rate in the DPD survey (26.1%) was significantly higher than in the register survey (22.3%; $t = 3.26$, $p < .01$).

Sample Composition

As shown in Table 2, the share of females in the target population (official data) was 49.7% (as of 2019). In the register survey, this share was slightly lower (47.9%), but still considerably higher than in the DPD survey, where only 39.0% of all respondents were female. Based on a one-sample test for the equality of proportions, women were significantly underrepresented in the DPD survey compared with the official data ($z = -5.65$, $p < .001$).

With regard to age, the distribution of respondents in the register survey was not significantly different from that in the target population. In the DPD survey, however, the age distribution was heavily skewed toward older people: The share of people aged 65–79 years (27.7%) was almost twice as high as in the target population. By contrast, the share of respondents aged 18–24 and 25–29 in the net sample of the DPD survey was only 3.3%, whereas in the target population 21.4% belonged to these age groups. This indicates that older people are considerably overrepresented in the ADB-DPD.

Regarding further sociodemographic variables (see Table 3, Panel A), the share of respondents with a migration background was rather low in both surveys. This finding is a common phenomenon, especially in self-administered surveys (Salentin, 2014). In the DPD survey, the share of respondents with a migration background was 11.7%, which was significantly lower than that in the register survey (21.7%; $t = 4.58$, $p < .001$).

To account for differences in sample composition between the two surveys with regard to age and sex, we estimated additional multivariate regression models based on the pooled dataset with age and sex as covariates (see Table 3, Panel B). We then calculated the predicted proportions of all sociodemographic variables for the two values of our sample variable (i.e., for our two surveys with the different sampling frames), holding age and sex at the grand mean of the pooled dataset. For the share of respondents with a migration background, the multivariate model revealed a reduced but still significant difference between the two surveys. With regard to formal education, the register survey showed a significantly higher share of respondents with a higher education entrance qualification (61.5% in the register survey vs. 51.7% in the DPD survey; $t = 3.44$, $p < .001$). In the multivariate model, however, these differences disappeared (and were even reversed), suggesting that differences in the sample composition with respect to age and sex were responsible

Table 2 Sex and age distribution in the target population (official data) and in the register and DPD surveys

Demographic variables	Official data (%)	Register survey (%)		DPD survey (%)		*p* (Register vs. DPD)
Female	49.7	47.9	ns	39.0	***	**
Age						
18–24	11.6	13.6	ns	1.3	***	***
25–29	9.8	10.9	ns	2.0	***	***
30–64	56.9	54.5	ns	62.4	**	**
65–79	14.8	15.9	ns	27.7	***	***
80 and over	6.9	5.2	ns	6.6	ns	ns

Note: Differences in demographic variables between the register survey/DPD survey and official data were tested using (two-sided) one-sample tests for the equality of proportions. Differences in demographic variables between the two surveys were tested using a (two-sided) two-sample test for the equality of proportions. ns = not significant.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3 Predicted proportions of other demographic variables in the register survey and the DPD survey with and without age and sex as covariates

	Panel A: Predicted proportions excluding age and sex as covariates			Panel B: Predicted proportions including age and sex as covariates		
Demographic variables	Register survey (%)	DPD survey (%)	*p*	Register survey (%)	DPD survey (%)	*p*
Migration background	21.7	11.7	***	19.4	13.1	**
High level of formal education	61.5	51.7	***	54.4	57.5	ns
Living in Mannheim since birth	32.4	51.0	***	32.6	50.8	***
Married	46.5	66.2	***	51.8	61.8	***
Second residence in Germany	6.6	8.1	ns	5.9	9.0	ns
Employed	58.9	57.1	ns	50.2	63.0	ns

Note: All estimates are predicted proportions based on logistic regression models with the respective demographic variable as dependent variable. The models in Panel A included the sample as the only independent variable and the models in Panel B included the sample, age, and sex as independent variables. The results in the *p*-columns refer to the *p*-values of the regression coefficients of the sample variable in the bivariate regression models (Panel A) and the multivariate regression models (Panel B), respectively. ns = not significant.

* $p < .05$, ** $p < .01$, *** $p < .001$.

for the higher share of highly educated respondents in the register survey. Yet, even after including sex and age as covariates, respondents in the DPD survey had a significantly higher probability of being married, of being employed, and of having lived in Mannheim since birth. For these variables, the net sample of the DPD survey significantly differed from that of the register survey, which we used as our reference distribution.

Finally, Table 4 shows differences between the register survey and the DPD survey with respect to substantive variables. Similarly to above, we report the predicted means and proportions for these variables and for the two surveys based on a bivariate regression model (Panel A) and on a multivariate model including age and sex as covariates (Panel B). Without accounting for the different sample composition, we found that responses in the DPD survey showed higher levels of political interest and lower levels of external efficacy. When age and sex were included as covariates, differences in self-reported political interest disappeared. However, in this scenario, the gap in external political efficacy remained and differences in institutional trust were even more pronounced. Although we found significant differences for some variables either in the bivariate or in the multivariate model, we would like to note that we consider the magnitude of these differences to be small.

Table 4 Predicted means/proportions of substantive items in the register survey and the DPD survey with and without age and sex as covariates

	Panel A: Predicted means/ proportions excluding age and sex as covariates			Panel B: Predicted means/ proportions including age and sex as covariates		
Substantive items	Register survey	DPD survey	*p*	Register survey	DPD survey	*p*
Self-reported political interest 1 = not at all; 7 = very strong	4.98	5.22	**	5.08	5.13	ns
Politicians care about what people like me think (external political efficacy) 1 = do not agree at all; 7 = completely agree	3.01	2.69	***	2.98	2.72	**
Abstention from voting	7.6%	5.6%	ns	8.0%	5.3%	ns
Intention to vote Conservative	19.3%	24.5%	*	22.2%	22.2%	ns
Interpersonal trust 0 = one cannot be too careful; 1 = most people can be trusted	56.2%	56.4%	ns	54.3%	58.0%	ns

Table 4 continued

Substantive items	Panel A: Predicted means/ proportions excluding age and sex as covariates			Panel B: Predicted means/ proportions including age and sex as covariates		
	Register survey	DPD survey	*p*	Register survey	DPD survey	*p*
Institutional trust						
Trust in the federal government 1= do not trust at all; 7= trust completely	4.07	3.96	ns	4.12	3.92	*
Trust in the media 1= do not trust at all; 7= trust completely	3.59	3.65	ns	3.66	3.58	ns
Trust in political parties 1= do not trust at all; 7= trust completely	3.27	3.14	ns	3.29	3.12	*
Personality Traits (Big Five)						
Openness to Experience 1= very low; 7= very high	4.75	4.59	ns	4.72	4.62	ns
Conscientiousness 1 = very low; 7 = very high	5.38	5.48	ns	5.44	5.43	ns
Extraversion 1 = very low; 7= very high	4.49	4.37	ns	4.43	4.42	ns
Agreeableness 1 = very low; 7 = very high	4.31	4.35	ns	4.32	4.34	ns
Neuroticism 1 = very low; 7 = very high	3.39	3.35	ns	3.33	3.41	ns

Note. All estimates are predicted means/proportions based on linear/logistic regression models (logistic regression models were estimated for "Abstention from voting," "Intention to vote Conservative," and "Interpersonal trust") with the respective substantive item as the dependent variable. The models in Panel A included the sample as the only independent variable; the models in Panel B included the sample, age, and sex as independent variables. The results in the *p*-columns refer to the *p*-values of the regression coefficients of the sample variable in the bivariate regression models (Panel A) and the multivariate regression models (Panel B), respectively. ns = not significant.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Discussion

With the present study, we tested the feasibility of using the ADB-DPD as a sampling frame for scientific surveys. In many countries, commercial enterprises—in particular postal service providers—have specialized in collecting and selling addresses of their residential populations. In Germany, DPD administers the largest database of this kind, which is used mainly for marketing purposes. How-

ever, this database, referred to in the present study as the ADB-DPD, can also serve as a frame for address-based sampling for nationwide surveys, as addresses can be randomly drawn from all current entries throughout the country.

The starting point for our study was the assumption that sampling from the official population registers is the gold standard for drawing representative samples of the German residential population. Nevertheless, we assumed that the ADB-DPD might be attractive as a complement to register-based sampling or even as an alternative sampling frame in two survey scenarios. In the first scenario, survey projects have limited resources in terms of time and funds but need to include target persons with a high regional diversification, or even aim to carry out a nationwide survey. In the second scenario, survey projects have sufficient resources to comply with the gold standard for sampling—that is, register-based sampling—but are faced with the problem that some municipalities refuse to provide the requested addresses. In this scenario (and particularly in cases where these municipalities cannot be easily substituted), the ADB-DPD might complement the population registers for address-based sampling. For these potential scopes of application, our study aimed to provide a first assessment of the feasibility of using the ADB-DPD as a frame for address-based sampling, especially in light of the fact that DPD provides no information on the coverage of this database.

A key limitation of the ADB-DPD is that it is meaningfully usable as a sampling frame only for self-administered surveys. This is because researchers do not receive the addresses directly but can communicate with their target persons only via a print service provider. Of course, this considerably limits the scope of application. However, despite this important restriction, our results were rather promising in terms of feasibility. Due to the centralized setup of the ADB-DPD, addresses from all over Germany can be randomly drawn and provided by DPD within five working days and at low costs. The ADB-DPD appears to be especially cost-effective for nationwide survey projects that consider relying fully on this sampling frame. In contrast, when a random sample is needed for only a small number of noncompliant municipalities that cannot be substituted (which we consider the most important case for scientific surveying), sampling via the ADB-DPD is rather expensive, due mainly to the fixed minimum contract value. Moreover, due to DPD's insistence on trade secrecy, the generation of the sampling frame is essentially a black box. As a result, coverage error is not computable.

Having said that, the ADB-DPD performed well in terms of survey response and up-to-dateness. With regard to survey response, the DPD survey even yielded a significantly higher response rate than the register survey. This outcome is surprising, given that DPD required that more data privacy information be included in the cover letter. However, the higher response rate might be related to the fact that the ADB-DPD (over)covers demographic groups with higher response propensities.

Moreover, the rate of undeliverable invitation letters was slightly lower in the DPD survey.

Regarding sample composition, we found a substantial underrepresentation of women and young people in the DPD survey. Given that we drew a simple random sample from both frames and administered an almost identical survey in terms of recruitment, field time, and questionnaire, this may indicate that the ADB-DPD suffers from coverage error for these demographic groups. Similarly, when comparing the net samples, the DPD survey showed a remarkably higher proportion of people who had been living in Mannheim since birth, but a considerably lower proportion of respondents with a migration background. All this suggests that the ADB-DPD covers a larger share of the less mobile segment of the population (older people, non-migrants, people who rarely change their place of residence). This reasoning might also explain the higher response rate in the DPD survey, as the less mobile segment of the population might have been particularly attracted by the local focus of the survey. Turning to substantive variables, we found some differences between the net samples of our two surveys—before and after including age and sex as covariates in our statistical models. However, these appeared to be of low magnitude.

Overall, we would like to caution that using the ADB-DPD comes with its own challenges and uncertainties, especially regarding the way in which addresses are obtained and how well the database covers the residential population. Regarding the feasibility of using the ADB-DPD for sampling purposes, this seems to be an option for smaller research projects that cannot afford to draw a nationwide sample from the population registers and/or that operate on a tight schedule. This holds true especially when the estimation of valid parameters for the residential population is not a high priority, but rather the focus is on experimentation.

Our study can be extended in various ways. First, we encourage future research to compare different alternatives to the gold standard (i.e., register-based sampling) and to detail the pros and cons of each alternative. If a noncompliant municipality cannot be substituted, there will be a trade-off between having no addresses for this regional unit (i.e., risking systematic undercoverage) and drawing on alternative frames with their own challenges and possible errors. As was the case in our study, we suggest investigating this question by fielding similar surveys in parallel in the same regional units using different sampling methods.

Second, our study focused on the municipality of Mannheim. Although our findings might hold true for other cities or regions in Germany, replication studies are required. Such studies should also aim to cover different topics. Our survey was framed as a community survey that covered a diverse set of substantive social science questions. However, it would be interesting to see how well the ADB-DPD performs for specific topics (e.g., election studies) or for questionnaires without a topic of local relevance.

Third, given the country-specific nature of the ADB-DPD, we refrain from generalizing our findings to other countries. However, we provide empirical evidence on how sampling approaches and their impact on survey outcomes differ. In our study, we show these differences for a presumably more cost-efficient alternative to the established gold standard—register-based sampling—in Germany. We would thus welcome further research that conducts similar studies in other countries. Such studies could aim to investigate how other country-specific commercial address services perform, and whether they are an alternative to or can complement register-based sampling.

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