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Nonresponse Bias in Economic Surveys: Evidence from Merging Israeli Administrative and Survey Data

By

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Nonresponse Bias in Economic Surveys: Evidence from Merging Israeli Administrative and Survey Data*

Ori Heffetz Daniel B. Reeves

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Abstract

What if those who respond to a survey are different, in fundamental ways, from those who do not? How biased will our survey-based answers to policy questions be? The impact of this potential bias has increased as survey response rates, even to large, well-funded surveys, have been steadily declining over the past decades. Past research suggests a method for studying this potential bias using measures of difficulty-of-reaching respondents. Here, we go beyond past analysis by matching survey and administrative data for national surveys in Israel. We are therefore able to empirically determine the degree to which survey nonrespondents do or do not look like survey respondents.

Keywords: nonresponse bias, selection bias, survey data, administrative data, difficulty of reaching, number of contact attempts, paradata, unemployment, expenditure, income

JEL Classification: C18, C83, J60, I18.

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1 Introduction

In spite of the explosion in digital data that seem to track almost every aspect of our behavior, survey data are still the primary (and, sometimes, the only viable) source for many national statistics, social indicators, and economic analyses. Closely watched around the world and heavily used in research, for example, national unemployment rates are based on labor-force surveys, and inflation figures are based on weights estimated from household expenditure surveys.

A decades-long trend of declining survey response rates has therefore been observed with some alarm. If units (individuals or households) sampled from a population to be included in a survey do not participate ("unit nonresponse") then, unless these nonparticipants are statistically identical to participants ("missing at random"), survey-based outcomes could suffer from nonresponse bias. Has increasing nonresponse rates turned this theoretically well-studied possibility into an actual empirical problem? Have indicators on the state of national economies, labor markets, and population health become less representative of the populations they are meant to track?

Existing empirical research assessing the accuracy of survey data have mostly taken one of two approaches. First, an extensive literature focuses on cases where (a) a specific survey outcome can be verified in administrative data, and (b) individual survey records can be matched to administrative records. In such cases, researchers can compare the survey outcomes with administrative outcomes.[1] Second, a smaller literature focuses on surveys whose paradata include information on the difficulty of reaching each respondent (e.g., the number of visits, or phone-call attempts, made before completing the interview). For a given survey outcome, researchers can then compare between respondents that are easier to reach and those that are increasingly more difficult to reach. If

[1] In a most recent example, Meyer and Mittag (2019) focus on responses in the Current Population Survey (CPS) regarding amounts received from four government income-transfer programs (e.g., food stamps and subsidized housing). Since most transfer programs record recipients' Social Security number (SSN), the authors are able to link responses to administrative records, and compare reported to actual amounts received at the household level. They have a high match rate: they can identify the SSN of at least one household member in 91 percent of CPS households in their sample. They find severe under-reporting.

a trend is found, then, *under the assumption that nonrespondents are more similar to difficult than to easy respondents*, researchers can make some inferences on the potential for selection bias. This research aims to assess this assumption.

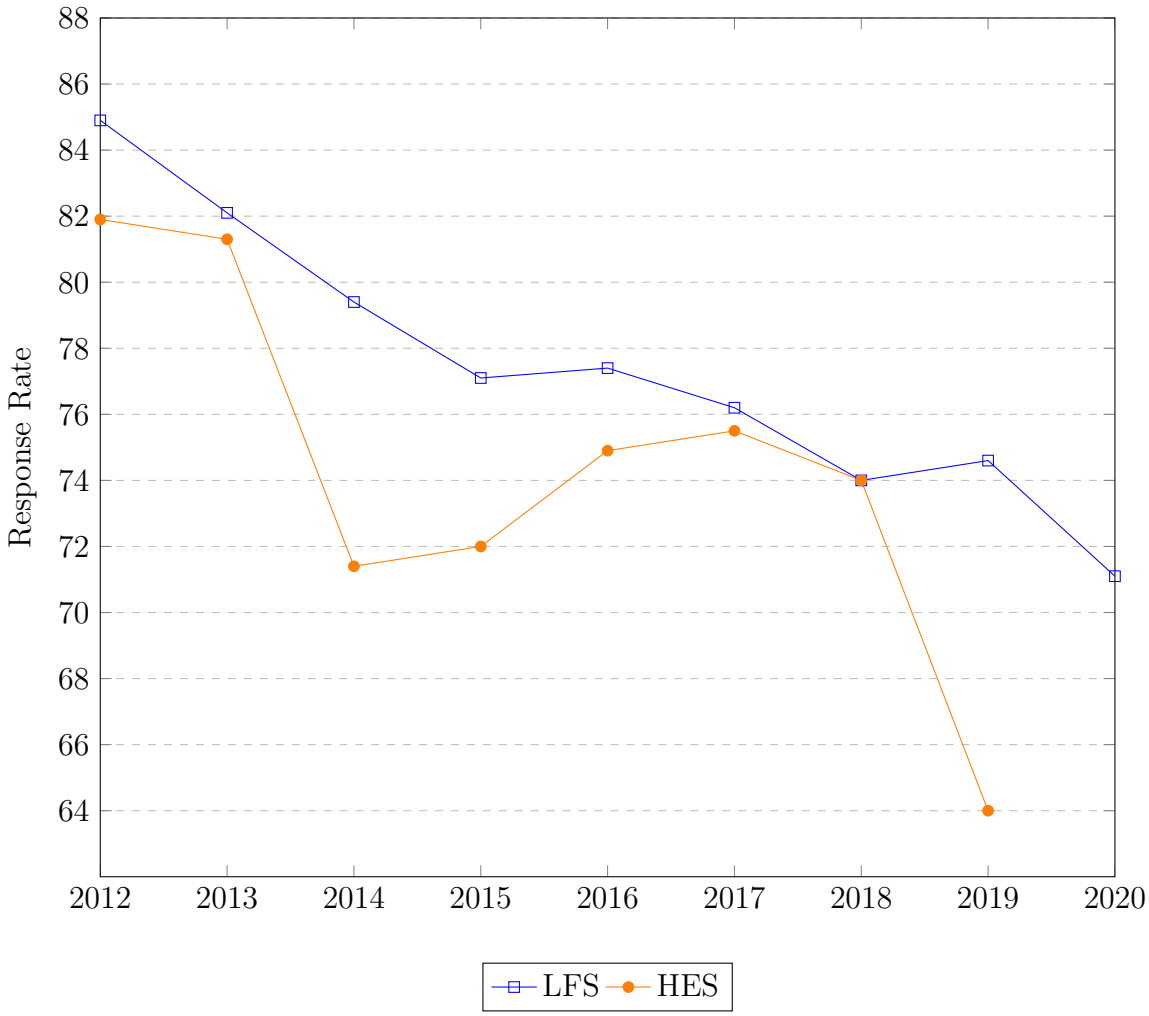
Heffetz and Reeves (2019) built upon Heffetz and Rabin (2013) to demonstrate that the difficulty of reaching respondents might help in assessing the potential for survey nonresponse bias. In particular, if the difficult-to-reach do not look like the easy-to-reach on the outcomes of interest, after controlling for observable characteristics, then there might be reason to believe that those that do not respond (and thus might be considered the hardest-to-reach of all) may differ from the average respondents to the survey. Heffetz and Reeves (2019) found that this was the case, in three widely-used sources of US economic data, for four widely-used statistics: unemployment rate, labor force participation rate, obesity rate, and household expenditures. However, while that paper found suggestive evidence that nonrespondents might not look like respondents, it suffered from a fundamental limitation of survey-based research: the inability to say anything definitive about those that do not respond to the survey.

In this paper, we attempt to bypass that limitation by connecting survey data with administrative measures of related outcomes. This allows us, first, to compare the easy-to-reach and difficult-to-reach not only within the survey, but also in the matched administrative data. Second, and crucially, we use the administrative data to examine those who do not respond to the survey at all and to assess the extent to which they look like respondents—collectively and across the difficulty-to-reach spectrum. To do this, we focus on two widely-used survey sources of Israeli economic data, that can, in turn, be matched to administrative records containing information on demographics (such as age, sex, and education) and outcome information such as months worked and household income.

Our analysis uses two national surveys conducted by the Israel Central Bureau of Statistics (ICBS): the Labor Force Survey (LFS) and the Household Expenditure Survey (HES). These two surveys provide the official Israeli estimates for labor force participation (LFS), the unemployment rate (LFS), and household expenditures (HES). They

are also used extensively in economics research.[2] As with many surveys in the US (including the three used in Heffetz and Reeves (2019)), both surveys have seen a decline in participation rates over the last decade (see Figure 1). This decline in response rate highlights the relevance of this study.

Figure 1 Response Rates for the HES and the LFS surveys



Notes: This figure contains the annual response rates for both the LFS and HES. The response rates are the percent of households that answered the surveys out of the number of households contacted.

In Section 2 we describe the LFS. Examining the LFS sample by difficulty-of-reaching, as measured by contact attempts, we find notable trends across many demographics such

[2]Examples include Ben-Porath and Gronau (1985), Finkel, Artsev and Yitzhaki (2006), and Schechtman, Yitzhaki and Artsev (2008).

as age and education. Before controlling for these demographic differences, we also find large, monotonic, and statistically significant trends in our two outcome variables of interest: labor force participation and unemployment rate. Labor force participation increases from 59.1% among the easiest-to-reach to 68.8% among the hardest-to-reach; while the unemployment rate goes from 6.1% to 5.1%, respectively. When controlling for demographic differences using adjusted means, the gap in labor force remains statistically significant, but the gap between easiest- and hardest-to-reach shrinks from 9.5 percentage points to 1.1 percentage points. The gap in unemployment rate also shrinks and becomes statistically insignificant (5.7% [SE: 0.2] versus 5.5% [0.1]).

In Section 3 we describe the HES data. We find similar demographic trends across difficulty categories. We also find a large and statistically significant difference between the easiest- and the harder-to-reach categories on household spending. The easiest-to-reach spend 11,535 NIS [64], while the two harder categories spend 12,409 NIS [101] and 12,004 NIS [71], respectively. We find large differences in income across difficulty categories: the share in the lowest quartile of income decreases from 27.4% to 22.3%, while the share in the highest quartile increases from 22.2% to 26.0%. After controlling for demographics, the gap in expenditures shrinks but remains statistically significant—becoming around 150 NIS. Using the adjusted means, there is no longer a significant difference between the easiest-to-reach and hardest-to-reach groups' income (easiest: 12,407 [87]; hardest 12,494 [100]), but the middle difficulty group has significantly higher income (12,862 [103]).

In summary, replicating the methods of past research that compares, among survey respondents, the difficult versus the easy to reach, we find substantial demographic differences across difficulty categories, particularly among age and education. We find large differences in our uncontrolled means across difficulty groups for our outcomes of interest: labor force participation, unemployment rate, income, and expenditure. But, these results are less robust than those found in similar US surveys. The pattern for expenditure is non-monotonic, with a spike in the middle difficulty category. As typically found in the US data, adding controls lowers the differences between difficulty

categories on all outcomes; however, unlike the US data, some of the differences are no longer statistically significant for two of our outcomes (unemployment rate and household income).

Section 4 presents our main contribution. We describe the administrative data that we use to match to not only respondents but, importantly, also nonrespondents from the two surveys. We take advantage of three administrative data sources: the Individual Income Registry, the Education Registry, and the Resident Registry. The ICBS uses the Dwellings and Buildings Registry to match these data sources with each of the surveys' sample frames. Our match quality is generally strong, with 88–94% matches for most of the administrative data for both survey samples.[3]

In the LFS sample, we construct two administrative data proxies for labor force participation, one using a match to the Individual Income Registry (indicating some employment income), and the other using employment for the entire 12 months of the year. In both cases, we find some evidence of a gap across difficulty-of-reaching categories, with the easiest-to-reach having substantially different outcomes than the hardest-to-reach, even after controlling for observable variables. In the HES sample, we use administratively measured income (income being strongly correlated with expenditures) as our outcome. Here, unlike with the survey data, we find a statistically significant, monotonic trend across difficulty-categories. For all three outcome variables, we do not find evidence that the gradient across difficulty categories extends monotonically into the group of survey nonrespondents. However, we do find evidence that nonrespondents are different from respondents—for two of the three variables (full annual employment and income) they are significantly lower than the group of respondents. We examine nonrespondents further by separating them by difficulty prior to not being reached and, for all three outcomes, we find a difficulty gradient (albeit not always monotonic and not statistically significant for income) among nonrespondents. This finding confirms that, much like respondents, not all nonrespondents are the same, even when controlling for observable characteristics.

[3]We have lower match rates for income and months worked variables, around 47–58%, which partially reflects the fact that not all households have employed members and would not appear in this data.

We conclude in section 5. Our findings from Israel generally support the existence of difficulty-of-reaching gradients in important outcome variables, even after controlling for observables. This finding continues to suggest that measures of difficulty-of-reaching contain information about outcomes of interest, in addition to the observable demographic differences across difficulty. We did not find evidence that the previously hypothesized difficulty gradient extended monotonically into the nonrespondents—nonrespondents did not generally look "harder" to reach than the hardest-to-reach respondent (as measured by either demographics or outcome variables). However, we do find evidence of heterogeneity in nonrespondents across difficulty-of-reaching groups that suggests examining nonrespondents at finer levels of granularity as an area of future research. While administrative data is often thought to be a panacea for the flaws of survey data, we find that survey nonrespondents are also generally more likely to be missing administrative data. Therefore, even the administrative "truth" may often be limited in what it can reveal to researchers about survey nonrespondents.

In addition to the work cited above, past work that is most closely related to ours includes Curtin, Presser and Singer (2000) that found consumer sentiment varied by the difficulty of reaching respondents, a predecessor to Heffetz and Rabin (2013). A literature also exists of theoretical papers, exploring the use of probability of survey participation's relationship to survey outcomes (see Potthoff, Manton and Woodbury (1993); Biemer, Chen and Wang (2013); Behaghel et al. (2014); and Krueger and West (2014) for examples). A limited number of studies examine linked survey and administrative data, while also examining difficulty of reaching, including Lin and Schaeffer (1995) and Kreuter, Müller and Trappmann (2010). Additionally, Keeter et al. (2000) experimentally explores the relationship between surveying effort and survey-measured outcomes.

2 Labor Force Survey (LFS)

The Labor Force Survey (LFS) is a monthly survey that measures and tracks the labor force in Israel. Similar to the Current Population Survey (CPS) in the US, the survey provides the nation's official unemployment rate and labor force participation rate. The survey also provides detailed information on the labor force's demographic characteristics—such as age, sex, and education—and collects information about living conditions and mobility in employment. We analyze the LFS data collected from 2012–2017.

The LFS is conducted using a two-phase sampling process: first, sampling localities in Israel and, second, sampling dwellings from each sampled locality to be part of the survey sample.[4] The survey interviews may be conducted by phone or in person. From the selected households, labor force information is confirmed for all the members who are permanent residents that are at least age 15. In dwellings with more than one household, each component household is surveyed.[5] [6]

Each year the sample is drawn and divided into 12 mutually exclusive groups known as panels. Panels are added, one by one, into the survey during the following 12 consecutive months. Each panel is surveyed in a rotational pattern of four consecutive months, followed by an eight months break, followed by four more months of being surveyed (the same interview pattern used by the US's CPS). Following Heffetz and Reeves (2019), we focus on the first interview that occurs when a panel is added to the sample (known as a Stage A interviews). Stage A interviews are conducted almost exclusively in person—however, in unique cases where a personal visit is too complicated to conduct (such as on permanent military bases), the interview is conducted by phone. For field interviewers, when no one was home on the first visit, interviewers usually make two subsequent visits. For each visit in which no household member is interviewed, the interviewer indicates

[4] Localties for the first stage of sampling include cities, small towns, Kibbutzim, and other types of communities.

[5] A small part of the population, with relatively stable characteristics, is covered by a permanent sample taken from the 2008 Census (e.g., the population of military bases).

[6] For more detail on the LFS, see `https://www.cbs.gov.il/en/publications/pages/2021/labour-force-survey-2019.aspx`.

the reason in a questionnaire.

Some dwellings initially chosen to be part of the sample are then dropped from the sample due to being unoccupied or non-residential dwellings.[7] Nonresponse to the survey can be due to absence of household members, refusal of household members to respond, difficulty with communication, or inability to locate the dwelling. The final reason for a household's data not being included in the survey is determined and coded during the data processing and editing step of the survey.

We focus on the labor force and unemployment questions of the LFS, which uses definitions for employment and labor force participation that are very similar to those of the Organization for Economic Co-operation and Development (OECD). Sample members are defined as employed if they work at least one hour during the week of the survey. They are classified as unemployed if they did not work during the week of the survey and, also, actively sought work during the four preceding weeks. Individuals, aged 15 and over, who were either employed or unemployed during the determinant week of the survey are considered part of the labor force. Besides information about work and the dwelling (e.g., number of rooms), the following demographic data are also collected: age, sex, marital status, country of birth, length of residence in Israel, and education (years of education, type of school last attended, and highest diploma received).

The survey paradata that was provided to us by the ICBS contain information about the ICBS initial contact attempts regarding dwellings that were sampled between 2012–2017.[8] The data contain information regarding the ICBS contact attempts during Stage A. In the case of unsuccessful contact attempts, there is one observation for every attempt. In the case of a successful attempt, there is one observation for every household member aged 15 and over. For some households, the initial interview was spread over several visits. The data provided by the ICBS contain the first successful contact attempt of the first visit (whether or not the interview was entirely completed on that same visit); or, in case no one in the dwelling was reached, the last contact attempt.

[7] These households are excluded from the calculated nonresponse rate and are known as "zero" cases for the interview.

[8] Appendix Table 19 describes the final disposition for each household sampled during our period of interest for the LFS, while Appendix Table 20 provides similar information for the HES.

We use these LFS paradata to create the "Total number of visits" variable (number of visits conducted until initial response or last attempt). We then keep the last visit (containing data in the case of a successful attempt or just the total number of attempts for the household otherwise). Following ICBS instructions, we then exclude 310 dwellings from the 2012 survey. The paradata are then merged to the LFS survey data. A total of 187,313 observations were surveyed and matched with the paradata. There are 27,089 records in the paradata that do not appear in the survey data. These are dwellings that were surveyed but did not participate; this group of household is the "nonrespondent" (NR) group.

2.1 Demographics

Table 1 is based on information from the 78,503 households that responded at least partially to the Stage A interview, and had paradata, between the years 2012–2017. For each responding household, the ICBS surveyor interviews an adult member of the household, and that member provides information about all family members. The 78,339 households that answered the LFS provided information on 187,313 household members. We divide these households into three groups based on the number of attempts required to reach the household for Stage A interview. The table's first three columns—1 attempt, 2 attempts, and 3 or more attempts—report basic demographics on each group. Every observation corresponds to a household member.

Analyzing Table 1, we find trends consistent with those in the literature. Easier-to-reach respondents tend to be older: the share of those aged 65 or more decreases from 18.3% of the easy-to-reach to 15.5% of the hard-to-reach. Additionally, the easy-to-reach tend to be less educated, with the lowest education group (less than high school) comprising 26.4% of the easiest-to-reach group but only 18.7% of the hardest-to reach group, and with the share of highest education category 4 percentage points higher among the hard-to-reach. There is also a trend in the religious composition of each difficulty-of-reaching group: 71.4% of the easy-to-reach identify as Jewish compared to 88.4% of the hardest-to-reach group. Finally, there is a strong trend in the labor force

Table 1: LFS Demographics

Attempts		1	2	3+	All
Age:	15-21	15.4	14.3	14.1	14.8
		(0.12)	(0.17)	(0.15)	(0.08)
	22-39	30.3	32.1	32.9	31.4
		(0.15)	(0.22)	(0.21)	(0.11)
	40-49	15.6	16.2	16.4	16
		(0.12)	(0.18)	(0.16)	(0.08)
	50-64	20.4	20.7	21.1	20.7
		(0.13)	(0.19)	(0.18)	(0.09)
	65+	18.3	16.8	15.5	17.2
		(0.13)	(0.18)	(0.16)	(0.09)
Children in HH		47.7	48.4	49.6	48.4
		(0.16)	(0.24)	(0.22)	(0.12)
Female		52.0	52.4	52.7	52.3
		(0.16)	(0.24)	(0.22)	(0.12)
Educ:	Less than High School	26.4	21.5	18.7	23.2
		(0.15)	(0.2)	(0.17)	(0.1)
	High School	28.6	27.8	28.4	28.4
		(0.15)	(0.21)	(0.2)	(0.1)
	13-15	20.4	22.7	22.9	21.6
		(0.13)	(0.2)	(0.19)	(0.1)
	16 and Up	23.9	27.2	28.2	25.8
		(0.14)	(0.21)	(0.2)	(0.1)
	Missing	0.7	0.8	1.8	1.0
		(0.03)	(0.04)	(0.06)	(0.02)
Contacted by Phone		1.1	8.5	47.7	15.6
		(0.03)	(0.13)	(0.22)	(0.08)
Rel. :	Jewish	71.4	81.2	88.4	78.3
		(0.15)	(0.19)	(0.14)	(0.1)
	Arab	26	15.8	8.5	18.8
		(0.14)	(0.17)	(0.12)	(0.09)
	Other	2.7	3.0	3.1	2.9
		(0.05)	(0.08)	(0.08)	(0.04)
L.F.P.:	Employed	55.5	60.8	65	59.4
		(0.16)	(0.23)	(0.21)	(0.11)
	Unemployed	3.6	3.6	3.5	3.6
		(0.06)	(0.09)	(0.08)	(0.04)
	Not in the labor force	40.9	35.6	31.4	37.1
		(0.16)	(0.23)	(0.2)	(0.11)
Labor force participation		59.1	64.4	68.6	62.9
		(0.16)	(0.23)	(0.2)	(0.11)
Unemployment rate		6.1	5.6	5.1	5.7
		(0.1)	(0.14)	(0.12)	(0.07)
Median number of attempts (known)		1	2	4	2
Observations		91,868	44,030	51,415	187,313

Notes: Sample: All Stage A households that were partially or completely surveyed. This corresponds to cells LS9 and LS11 in Figure 2. All figures (and standard errors) reflect proportions within each column's difficulty-of-reaching category, except for the unemployment figures which are are calculated as described in the text and the number of attempts (which report medians). Source: Labor Force Survey 2012–2017.

Table 2: LFS—Attempts Crosstabulation

	Phone Attempts							
In-person Attempts	1	2	3	4	5	6	NA	Total
1	2,664	1,431	812	445	248	321	90,958	96,879
2	3,585	1,835	1,075	602	340	389	40,377	48,203
3	2,923	1,655	965	510	390	277	15,886	22,606
4	1,672	827	471	240	169	208	5,863	9,450
5	627	403	205	100	80	105	2,082	3,602
6	248	146	63	55	27	32	650	1,221
7	144	89	71	38	36	52	336	766
NA	910	989	935	604	446	702	0	4,586
Total	12,773	7,375	4,597	2,594	1,736	2,086	156,152	187,313

Notes: Sample: All Stage A households that were partially or completely surveyed. Counts the number of contact attempt by mode. NA means no reported attempts using that mode. Source: Labor Force Survey 2012–2017.

composition of the difficulty groups. The share employed grows from 55.5% among the 1-contact group, to 60.8% in the 2-attempt group, and to 65.0% among the hardest-to-reach group. Correspondingly, the labor force participation rate grows from 59.1% to 68.6% from easiest to hardest-to-reach. The unemployment rate falls from 6.1% to 5.1% from the easiest- to the hardest-to-reach groups.

Another notable trend in the data is the rapid increase of the percentage contacted by phone across difficulty categories. While only 16% of total interviews were completed by phone, almost 48% of the most difficult-to-reach were contacted by phone. Table 2 explores the relationship between in-person and phone contacts. Almost all of those with a phone attempt, have also had at least one in-person contact attempt (while the converse is not true). Additionally, among those with just phone attempts, the share across higher contact attempts is much higher—compared with those with just in person attempts, where there is a steep decline for the higher number of attempts. Both of these effects combine to cause telephone interviews to be a much higher share of the difficult-to-reach group.

Table 3: LFS Labor force participation

Attempts	1	2	3+
	A. Regression with Interactions		
	Base	Interactions	
Age: 15-21	-0.279***	-0.019	0.003
	(0.006)	(0.011)	(0.010)
22-39	-0.022***	-0.002	-0.005
	(0.004)	(0.007)	(0.007)
50-64	-0.142***	0.016	0.020
	(0.005)	(0.008)	(0.008)
65 and up	-0.594***	-0.016	0.005
	(0.006)	(0.010)	(0.009)
Children in HH	-0.027***	-0.002	-0.013
	(0.004)	(0.007)	(0.006)
Female	-0.043*	0.000	0.015
	(0.016)	(0.027)	(0.025)
Orthodox	-0.340***	-0.002	0.019
	(0.010)	(0.016)	(0.014)
Female Orthodox	0.274***	-0.014	-0.039
	(0.013)	(0.021)	(0.020)
Female Jew	-0.028	0.005	-0.014
	(0.016)	(0.027)	(0.026)
Female Arab	-0.295***	-0.003	-0.012
	(0.017)	(0.029)	(0.028)
Phone Dummy	0.100***	-0.111***	-0.093***
	(0.012)	(0.014)	(0.013)
Educ: Less than High School	-0.203***	-0.011	-0.026***
	(0.004)	(0.007)	(0.006)
13-15	-0.019***	0.006	0.001
	(0.004)	(0.007)	(0.006)
16+	0.036***	-0.012	-0.016*
	(0.004)	(0.006)	(0.006)
Missing	-0.156***	0.022	0.072***
	(0.016)	(0.026)	(0.021)
Nationality.: Arab	-0.078***	0.002	0.027*
	(0.004)	(0.009)	(0.010)
Other	0.070***	-0.035	-0.045
	(0.012)	(0.021)	(0.019)
Constant	0.921***	0.034	0.090***
	(0.008)	(0.014)	(0.013)
		B. Adjusted Means	
Labor Force Participation	0.634***	0.629***	0.645***
	(0.002)	(0.002)	(0.002)

Notes: N=187,313 (1 Attempt: 91,868; 2: 44,030; 3+: 51,415). R^2 = 0.37. Sample: All Stage A households that were partially or completely surveyed. Cells LS9 and LS11 in Figure 2. The table reports estimates from a single OLS regression. Dependent variable: 0/1 labor force participation indicator. See page 14 for a full explanation of table structure. (A) Estimated coefficients from a fully interacted regression: each regressor is interacted with each difficulty-to-reach category (omitted category: 1 attempt). Regression also includes unreported indicators (and their interactions) for Marital Status (5 categories), Household Size (5 categories). Standard errors, clustered at the household level, in parentheses. (B) Adjusted means, calculated from panel A regression. Significant at ***p < 0.01, **p < 0.05, and *p < 0.1. Source: Labor Force Survey 2012-2017.

2.2 Labor Force Participation and Unemployment Rate

Table 3 presents the regression analysis of survey results from the LFS. The table structure follows that developed and described in Heffetz and Reeves (2019). Its basic structure will be repeated frequently throughout the paper (albeit with different data sources and dependent variables). Here, the three columns report results from a single OLS regression where the dependent variable is a 0/1 labor force participation indicator.

The regressors include the set of demographic variables reported as rows in Panel A plus controls for martial status (5 categories) and household size (5 categories), and their interactions with the difficulty-to-reach indicators. Panel A reports the estimated coefficients from the regression in the following manner: the first column reports coefficients on the demographic indicators for the base (omitted) difficulty-to-reach category (1 contact attempt), and the other columns report the coefficients on the demographic indicators interacted with each of the two other difficulty categories (2 and 3-or-more contact attempts).

Panel B then reports adjusted means for the three difficulty-to-reach categories (using the regression results from Panel A). Intuitively, the adjusted means are calculated as follows.[9] For each observation, one calculates the dependent variable's predicted value three times, using that observation's values for everything except for the set of difficulty-to-reach indicators, which are changed to match each corresponding difficulty group, one at a time. That is, changed to indicate 1 attempt for the 1-attempt adjusted mean, and then changed to indicate 2 attempts for the 2-attempts adjusted mean, and 3+ for the 3+ adjusted mean. The adjusted means row then reports these predicted values averaged across all of the sample's observations. The three adjusted means are therefore the average predicted value of the dependent variable in three hypothetical samples—one for each difficulty group.

Beginning with the top-line results in Panel B: we find differences in labor force participation across difficulty-of-reaching groups. Even after controlling for demographic

[9]Here we use the STATA 15.1 command "margins," which computes adjusted means and their accompanying standard errors. Our explanation of adjusted means is informed by Williams (2011) and follows that in Heffetz and Reeves (2019).

variables, more difficult-to-reach households have higher labor force participation than easier-to-reach households. There is a non-monotonic trend increasing from 63.4% to 64.5%, moving from the easiest- to hardest-to-reach group. The 1.1 percentage point gap between the easiest and hardest to reach groups is less than the 9.5 percentage point gap found in the uncontrolled means.

Examining Panel A, we also find some noticeable trends within demographic groups across difficulty-to-reach categories. The least-educated hard-to-reach group is significantly less likely to be part of the labor force (about 3 percentage points less likely). Likewise the most educated group is also about 2 percentage points less likely to be part of the labor force than the easiest-to-reach. Interestingly, the easiest-to-reach by phone are more likely to be part of the labor force, while those that took two or more attempts were about 10 percentage points less likely to be part of the labor force. This points to strong differences among those reached by phone versus in-person, across difficulty categories.

Table 4 repeats the analysis of Table 3 with two changes. First, the sample is limited to the 117,894 individuals considered to be in the labor force based on their survey answers. Second, the regression's dependent variable is a binary 0/1 indicator of unemployment status. Beginning with Panel B, we find a qualitatively small, and statistically insignificant trend in the adjusted means for unemployment rate. The unemployment rate is 5.7% among the easiest-to-reach and 5.5% among the hardest-to-reach group. Thus the gap shrinks from 1 percentage point without controls, to only 0.2 percentage points when controlling for demographic differences across the difficulty categories. In Panel A, we find no statistically significant within-group trends across difficulty-of-reaching categories.

Table 4: LFS Unemployment Rate

Attempts	1	2	3+
	A. Regression with Interactions		
	Base	Interactions	
Age: 15-21	0.022***	-0.006	-0.010
	(0.005)	(0.008)	(0.008)
22-39	0.018***	-0.002	-0.007
	(0.003)	(0.005)	(0.004)
50-64	0.005	-0.009	-0.004
	(0.003)	(0.006)	(0.005)
65 and up	0.001	-0.011	-0.003
	(0.005)	(0.009)	(0.008)
Children in HH	0.005	-0.000	-0.000
	(0.003)	(0.005)	(0.004)
Female	-0.015	0.013	-0.004
	(0.010)	(0.018)	(0.017)
Orthodox	0.036***	0.005	0.013
	(0.009)	(0.014)	(0.012)
Female Orthodox	-0.013	-0.001	-0.009
	(0.011)	(0.018)	(0.016)
Female Jew	0.017	-0.018	0.006
	(0.011)	(0.018)	(0.017)
Female Arab	0.073***	-0.012	0.014
	(0.012)	(0.021)	(0.020)
Phone Dummy	-0.021	0.016	0.016
	(0.009)	(0.010)	(0.009)
Educ: Less than High School	0.041***	-0.008	-0.013
	(0.003)	(0.006)	(0.006)
13-15	-0.001	-0.003	-0.004
	(0.003)	(0.005)	(0.004)
16+	-0.015***	-0.002	-0.005
	(0.003)	(0.005)	(0.004)
Missing	-0.019	0.003	0.012
	(0.014)	(0.023)	(0.018)
Nationality.: Arab	-0.008	-0.000	0.008
	(0.003)	(0.006)	(0.007)
Other	-0.011	0.001	0.009
	(0.008)	(0.014)	(0.013)
Constant	0.054***	-0.005	-0.026*
	(0.007)	(0.011)	(0.010)
		B. Adjusted Means	
Unemployment Rate	0.057***	0.056***	0.055***
	(0.002)	(0.001)	(0.001)

Notes: N=117,894 (1 Attempt: 54,299; 2: 28,345; 3+: 35,250). R^2 = 0.02. Sample: All households from Table 3 that are in the labor force, a subset of cells LS9 and LS11-16 Figure 2. The table reports estimates from a single OLS regression. Dependent variable: 0/1 unemployment indicator. See page 14 for a full explanation of the table structure. (A) Estimated coefficients from a fully interacted regression: each regressor is interacted with each difficulty-to-reach category (omitted category: 1 attempt). Regression also includes unreported indicators (and their interactions) for Marital Status (5 categories), Household Size (5 categories). Standard errors, clustered at the household level, in parentheses. (B) Adjusted means, calculated from panel A regression. Significant at ***p < 0.01, **p < 0.05, and *p < 0.1. Source: Labor Force Survey 2012-2017.

3 Household Expenditure Survey (HES)

The Household Expenditure Survey (HES) measures the purchasing habits of Israeli households.[10] Its sample is designed to be representative of the population of Israel, excluding those residing in collective kibbutzim and Bedouin populations living outside sampled communities.[11]

The HES consists of three components. The first component is a personal interview, conducted in person by an ICBS surveyor, where demographic information about the head of the household is obtained. The second component is a questionnaire that collects information on household income and on large or exceptional expenditures. This questionnaire is completed by the interviewer using the respondent's reports on the 3- to 12-month period preceding the interview date—the specific look-back period varies by the expenditure type's rarity. The final component of the survey is a log, in which the household records each member's daily expenditures over a period of 15 days in total, including the day of the initial interview. For every year of the survey the interviews were conducted in the field over a period of approximately 13 months, beginning in January of the survey year and ending in January of the subsequent year.

The HES survey data was provided to us by the ICBS and contains paradata with information about the ICBS initial contact attempt regarding dwellings that were sampled between 2012–2016. The original HES sample for that period is 64,563 households, of which, 62,664 were eventually contacted. We merge the HES survey data with its paradata and twenty-four households were missing contact observations in the paradata and were excluded from analysis. The paradata contain information on the survey process and, most importantly for this analysis, the number of contact attempts until a successful interview (or last failed attempt). Of the households contacted, 44,141 completed survey information (including 4,196 partial completions). We then create variables for difficulty of reaching (max number of visit attempts) and quintiles of income.

[10] All information about the HES was taken from the ICBS publication on the 2016 HES: `https://www.cbs.gov.il/he/publications/DocLib/2019/1719/e_print.pdf`. The survey design has not significantly changed since 2012.

[11] Beginning with the 2012 design, the population coverage is about 97%.

3.1 Demographics

Table 5 presents demographic information for the households that answered the survey. We again divide these households into three groups based on the number of attempts it took the ICBS surveyors to reach the households for the first visit (our "difficulty to reach" variable), corresponding with the table's first three columns: 1 attempt, 2 attempts, and 3-or-more attempts. The demographic information, except for income and expenditure, refers to the household member considered to be the head of the household. The income and expenditure information are the totals reported for the entire household.

Once again we find systematic demographic differences between the easy- and hard-to-reach groups. The easy-to-reach are older: the share of those aged 65 or more decreases from 23% of the easy-to-reach to 17% of the hard-to-reach. Similarly, the easy-to-reach are less well-educated, with the share of the highest education category about 5 percentage points lower, and the share of the lowest education category almost 8 percentage points higher, than among the hard-to-reach. Similar to the LFS, Jewish heads-of-households in the HES are a larger share in the harder-to-reach category (89%) than in the easier-to-reach category (76%); while Muslim households are the reverse: 16% of the 1-attempt group and 5% of the 3+ attempt group.

Similar to the overall employment results in the LFS, we find in the HES that the easiest-to-reach households have relatively lower household income than the hardest-to-reach households: the lowest income category's share is almost five percentage points lower in the hard-to-reach relative to the easy-to-reach, while the highest income share is about 4 percentage points higher. However this trend is not purely monotonic, as the 2-attempt group actually has the largest share of households in the highest two income groups. The average household expenditure is also about 4% higher in the hardest-to-reach relative to the easiest-to-reach groups; but once again it is actually the 2-attempt group with the overall highest average expenditure.

Table 5: HES Demographics

Attempts		1	2	3+	All
Age:	15-21	3.5	2.7	2.9	3.1
		(0.14)	(0.15)	(0.14)	(0.08)
	22-39	32.6	32.5	35.0	33.4
		(0.36)	(0.43)	(0.39)	(0.22)
	40-49	19.1	20.1	20.0	19.6
		(0.3)	(0.37)	(0.33)	(0.19)
	50-64	22.2	24.2	24.7	23.6
		(0.32)	(0.4)	(0.35)	(0.2)
	65 and up	22.7	20.5	17.4	20.3
		(0.32)	(0.37)	(0.31)	(0.2)
Educ:	Less than High School	23.1	17.5	15.5	19.1
		(0.32)	(0.35)	(0.3)	(0.19)
	High School	26.9	25.8	26.9	26.6
		(0.34)	(0.4)	(0.36)	(0.21)
	13-15	22.5	23.6	25.2	23.7
		(0.32)	(0.39)	(0.35)	(0.2)
	16 and Up	27.4	33.0	32.4	30.6
		(0.34)	(0.43)	(0.38)	(0.22)
Rel. :	Jewish	75.8	85.4	88.9	82.8
		(0.32)	(0.33)	(0.26)	(0.18)
	Christian	3.8	2.9	2.8	3.2
		(0.14)	(0.16)	(0.13)	(0.08)
	Muslim	16.4	8.7	5.0	10.5
		(0.28)	(0.26)	(0.18)	(0.15)
	Other	4.0	3.0	3.3	3.5
		(0.15)	(0.16)	(0.14)	(0.09)
Inc. :	0-7,299	27.4	22.6	22.3	24.4
		(0.34)	(0.39)	(0.34)	(0.2)
	7,300-13,499	26.3	24.6	25.9	25.7
		(0.33)	(0.4)	(0.36)	(0.21)
	13,500-22,999	24.1	25.8	25.7	25.1
		(0.32)	(0.4)	(0.36)	(0.21)
	23,000+	22.2	27.0	26.0	24.8
		(0.32)	(0.41)	(0.36)	(0.21)
Total Expenditures (log NIS)		9.113	9.191	9.163	9.15
		(0.006)	(0.007)	(0.006)	(0.003)
	Total (NIS)	11,535.3	12,408.7	12,004.4	11,926.8
		(64.35)	(101.24)	(71.04)	(44.18)
	Health (log NIS)	5.912	6.082	5.947	5.969
		(0.014)	(0.015)	(0.013)	(0.008)
	Food (log NIS)	7.316	7.334	7.245	7.297
		(0.007)	(0.009)	(0.008)	(0.005)
Median number of attempts (known)		1	2	4	2
Observations		17,383	11,690	15,071	44,144

Notes: Sample: All stage A observations that were surveyed completely or partially. The observations of this table correspond to the households in cells HS10 and HS11 in Figure 3, except for those with no reported contact attempts. All figures (and standard errors) reflect proportions within each column's difficulty-of-reaching category, except for the expenditure (mean) and contact attempts variables (median). Source: Household Expenditure Survey 2012-2016.

3.2 Expenditures and Income

We then look at the two dependent variables of interest in the HES: household expenditures and household income. Table 6 follows the structure introduced in Table 3. Here the dependent variable of the regression is the natural log of (1 + household expenditures), measured in New Israeli Shekels (NIS).[12] Beginning with Panel B, we find that the easy-to-reach are significantly different from the hardest-to-reach. After converting the dependent variable back to NIS (from log(NIS)), we see the average household expenditure among the easy-to-reach is 9,320 and among the hard-to-reach is 9,441. As in the unadjusted means, it is actually the 2-contact group that has the highest adjusted mean expenditure of 9,503. Thus, while there is not a monotonic trend amongst difficulty-of-reach categories, there do appear to be clear differences between households that differ on their difficulty of reaching, even after controlling for observable characteristics. Looking at Panel A, we no evidence of within-demographic-subgroup differences across the difficulty-of-reaching categories.

Table 7 uses a dependent variable of household income. In Panel B we do not find a statistically significant difference between the hardest- and easiest-to-reach groups' adjusted mean income: 12,494 [100] NIS versus 12,407 [87] NIS. However, once again, the 2-contact attempt group has the highest, and statistically significantly different, value: 12,862 [103] NIS. There are no statistically significant trends in Panel A.

[12] During the period of 2012–2016, the NIS was worth around $0.25–$0.30.

Table 6: HES—Total Expenditures

Attempts	1	2	3+
	A. Regression with Interactions		
	Base	Interactions	
Age: 15-21	-0.009	-0.041	-0.026
	(0.025)	(0.041)	(0.038)
22-39	-0.027	-0.020	0.009
	(0.012)	(0.018)	(0.017)
50-64	-0.042***	-0.011	-0.041
	(0.013)	(0.020)	(0.018)
65 and up	-0.155***	0.003	-0.007
	(0.015)	(0.024)	(0.022)
Educ: Less than High School	-0.118***	-0.023	-0.025
	(0.012)	(0.019)	(0.018)
13-15	0.034**	0.010	-0.007
	(0.011)	(0.018)	(0.016)
16+	0.109***	0.020	0.019
	(0.011)	(0.017)	(0.016)
Orthodox	-0.084***	-0.003	-0.002
	(0.019)	(0.030)	(0.028)
Nat.: Arab	0.124***	0.025	-0.014
	(0.011)	(0.020)	(0.021)
Other	-0.043	0.004	-0.018
	(0.020)	(0.033)	(0.029)
Constant	8.789***	0.117**	0.187***
	(0.026)	(0.042)	(0.038)
		B. Adjusted Means	
Total Expenditures (log NIS)	9.140***	9.159***	9.153***
	(0.004)	(0.005)	(0.004)
Total Expenditures (NIS)	9,320***	9,503***	9,441***
	(36)	(45)	(40)

Notes: N= 44,143 (1 Attempt: 17,382; 2: 11,690; 3+: 15,071). $R^2 = 0.51$. Sample: All households from Table 5, excluding households that were missing the variable "Total Expenditures." The observations of this table correspond to the households in cells HS10 and HS11 in Figure 3, excluding those with missing expenditures. The table reports estimates from a single OLS regression. Dependent variable: ln(total household expenditures +1). See page 14 for a full explanation of the table structure. (A) Estimated coefficients from a fully interacted regression. Each regressor is interacted with each difficulty-to-reach category (omitted category: one attempt). Regression also includes unreported quintiles (and their interactions, 5 categories), marital status (6), size of consumer unit (4); Standard errors in parentheses. (B) Adjusted means, calculated from panel A regression. ***p< 0.01, **p<0.05, and *p<0.1. Source: Household Expenditure Survey, 2012–2016.

Table 7: HES—ln(income), Survey Information

Attempts	1	2	3+
	A. Regression with Interactions		
	Base	Interactions	
Age: 15-21	-0.335***	0.033	0.063
	(0.040)	(0.067)	(0.061)
22-39	-0.235***	0.015	0.009
	(0.019)	(0.030)	(0.028)
50-64	-0.127***	0.018	0.050
	(0.021)	(0.033)	(0.030)
65 and up	-0.590***	-0.011	0.058
	(0.021)	(0.034)	(0.032)
Educ: Less than High School	-0.380***	0.026	0.061
	(0.020)	(0.034)	(0.031)
13-15	0.017	0.060	0.036
	(0.020)	(0.031)	(0.028)
16+	0.341***	-0.008	-0.019
	(0.019)	(0.029)	(0.027)
Orthodox	-0.389***	-0.070	-0.053
	(0.032)	(0.051)	(0.046)
Nat.: Arab	-0.406***	-0.036	0.068
	(0.018)	(0.033)	(0.035)
Other	-0.393***	0.056	0.087
	(0.035)	(0.057)	(0.050)
Constant	9.717***	0.018	-0.046
	(0.020)	(0.031)	(0.028)
	B. Adjusted Means		
Income (log NIS)	9.426***	9.462***	9.433***
	(0.007)	(0.008)	(0.008)
Income (NIS)	12,407***	12,862***	12,494***
	(87)	(103)	(100)

Notes: N= 44,125 (1 Attempt: 17,375; 2: 11,685; 3+: 15,065). $R^2 = 0.16$. Sample: All households from Table 5, excluding households with missing data. The table reports estimates from a single OLS regression. Dependent variable: ln(total household income +1). The observations of this table correspond to the households in cells HS10 and HS11 in Figure 3. See page 14 for a full explanation of the table structure. (A) Estimated coefficients from a fully interacted regression. Each regressor is interacted with each difficulty-to-reach category (omitted category: one attempt). Regression has no unreported variables. Standard errors in parentheses. (B) Adjusted means, calculated from panel A regression. ***p< 0.01, **p<0.05, and *p<0.1. Source: Household Expenditure Survey, 2012–2016.

4 Administrative Data

4.1 Administrative Data Sources

Unlike the previous work in Heffetz and Reeves (2019), we are able to match our survey results with administrative data that contain objective, non-survey, measures of our outcomes of interest. We utilize three sources of administrative data. Our administrative income and education data are taken from the Individual Income Registry and the Education Registry, respectively, which are maintained by the ICBS. Our administrative demographic data are taken from the Resident Registry, which is maintained by the Ministry of Interior Affairs. The matching is based on the Israeli personal identification ("Teudat Zehut") number, a unique 9-digit number issued by the Ministry of Interior Affairs to every Israeli, at birth or when immigrating to Israel. (In some ways this ID number functions in Israel like a Social Security Number in the U.S.)

The Individual Income Registry is a registry the ICBS creates based on tax reports of employed (including self-employed) individuals in Israel. The ICBS receives income information from tax reports filed to the Treasury of Israel. These reports are filed by a person's employer or by the person themselves (potentially using a professional representative) if they are self-employed. The ICBS receives the filings 18 months after the end of the tax year—a lag that increases accuracy for the final payments during the relevant tax year. After receiving the data, the ICBS aggregates, at the individual level, all income from all sources, creating a total figure of the net annual income of each individual. In the case of employees the registry also has a variable for the number of months worked in the relevant tax year (which is based on the reported salaries and calculated by the ICBS).

The Education Registry is based on several different sources. For every personal ID number, the ICBS searches all the available data and includes the highest reported education available. This might result in different data than in the survey and the registry: if an individual finished college after four years and not after three, then the administrative data will show 15 years of education while the individual would report 16.

An additional discrepancy could occur if an individual receives and reports education from an informal institution; those years of education would not be counted in the administrative data, but could be reported in the survey.

The Resident Registry contains demographic data on all residents of Israel. The data are collected from birth certificates and from children born abroad to Israeli parents, which can be reported through an online application. Official changes in demographics (e.g., marital status) are updated when reported to the relevant authorities. The Registry is the administrative source of our age, sex, religion, nationality and marital status variables.

4.2 Administrative Data Matching

Beginning in 2012 the ICBS uses the "Dwellings and Buildings Registry" to sample dwellings within the sampled localities for survey collection. This registry is a national database for dwellings in Israel, including information on their location, their characteristics, and their use. The registry data are collected from the yearly property tax payments. Importantly for this study, the data typically include the personal ID numbers of both the dwelling's property-tax payer—i.e., its current occupant—and the dwelling owner. One limitation of the data is that some localities, such as communal towns, do not maintain detailed information about the taxpayers associated with given properties and some buildings do not have a registered property-tax payer for every component dwelling.[13] In addition, information about the owner of the dwelling is more limited than that of the property taxpayer. This discrepancy could be explained by the fact that owner information is less important for the local authorities, which aim to collect property tax (which the dwelling's current occupants are responsible for paying).

Dwellings that were in localities for which the local authorities maintain detailed information about property-tax payers had the potential to have an ID matched to both the dwelling owner and property-tax payer. The existence of the ID is independent of the dwelling status: if the dwelling was selected from a locality that maintains information

[13]For example, student dorms or assisted living.

on the property-tax payer, the ID variable should exist regardless of whether the dwelling was invalid for the survey (e.g., was under renovation, demolished, vacant during the survey, etc.).

For all dwellings with the potential to have an ID matched, the ICBS checked whether the ID that appears in the Dwellings and Buildings Registry is valid. A valid ID is of the correct length (a total of nine digits), with some limitations on the first digit and on the ninth digit (used as a "validation digit"). All of the property-tax payer IDs that appeared in the Dwellings and Buildings Registry were valid. However, the ID might not have actually been issued by the Ministry of the Interior to a resident. Thus, some IDs could pass the validity check of the ICBS but not have actually been assigned to a resident. The ICBS then used the IDs to match the dwelling to our three sources of administrative data, each of which is updated annually: the Resident Registry, the Education Registry, and the Individual Income Registry.

Using these registries, the ICBS was able to match administrative data for most dwellings in the sample, including for the dwellings containing nonrespondents. The matching process was performed as follows: for every dwelling with the potential of having an ID in the Dwellings and Buildings Registry (based on the locality), the ID of the property-tax payer was taken in accordance to the year in which the survey was conducted. If the dwelling was surveyed in 2014, the ID of the registered tax payer of that dwelling in 2014 was taken and matched to all three registries using the data regarding 2014. When matching an ID to the dwelling we chose to focus on the property-tax payer, rather than on the dwelling owner, to account for the fact that for rented dwellings the owner will not actually live in the dwelling.[14] One limitation of this match is that it is possible that for some dwellings there could be a timing mismatch between surveyed occupant and registry information if the dwelling is sold or its occupants move between the time registry information is collected and the survey is conducted.

When matching IDs, the Resident Registry was used to check if the ID had actually been assigned to an individual: an assigned ID should have a match to the Resident

[14]During 2017, according to the LFS, 66.5% of the Israeli households owned the residence they live in, and 29.5% lived in a rented residence.

Registry. Since all of the property-tax payers' IDs were valid, an unmatched ID could be because the ID did not appear in the Resident Registry or because of a typo in either the Resident Registry or Dwellings and Buildings Registry (though the possibility of typos is somewhat limited by the validation digit requirement). Based on our conversations with the ICBS, the primary source of mismatches is likely registration problems with local authorities resulting in bad or missing ID data.

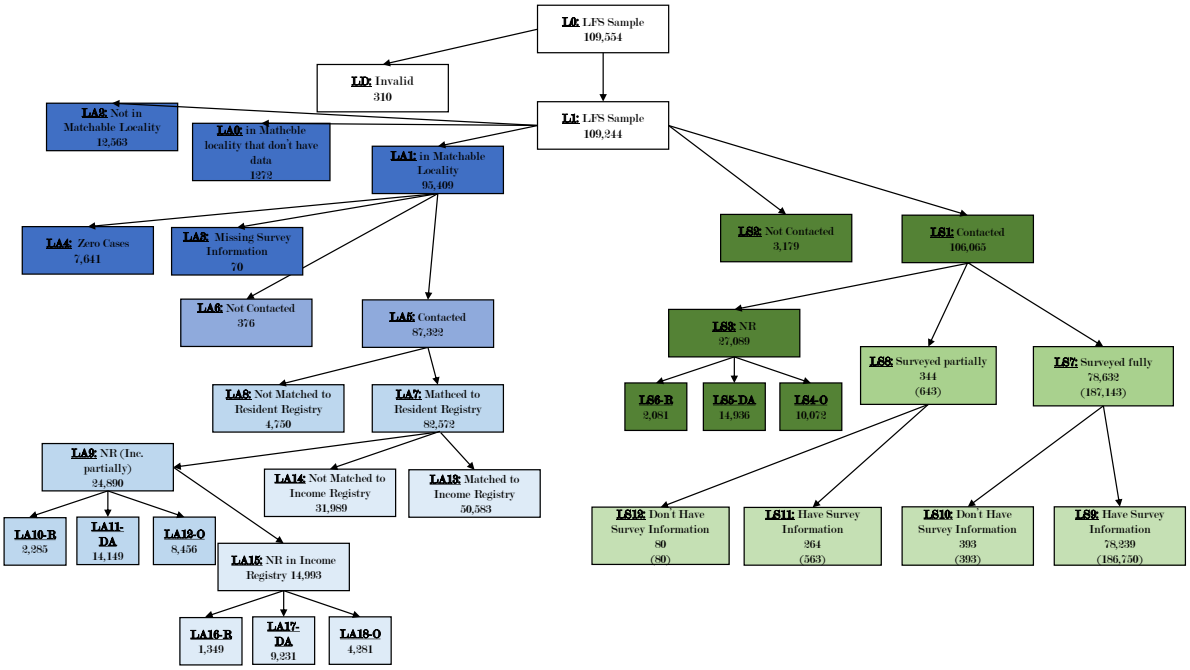
The Income Registry is based on Israel's IRS data and was used for two variables: number of months worked as an employee in the previous year and income (both labor and business income). In the case of self-employment, the number of months working as an employee in the previous year is missing. The Income Registry contains information on the previous fiscal year.[15]

In order to check for the quality of the matched data, we examined whether the dwellings for which we have the number of months working as an employee in the previous year are in fact a subset of the dwellings for which we have income information (including 0 income), assuming that all employed residents will have a reported income. In the LFS there were seventeen dwellings which had non-missing values for months worked as an employee in the previous year but income information was missing; in the HES there were none. All dwellings for which there was non-missing data for either months worked or income were a subset of the dwellings for which the religion variable in the Resident Registry was not missing (i.e., they had a matched ID).

Figure 2 and its related Table 8 show the matching process for the LFS as described above. The LFS samples between 2012–2017 contained 109,266 valid dwellings out of which 95,409 were listed in matchable localities and had contact data. 7,641 of the matchable dwellings where classified as zero cases (not belonging to the survey sample) and were omitted from further analyses. In order to compare nonrespondents to respondents in this stage we also omitted dwellings that were surveyed, but the survey data were missing (70 dwellings). Omitting an additional 376 dwellings that were never contacted, there were 87,322 valid dwellings that were surveyed and we attempted to

[15] After matching, the LFS sample had 996 observations of 0 income and the HES sample had 562.

Figure 2: Matching Process LFS



Notes: Matching process for the dwellings in the LFS sample frame. Starting with the entire sample, focusing on dwellings that had the potential of having the ID of the property-tax payer and finally on the matches to the registries of the contacted dwellings. The match to the Resident Registry is based on non-missing values of the religion variable. Details for each cell can be found in Table 8

match to the Resident Registry. Out of these, 82,572 (94.6%) were matched to the Resident Registry (have a verified ID). We believe that the unsuccessful match of the 4,750 is largely due to their living in small localities. Out of the 4,750 unmatched dwellings which were contacted, 3,095 were successfully surveyed. From those that were matched to the Resident Registry, 50,583 were matched to the Individual Income Registry (61.3% of the dwellings that were matched to the Resident Registry). Since all of these dwellings have a verified property-tax-payer ID, those not matched to the Individual Income Registry had no declared income.

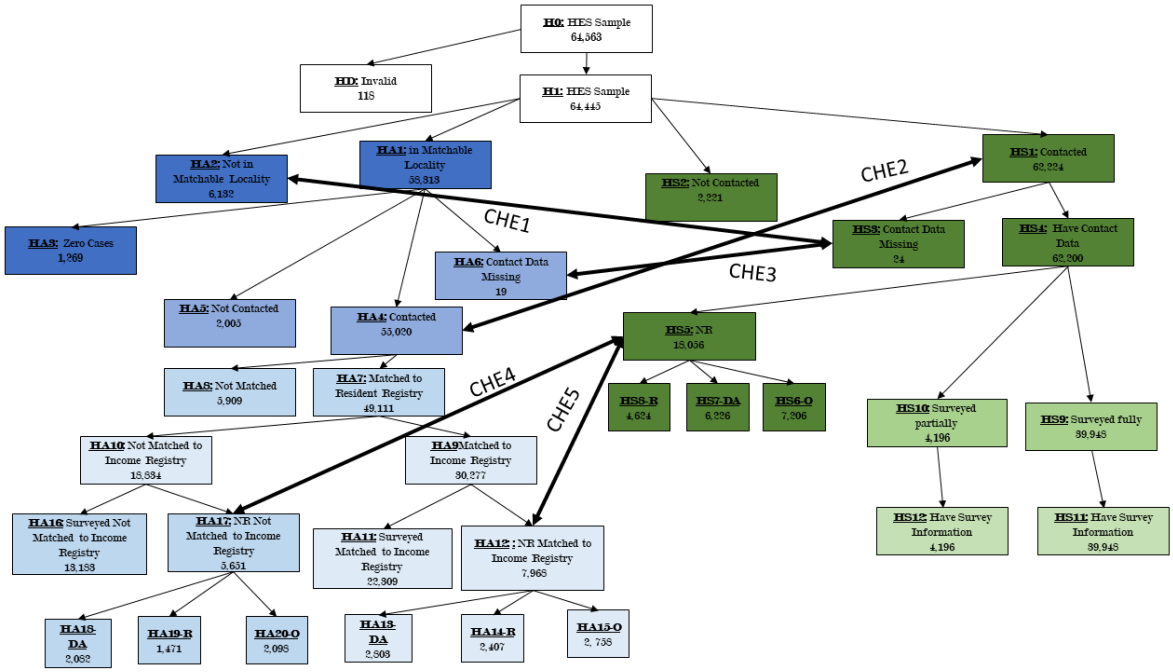
Figure 3 and its related Table 9 show the matching process for the HES. The HES sample from 2012–2016 contained 64,445 valid dwellings out of which 58,313 were in matchable localities. Out of these dwellings 1,269 were classified as zero cases and omitted from further analyses. In order to compare nonrespondents to respondents, at this stage we also omitted the surveyed dwellings that had the number-of-visits variable

Table 8: LFS Flow Chart

	All Dwellings
L0	Number of dwellings in the original samples of the LFS
LD	Households dropped from analysis by the ICBS (only households surveyed during 2012)
L1	Undropped dwellings from the original samples
	All Undropped Dwellings–Survey Data
LS1	Dwellings in the original samples that were contacted
LS2	Dwellings in the original samples that do not have contact data
LS3	Dwellings that were contacted but were not surveyed
LS4	Dwellings that were contacted but were not surveyed for various reasons
LS5	Dwellings that **Didn't Answer** the ICBS surveyors, i.e. the residents of the dwellings were never reached
LS6	Households that **Refused** to answer the survey
LS7	Households that were surveyed fully
LS8	Households that were surveyed partially
LS9	Households that were surveyed fully and have survey information
LS10	Households that were surveyed fully and are missing survey information
LS11	Households that were surveyed partially and have survey information (all of the households in HS9)
LS11	Households that were surveyed partially and are missing survey information (all of the households in HS9)
	All Undropped Dwellings–Administrative Data
LA0	Dwellings in in matchable locality that don't have data
LA1	Dwellings in matchable localities
LA2	Dwellings in unmatchable localities (e.g. small towns and Kibbutzim)
LA3	Households that were surveyed (including partially) and had no survey information (cells LS10 and LS12)
LA5	Dwellings in matchable localities that were contacted
LA6	Dwellings in matchable localities that were not contacted
LA7	Dwellings in matchable localities that were contacted and appeared in the Resident Registry
LA8	Dwellings in matchable localities that were contacted and did not appear in the Resident Registry
LA9	Dwellings that were matched to the Individual Income Registry
LA10	Dwellings that were not matched to the Individual Income Registry
LA11	Dwellings that were matched to the Individual Income Registry and were surveyed
LA12	Dwellings that were matched to the Individual Income Registry that were contacted but were not surveyed for various reasons
LA13	Households in matchable localities that **Refused** to answer the survey
LA14	Dwellings in matchable localities that **Didn't Answer** the ICBS surveyors
LA15	Dwellings in matchable localities that were not surveyed for **Other** reasons
LA16	Dwellings that were not matched to the Individual Income Registry that were contacted but were not surveyed for various reasons
LA17	Dwellings that were matched to the Individual Income Registry that were contacted and surveyed
LA18	Households in matchable localities that were not matched to the Individual Income Registry and **Refused** to answer the survey
LA19	Households in matchable localities that were not matched to the Individual Income Registry and **Didn't Answer** the ICBS surveyors
LA20	Households in matchable localities that were not matched to the Individual Income Registry and were not surveyed for **Other** reasons
LA21	Households that were not matched to the Individual Income Registry that were surveyed but are missing survey information
LA22	Households that were matched to the Individual Income Registry that were surveyed but are missing survey information
	Connections
CLF1	LA5 is a subset of LS1
CLF2	LA16 is a subset of LS3
CLF3	65.6 percent (258 Observations) out of LS9 are in LA7
CLF4	98.6 percent (65,116 Observations) out of LS10 are in LA7
CLF5	76.9 percent (203 Observations) out of LS11 are in LA7
CLF6	LA12 is a subset of LS3

Notes: The difference between LA1 and LA3 is 1,272. These dwellings, though classified as matchable (since they pay property tax), belong to small localities that calculate the taxes manually and therefore cannot be matched to the additional registries. Sources: Labor Force Survey 2012-2017, Resident Registry, Individual Income Registry.

Figure 3: Matching Process HES



Notes: This figure presents the matching process of the dwellings from the HES sample. Starting with the entire sample, focusing on dwellings that had the potential of having the ID of the property tax payer and finally on the matches to the registries of the contacted dwellings. The match to the Resident Registry is based on non-missing values of the religion variable. Details for each cell can be found in Table 9

missing. Omitting an additional 2,005 dwellings that were never contacted, there were 55,020 dwellings in matchable localities. Out of these, 49,111 (89.3%) were matched to the Resident Registry (have a verified ID). From those that were matched to the Resident Registry, 30,277 were also matched to the Income Registry (61.6% of the dwellings that were matched to the Resident Registry).

Table 10 shows in detail the matching rates for each survey and the administrative data for each variable (including the registry source). Most administrative variables have a match rate of 88–94% and, in general, the variables have consistent match rates within a registry source. The difference in the match rates of the variables from the Income Registry (months worked and income) comes, at least partially, from groups that would not be expected to appear in this data, namely those that are not in the labor force during the year of the survey. This includes individuals such as students,

Table 9: HES Flow Chart

	All Dwellings
H0	Number of dwellings in the original samples of the HES
HD	Households dropped from analysis by the ICBS **after being processed**
H1	Undropped dwellings from the original samples
	All Undropped Dwellings–Survey Data
HS1	Dwellings in the original samples that were contacted
HS2	Dwellings in the original samples that were not contacted
HS3	Households that were surveyed and are missing contact attempts information
HS4	Households that were surveyed and have contact attempts information
HS5	Dwellings that were contacted but were not surveyed
HS6	Dwellings that were contacted but were not surveyed for various reasons
HS7	Dwellings that **Didn't Answer** the ICBS surveyors, i.e. the residents of the dwellings were never reached
HS8	Houesholds that **Refused** to answer the survey
HS9	Households that were surveyed fully
HS10	Households that were surveyed partially
HS11	Households that were surveyed fully and have survey information (all of the household in HS8)
HS12	Households that were surveyed partially and have survey information (all of the households in HS9)
	All Valid Dwellings–Administrative Data
HA1	Dwellings in matchable localities
HA2	Dwellings in unmatchable localities (e.g. small towns and Kibbutzim)
HA3	Zero Cases: Dwellings not intended to be surveyed (non residential or not part survey sample)
HA4	Dwellings in matchable localities that were contacted
HA5	Dwellings in matchable localities that were not contacted
HA6	Households in matchable localities that were surveyed and are missing contact attempts information
HA7	Dwellings in matchable localities that were contacted and appeared in the Resident Registry
HA8	Dwellings in matchable localities that were contacted and did not appear in the Resident Registry
HA9	Dwellings that were matched to the Individual Income Registry
HA10	Dwellings that were not matched to the Individual Income Registry
HA11	Dwellings that were matched to the Individual Income Registry and were surveyed
HA12	Dwellings that were matched to the Individual Income Registry that were contacted but were not surveyed for various reasons
HA13	Households in matchable localities that **Refused** to answer the survey
HA14	Dwellings in matchable localities that **Didn't Answer** the ICBS surveyors
HA15	Dwellings in matchable localities that weren't surveyed for **Other** reasons
HA16	Dwellings that were not matched to the Individual Income Registry that were contacted but were not surveyed for various reasons
HA17	Dwellings that were matched to the Individual Income Registry that were contacted and surveyed
HA18	Households in matchable localities that were not matched to the Individual Income Registry and **Refused** to answer the survey
HA19	Households in matchable localities that were not matched to the Individual Income Registry and **Didn't Answer** the ICBS surveyors
HA20	Households in matchable localities that were not matched to the Individual Income Registry and were not surveyed for **Other** reasons
	Connections
CHE1	20.8 percent (5 Observations) out of HS3 are in HA2
CHE2	HA4 is a subset of HS1
CHE3	HA6 is a subset of HS3
CHE4	HA17 is a subset of HS4
CHE5	HA12 is a subset of HS4

Notes Definitions for each cell in Figure 3. Sources: Household Expenditure Survey 2012-2016, Resident Registry, Individual Income Registry.

Table 10: Administrative Information: LFS, HES

Variable	Non-Missing Dwellings		Percent From Possible Matches		Source
	LFS	HES	LFS	HES	LFS & HES
Age	89,551	51,496	93.9%	88.3%	Resident Registry
Marital Status	89,802	51,460	94.1%	88.2%	Resident Registry
Nationality	89,872	51,497	94.2%	88.3%	Resident Registry
Religion	89,872	51,497	94.2%	88.3%	Resident Registry
Sex	89,855	51,483	94.2%	88.3%	Resident Registry
Income	55,064	31,635	57.7%	54.3%	Individual Income Registry
Months Worked	47,468	27,319	49.8%	46.8%	Individual Income Registry
Education	80,724	43,816	84.6%	75.1%	Education Registry

Notes: All percentages are calculated from the dwellings that were in the matchable locality (HA1 and LA1 in the flow charts): 95,409 in the LFS and 58,313 in the HES. Age: The HES had 19 observations of age under 18 and the LFS had 38. The HES had 54 observations of age over 120 and the LFS had 90. Income: The HES had 595 observations with 0 income (not missing, but 0) and the LFS had 990. These numbers include the dwellings that were not contacted.

retirees, the permanently disabled, and disillusioned workers. Additionally, the months-worked variable match is lower than the income variable, some of this lowered match is caused by self-employed residents who would not have the months-worked variable populated.

4.3 Administrative Data Analysis: Labor Force Survey (LFS)

Table 11 presents the demographics of the sample that was matched to administrative data, including the nonrespondents (NR) who did not answer the survey. The table is split into five columns, where once again the first three columns are based on the difficulty of reaching the household, as measured by the number of contact attempts (1, 2, or 3+). The fourth column is "NR" and contains the 17,317 dwellings the ICBS attempted to contact for the survey, but who were nonrespondents. The fifth column, is "All" and contains the overall averages for the entire sample. Administrative data is used for all variables.

Beginning with the first three columns, which contain those households that participated in the survey and were matched to administrative data, we once again find significant patterns across difficulty-of-reaching. As before, the easy-to-reach are disproportionately older: 18.7% of the 1-contact group are 39 or younger, while this group makes up 24.3% of the 3-or-more attempt category. Similarly, the education composition

of the sample skews towards higher education as difficulty-of-reaching increases: 13-or-more years of education grows from 39.6% to 45.4% of the sample. Finally, the income and months employed increase from the easy-to-reach to hard-to-reach: the highest income category grows by around 2.3 percentage points (from a share of 8% to 10.3%) between the easiest- and hardest-to-reach, while the share working 10 or more then months grows by around 7 percentage points (42.8% to 49.6%).

If the NR group were simply harder to reach than the hardest-to-reach group, it might be expected that their shares would continue the trends across difficulty-of-reaching groups. However, this is often not what we find. For some variables the shares of the categories are in between the 1- and 2-attempt shares, while others are more like the 1-attempt share. One difficulty however in interpreting these numbers is the share of missing data for the NR category. For most variables, the NR group has the highest or second highest share of missing data of the difficulty-of-reaching categories. Interestingly, this means the households less likely to give survey information are also less likely to have administrative data matched to them. This phenomenon is most striking in the education variable, where the NR category has 16.4% missing administrative data, while the next highest group is 8.8% in the 1-attempt group. In the cases of income and months worked, the missing data can also proxy for for those not in the labor force or that are unemployed.

Tables 12 and 13 recreate Table 3 using administrative data as the source for covariates and dependent variables. In the administrative data, we do not have a direct corresponding measure of labor force participation or the unemployment rate, as measured by the survey. This is because being classified as unemployed and, therefore, also as participating in the labor force when not currently employed, requires the act of searching for a job—an act that is not readily recorded in administrative data. As a proxy, we examine two alternate dependent variables that are recorded in the administrative data. Table 12 uses a dummy variable of being matched to the income registry (indicating some employment in the last 12 months). Table 13 uses an indicator for all

12 months in the last year worked.[16]

Beginning with Panel B of Table 12, we find that the trend in adjusted means for labor force participation is monotonic across difficulty-of-reaching groups, but with no continued rise into the "NR" category. The adjusted mean goes from 60.6% [0.2] to 61.1% [0.3] to 63.2% [0.3] among 1- to 2- to 3+-attempt groups, and is 61.5% [0.3] among the NR group (both the 3+-attempt and the NR groups are statistically significantly higher than the 1-attempt group). Likewise, in Panel B of Table 13 we have a similar finding across the difficulty categories: an increase in "proxy" labor force participation across the difficulty categories, from 41.3% [0.3] to 41.3% [0.3] to 42.9% [0.3]. However, using the 12-months employment proxy, the nonrespondents actually have a lower 12-month participation than the even easiest-to-reach, at 40.4% [0.3]. It is possible that this is caused by a higher prevalence of the self-employed among nonrespondents, who would not be captured as employed by this proxy. It is also possible that nonrespondents contain a higher proportion of workers that work less than 12 months per year (e.g., seasonal employees), and thus would not be captured in this proxy measure of labor force participation.

Examining the two respective Panel A's of each regression table, we find some limited evidence of within-demographic-group differences across difficulty-of-reaching in Table 12. One notable trend is within the eldest age group: the more difficult to reach members of the those aged 65 or more were more likely to work (by about 5 percentage points). This was also true for the nonrespondents within the eldest group. The evidence in Panel A of Table 13 of within-demographic-group differences across difficulty categories is weaker. There are no statistically significant trends within groups, across the difficulty categories. However, the nonrespondents among the Arab nationality and among the oldest population group are both more likely to be part of the labor force, by 5–6 percentage points.

[16]One issue with this proxy is that individuals who are only self-employed for the tax year will have a value of 0.

Table 11: LFS Demographics—Including NR

Attempts		1	2	3+	NR	All
Age:	15-21	3.7	4.4	5.4	5.2	4.4
		(0.1)	(0.16)	(0.2)	(0.17)	(0.07)
	22-39	15	17.5	18.9	15.9	16.3
		(0.19)	(0.29)	(0.34)	(0.28)	(0.13)
	40-49	18.8	20.1	20.2	19.1	19.4
		(0.208)	(0.31)	(0.35)	(0.3)	(0.14)
	50-64	27.0	27.5	28.3	26.9	27.3
		(0.236)	(0.34)	(0.39)	(0.34)	(0.15)
	65+	35.4	30.4	27.1	32.8	32.5
		(0.255)	(0.35)	(0.39)	(0.36)	(0.16)
	Missing	0.1	0.1	0.1	0.2	0.1
		(0.017)	(0.02)	(0.02)	(0.03)	(0.01)
Female		70.3	69.8	68.7	65.9	69.0
		(0.243)	(0.35)	(0.41)	(0.36)	(0.16)
Educ:	Less than High School	26.8	21.9	19.8	21.6	23.6
		(0.236)	(0.32)	(0.35)	(0.31)	(0.15)
	High School	24.9	26.1	27.7	27.0	26.0
		(0.23)	(0.34)	(0.39)	(0.34)	(0.15)
	13-15	21.6	23.7	24.8	19.2	22.0
		(0.219)	(0.33)	(0.38)	(0.3)	(0.14)
	16 and Up	18.0	20.5	20.6	15.7	18.4
		(0.205)	(0.31)	(0.35)	(0.28)	(0.13)
	Missing	8.8	7.8	7.1	16.4	9.9
		(0.151)	(0.21)	(0.23)	(0.28)	(0.1)
Income:	0-7,299 (NIS)	25.8	25.9	26.8	25.9	26.0
		(0.233)	(0.34)	(0.39)	(0.33)	(0.15)
	7,300-13,499 (NIS)	15.0	15.7	17.5	15.5	15.6
		(0.19)	(0.28)	(0.33)	(0.27)	(0.13)
	13,500-22,999 (NIS)	10.0	11.9	12.7	9.7	10.8
		(0.16)	(0.25)	(0.29)	(0.23)	(0.11)
	23,000+ (NIS)	8.0	10.2	10.3	8.3	8.9
		(0.144)	(0.23)	(0.27)	(0.21)	(0.1)
	Missing	41.2	36.3	32.7	40.6	38.7
		(0.262)	(0.37)	(0.41)	(0.37)	(0.17)
Contacted by Phone		11.2	12.7	19.3	0.7	10.6
		(0.168)	(0.26)	(0.35)	(0.06)	(0.11)
Months Employed Past Year :	0-3	2.4	2.3	2.4	2.4	2.4
		(0.082)	(0.12)	(0.13)	(0.12)	(0.05)
	4-6	2.5	2.9	2.7	2.7	2.7
		(0.083)	(0.13)	(0.14)	(0.12)	(0.06)
	7-9	3.2	3.6	3.5	3.5	3.4
		(0.093)	(0.14)	(0.16)	(0.14)	(0.06)
	10-12	42.8	46.4	49.6	42.3	44.5
		(0.263)	(0.38)	(0.44)	(0.38)	(0.17)
	Missing	49.2	44.8	41.8	49.1	47.1
		(0.266)	(0.38)	(0.43)	(0.38)	(0.17)
Median number of attempts (known)		1	2	3	2	2
Observations		35,278	16,966	13,011	17,317	82,572

Notes: Sample: All Stage A observations that were contacted and appeared in the administrative data, cell LA7, except for those with missing contact attempts. All figures (and standard errors) reflect proportions within each column's difficulty-of-reaching category, except for the number of attempts (which report medians). Sources: Labor Force Survey, Education Registry, Resident Registry and Individual Income Registry 2012-2017

Table 12: LFS Labor Force Participation—Administrative Data

Attempts	1	2	3+	NR
	A. Regression with Interactions			
	Base	Interactions		
Age: 15-21	-0.091	-0.011	-0.185	-0.103
	(0.070)	(0.131)	(0.109)	(0.097)
22-39	-0.024***	-0.019	-0.005	0.017
	(0.007)	(0.012)	(0.012)	(0.012)
50-64	-0.118***	0.018	0.027	0.017
	(0.007)	(0.011)	(0.011)	(0.011)
65 and up	-0.560***	0.010	0.048***	0.051***
	(0.007)	(0.012)	(0.011)	(0.012)
Female	-0.096***	0.051	0.104*	0.046
	(0.024)	(0.039)	(0.038)	(0.037)
Nationality.: Arab	-0.020**	0.012	0.033	0.018
	(0.007)	(0.013)	(0.015)	(0.013)
Other	0.053***	-0.030	-0.010	0.008
	(0.015)	(0.025)	(0.025)	(0.024)
Female Jew	0.029	-0.033	-0.082	-0.022
	(0.024)	(0.041)	(0.039)	(0.038)
Female Arab	-0.197***	0.024	-0.122	-0.004
	(0.027)	(0.049)	(0.051)	(0.046)
Educ: Less than High School	-0.051***	0.001	-0.006	-0.002
	(0.007)	(0.012)	(0.011)	(0.011)
13-15	0.076***	0.008	-0.012	-0.009
	(0.007)	(0.011)	(0.011)	(0.011)
16+	0.130***	-0.002	-0.017	-0.029
	(0.007)	(0.012)	(0.011)	(0.012)
Missing	-0.182***	0.003	-0.020	-0.043**
	(0.010)	(0.017)	(0.016)	(0.014)
Constant	0.841***	-0.009	0.002	-0.015
	(0.007)	(0.011)	(0.011)	(0.011)
		B. Adjusted Means		
Labor Force Participation	0.606***	0.611***	0.632***	0.615***
	(0.002)	(0.003)	(0.003)	(0.003)

Notes: N=82,479 (1 Attempt: 31,340; 2: 15,921; 3+: 18,048; NR: 17,170). $R^2 = 0.34$. Sample: Stage A observations that were contacted and appeared in the administrative data, cell LA7 excepting those with missing age data. The table reports estimates from a single OLS regression. Dependent variable: 0/1 labor force participation indicator proxy: a dummy variable indicating whether there was a match to the Individual Income registry. See page 14 for a full explanation of the table structure. (A) Estimated coefficients from a fully interacted regression: each regressor is interacted with each difficulty-to-reach category (omitted category: 1 attempt). Standard errors, clustered at the household level, in parentheses. (B) Adjusted means, calculated from panel A regression. Significant at ***p < 0.01, **p < 0.05, and *p < 0.1. Sources: Labor Force Survey, Education Registry, Resident Registry and Individual Income Registry 2012-2017.

Table 13: Employment Rate—Administrative Data

Attempts	1	2	3+	NR
	A. Regression with Interactions			
	Base	Interactions		
Age: 15-21	-0.518***	0.263	0.086	0.141
	(0.078)	(0.144)	(0.120)	(0.108)
22-39	-0.059***	-0.019	-0.012	0.000
	(0.008)	(0.014)	(0.013)	(0.013)
50-64	-0.096***	0.016	0.023	0.010
	(0.007)	(0.013)	(0.012)	(0.012)
65 and up	-0.463***	-0.010	0.027	0.057***
	(0.007)	(0.013)	(0.013)	(0.013)
Female	-0.092***	-0.000	0.083	0.008
	(0.026)	(0.044)	(0.042)	(0.041)
Nationality.: Arab	-0.069***	0.007	0.028	0.049***
	(0.007)	(0.014)	(0.016)	(0.015)
Other	0.066***	-0.016	-0.004	-0.017
	(0.017)	(0.028)	(0.027)	(0.027)
Female Jew	0.036	0.003	-0.082	0.007
	(0.027)	(0.045)	(0.043)	(0.042)
Female Arab	-0.067	0.064	-0.125	-0.002
	(0.030)	(0.054)	(0.057)	(0.051)
Educ: Less than High School	-0.032***	-0.008	0.000	-0.011
	(0.007)	(0.013)	(0.012)	(0.012)
13-15	0.091***	0.013	0.001	0.004
	(0.007)	(0.012)	(0.012)	(0.012)
16+	0.128***	0.009	0.017	0.002
	(0.008)	(0.013)	(0.012)	(0.013)
Missing	-0.089***	0.013	-0.020	-0.029
	(0.011)	(0.018)	(0.018)	(0.016)
Constant	0.602***	-0.003	-0.003	-0.037**
	(0.007)	(0.012)	(0.012)	(0.012)
		B. Adjusted Means		
Full Annual Employment	0.413***	0.413***	0.429***	0.404***
	(0.003)	(0.003)	(0.003)	(0.003)

Notes: N= 82,479 (1 Attempt: 31,340; 2: 15,921; 3+: 18,048; NR: 17,170). $R^2 = 0.21$. Sample: Stage A observations that were contacted and appeared in the administrative data, cell LA7 excepting those with missing age data. The table reports estimates from a single OLS regression. Dependent variable: 0/1 employment indicator (1 if worked all 12 months 0 o.w.). See page 14 for a full explanation of the table structure. (A) Estimated coefficients from a fully interacted regression: each regressor is interacted with each difficulty-to-reach category (omitted category: 1 attempt). Standard errors, clustered at the household level, in parentheses. (B) Adjusted means, calculated from panel A regression. Significant at ***p < 0.01, **p < 0.05, and *p < 0.1. Sources: Labor Force Survey, Education Registry, Resident Registry and Individual Income Registry 2012-2017.

4.4 Admin. Data Analysis: Household Expenditure Survey (HES)

Table 14 adds nonrespondents to Table 5 and presents the administrative demographic data for the HES survey, including nonrespondents. As in the LFS table above, the first three columns present the administrative demographic information for those households that participated in the survey, while the fourth presents it for those who were nonrespondents (NR), and the fifth presents overall sample averages. Examining the shares among respondents, we find the expected trends: the easier-to-reach are older, less educated, and have somewhat lower incomes. As in the LFS, the demographics of the nonrespondents do not necessarily look more like the hard-to-reach. While the NR's female share is higher than the 3+-contact group and does appear to continue a monotonically increasing trend from easy- to hard-to-reach to unreached, the shares of NR's age, education, and income are closer to the 1-contact group.

Table 15 presents the regression results for the HES population using administrative data on demographics with administratively-measured household income as the dependent variable. Starting in Panel B, there are statistically significant differences across difficulty-to-reach categories. Unlike the survey data, there is a monotonic trend from lowest income among the 1-attempt group (6,477 [117] NIS) to highest income (6,836 [123] NIS) among the 3+ group. Here, the unreached group (6,260 [113]) is lower than even the easiest-to-reach group, although the two groups are not statistically distinguishable. In Panel A, we find essentially no within-demographic-group differences in income across the difficulty-of-reaching categories.

Table 14: HES Demographics including NR

Attempts		1	2	3 +	NR	All
Age:	15-21	0.1	0.0	0.1	0.1	0.1
		(0.02)	(0.02)	(0.03)	(0.03)	(0.01)
	22-39	19.8	21.0	22.5	20.4	20.9
		(0.34)	(0.42)	(0.37)	(0.35)	(0.18)
	40-49	19.3	19.7	19.7	18.4	19.2
		(0.34)	(0.41)	(0.35)	(0.33)	(0.18)
	50-54	28.2	27.9	29.0	26.8	28.0
		(0.39)	(0.46)	(0.4)	(0.38)	(0.2)
	65+	32.5	31.3	28.6	34.1	31.7
		(0.41)	(0.48)	(0.4)	(0.41)	(0.21)
	Missing	0.1	0.0	0.1	0.1	0.1
		(0.03)	(0.02)	(0.03)	(0.03)	(0.02)
Educ:	Less than High School	24.8	20.3	19.3	22.3	21.8
		(0.37)	(0.41)	(0.35)	(0.36)	(0.19)
	High School	26.0	26.3	27.9	26.5	26.7
		(0.38)	(0.45)	(0.4)	(0.38)	(0.2)
	13-15	19.2	20.9	21.7	17.7	19.7
		(0.34)	(0.42)	(0.37)	(0.33)	(0.18)
	16 and Up	15.9	18.9	18.5	15.2	17.0
		(0.32)	(0.4)	(0.35)	(0.31)	(0.17)
	Missing	14.1	13.7	12.6	18.3	14.8
		(0.3)	(0.35)	(0.3)	(0.33)	(0.16)
Female:		28.0	29.1	31.0	33.8	30.6
		(0.39)	(0.47)	(0.41)	(0.41)	(0.21)
Missing:		0.0	0.0	0.0	0.0	0.0
		(0.01)	(0.01)	(0.02)	(0.02)	(0.01)
Nat. :	Jewish	77.2	85.7	89.2	84.4	83.9
		(0.36)	(0.36)	(0.28)	(0.31)	(0.17)
	Arab	18.9	10.2	6.1	11.7	11.9
		(0.34)	(0.31)	(0.21)	(0.28)	(0.15)
	Other	3.9	4.1	4.7	3.9	4.1
		(0.17)	(0.2)	(0.19)	(0.17)	(0.09)
Inc. :	0-7,299	26.3	26.1	26.1	26.5	26.3
		(0.38)	(0.45)	(0.39)	(0.38)	(0.2)
	7,300-13,499	15.5	15.3	17.1	14.5	15.6
		(0.31)	(0.37)	(0.33)	(0.3)	(0.16)
	13,500-22,999	10.1	12.0	12.0	10.1	10.9
		(0.26)	(0.33)	(0.29)	(0.26)	(0.14)
	23,000+	8.1	9.9	10.4	7.4	8.9
		(0.24)	(0.31)	(0.27)	(0.22)	(0.13)
	Missing	40	36.8	34.4	41.5	38.3
		(0.42)	(0.5)	(0.42)	(0.42)	(0.22)
Median number of attempts (known)		1	2	4	3	2
Observations		13,363	9,483	12,641	13,617	49,104

Notes: Sample: All Stage A observations that were in matchable localities and did not have missing contact attempts. All figures (and standard errors) reflect proportions within each column's difficulty-of-reaching category. Source: Household Expenditure Survey, Education Registry, Resident Registry and Income Registry and Individual Income Registry 2012-2016.

Table 15: HES—ln(Income) including NR

Attempts		1	2	3+	NR
		A. Regression with Interactions			
		Base	Interactions		
Age:	15-21	-1.554	-1.651	-1.484	-0.031
		(0.717)	(1.756)	(0.895)	(0.854)
	22-39	-0.274***	-0.020	-0.011	0.013
		(0.049)	(0.075)	(0.068)	(0.069)
	50-64	-0.207***	0.088	0.015	0.023
		(0.047)	(0.071)	(0.066)	(0.067)
	65 and up	-1.293***	0.104	0.206	0.187
		(0.064)	(0.097)	(0.089)	(0.090)
Educ:	Less than High School	-0.147**	0.076	-0.001	-0.056
		(0.052)	(0.082)	(0.075)	(0.073)
	13-15	0.490***	-0.015	-0.051	-0.136
		(0.049)	(0.075)	(0.069)	(0.070)
	16+	0.836***	0.064	0.063	-0.018
		(0.052)	(0.078)	(0.072)	(0.073)
Nat.:	Arab	-0.268***	0.095	0.211	0.217**
		(0.049)	(0.086)	(0.088)	(0.074)
	Other	-0.200	-0.065	-0.017	0.012
		(0.087)	(0.132)	(0.116)	(0.121)
Constant		8.882***	-0.054	-0.015	-0.058
		(0.045)	(0.068)	(0.062)	(0.063)
			B. Adjusted Means		
Total Income (log NIS)		8.776***	8.810***	8.830***	8.742***
		(0.018)	(0.021)	(0.018)	(0.018)
Total Income (NIS)		6,477***	6,701***	6,836***	6,260***
		(117)	(141)	(123)	(113)

Notes: N= 30,273 (1 Attempt: 8,016; 2: 5,994; 3+: 8,296; NR: 7,967). R^2 = 0.1. Sample: All households that appeared in the Individual Income Registry, this corresponds to cell HA13 in Figure 3. The table reports estimates from a single OLS regression. Dependent variable: ln(income of regestered property tax payer +1). See page 14 for a full explanation of the table structure. (A) Estimated coefficients from a fully interacted regression. Each regressor is interacted with each difficulty-to-reach category (omitted category: one attempt). Standard errors in parentheses. (B) Adjusted means, calculated from panel A regression. ***p< 0.01, **p<0.05, and *p<0.1. Sources: Household Expenditure Survey, Education Registry, Resident Registry and Individual Income Registry 2012–2016.

4.5 Administrative Data Analysis: Survey Nonresponders (NR)

We found in the previous sections that the nonrespondents do not cleanly carry on the trend as if they were harder-to-reach than the hardest-to-reach respondents for the outcome variables that we were able to examine. Such a trend would be consistent with the average nonrespondent being "harder" to reach than even hard-to-reach respondents, as implied by the view that nonresponders could have potentially become respondents with additional effort. However, not all nonrespondents are the same: some refuse, some were never reached, and some were reached but could not be surveyed due to difficulties such as language barriers. In this section, we take a closer look at the nonrespondents.

We begin with Tables 16 and 17 which use our administrative proxies for labor force participation. Here, instead of treating the NR-group as a homogeneous entity, we add three additional columns that split the NR group into the number of contact attempts that were made before the household was classified as a nonrespondent. Beginning with Panel B of Table 16 we find that, just as among respondents, there is a monotonic trend of labor force participation (proxied by inclusion in the Income Registry) among the nonrespondents. The trend in respondents is from 60.6% [0.2] to 63.2% [0.3], while among nonrespondents it is even steeper, from 57.6% [0.7] to 63.2% [0.4]. Similarly, using twelve months of employment as the dependent variable in Table 17, we again find a monotonic trend among the nonrespondents. While the trend among respondents is from 41.3% [0.3] to 42.9 [0.3], amongst nonrespondents it is again steeper, from 38.0% [0.8] to 41.6% [0.4].

Table 18 conducts a similar exercise with the administrative measure of income. Among nonrespondents, the two hardest-to-reach groups have qualitatively higher incomes than the easiest-to-reach group of nonrespondents (with incomes of around 6,300, compared with an income of 6,069). However, these trends are not statistically significant. All three groups of nonrespondents have incomes below their respective difficulty categories of respondents and, indeed, have lower means than any group of respondents.

Table 16: Labor Force Participation—Administrative Data

Attempts		1	2	3+	1 NR	2 NR	3 + NR
			A. Regression with Interactions				
		Base	Interactions				
Age:	15-21	-0.091	-0.011	-0.185	-0.078	-0.266	-0.042
		(0.070)	(0.131)	(0.109)	(0.140)	(0.177)	(0.117)
	22-39	-0.024***	-0.019	-0.005	0.040	0.039	0.006
		(0.007)	(0.012)	(0.012)	(0.023)	(0.026)	(0.014)
	50-64	-0.118***	0.018	0.027	-0.015	0.012	0.026
		(0.007)	(0.011)	(0.011)	(0.023)	(0.025)	(0.013)
	65 and up	-0.560***	0.010	0.048***	0.044	0.068*	0.053***
		(0.007)	(0.012)	(0.011)	(0.023)	(0.025)	(0.013)
Female		-0.096***	0.051	0.104*	0.018	0.113	0.032
		(0.024)	(0.039)	(0.038)	(0.076)	(0.071)	(0.042)
Nationality.:	Arab	-0.020**	0.012	0.033	0.058*	-0.035	0.047
		(0.007)	(0.013)	(0.015)	(0.022)	(0.028)	(0.019)
	Other	0.053***	-0.030	-0.010	0.030	0.017	-0.001
		(0.015)	(0.025)	(0.025)	(0.049)	(0.049)	(0.027)
Female Jew		0.029	-0.033	-0.082	0.011	-0.128	0.001
		(0.024)	(0.041)	(0.039)	(0.078)	(0.073)	(0.043)
Female Arab		-0.197***	0.024	-0.122	-0.026	0.013	0.022
		(0.027)	(0.049)	(0.051)	(0.086)	(0.091)	(0.060)
Educ:	Less than High School	-0.051***	0.001	-0.006	-0.052	0.027	0.012
		(0.007)	(0.012)	(0.011)	(0.021)	(0.025)	(0.013)
	13-15	0.076***	0.008	-0.012	-0.009	0.061	-0.024
		(0.007)	(0.011)	(0.011)	(0.023)	(0.025)	(0.013)
	16+	0.130***	-0.002	-0.017	-0.036	0.007	-0.032
		(0.007)	(0.012)	(0.011)	(0.024)	(0.027)	(0.014)
	Missing	-0.182***	0.003	-0.020	-0.046	0.003	-0.042
		(0.010)	(0.017)	(0.016)	(0.024)	(0.028)	(0.017)
Constant		0.841***	-0.009	0.002	-0.039	-0.057	-0.004
		(0.007)	(0.011)	(0.011)	(0.022)	(0.025)	(0.012)
			B. Adjusted Means				
Labor Force Participation		0.606***	0.611***	0.632***	0.576***	0.599***	0.632***
		(0.002)	(0.003)	(0.003)	(0.007)	(0.008)	(0.004)

Notes: N= 82,479 (1 Attempt: 31,340; 2: 15,921; 3+: 18,048; NR: 3,528). $R^2 = 0.34$. Sample: Stage A observations that were contacted and appeared in the administrative data, cell LA7 excepting those with missing age data. The table reports estimates from a single OLS regression. Dependent variable: 0/1 employment indicator (1 if worked all 12 months 0 o.w.). See page 14 for a full explanation of the table structure. (A) Estimated coefficients from a fully interacted regression: each regressor is interacted with each difficulty-to-reach category (omitted category: 1 attempt). Standard errors, clustered at the household level, in parentheses. (B) Adjusted means, calculated from panel A regression. Significant at ***p < 0.01, **p < 0.05, and *p < 0.1. Sources: Labor Force Survey, Education Registry, Resident Registry and Individual Income Registry 2012-2017.

Table 17: Employment Rate—Administrative Data

Attempts		1	2	3+	1 NR	2 NR	3 + NR
			A. Regression with Interactions				
		Base	Interactions				
Age:	15-21	-0.518***	0.263	0.086	0.230	0.226	0.079
		(0.078)	(0.144)	(0.120)	(0.154)	(0.196)	(0.130)
	22-39	-0.059***	-0.019	-0.012	0.050	0.010	-0.014
		(0.008)	(0.014)	(0.013)	(0.026)	(0.029)	(0.015)
	50-64	-0.096***	0.016	0.023	0.011	0.026	0.007
		(0.007)	(0.013)	(0.012)	(0.025)	(0.028)	(0.014)
	65 and up	-0.463***	-0.010	0.027	0.098***	0.072*	0.045**
		(0.007)	(0.013)	(0.013)	(0.025)	(0.028)	(0.015)
Female		-0.092***	-0.000	0.083	-0.027	0.032	0.009
		(0.026)	(0.044)	(0.042)	(0.084)	(0.078)	(0.047)
Nationality.:	Arab	-0.069***	0.007	0.028	0.069**	0.047	0.063**
		(0.007)	(0.014)	(0.016)	(0.024)	(0.031)	(0.021)
	Other	0.066***	-0.016	-0.004	-0.033	-0.002	-0.016
		(0.017)	(0.028)	(0.027)	(0.054)	(0.054)	(0.030)
Female Jew		0.036	0.003	-0.082	0.034	-0.036	0.015
		(0.027)	(0.045)	(0.043)	(0.086)	(0.081)	(0.048)
Female Arab		-0.067	0.064	-0.125	0.034	-0.005	-0.025
		(0.030)	(0.054)	(0.057)	(0.095)	(0.100)	(0.067)
Educ:	Less than High School	-0.032***	-0.008	0.000	-0.056	0.024	-0.000
		(0.007)	(0.013)	(0.012)	(0.023)	(0.027)	(0.014)
	13-15	0.091***	0.013	0.001	0.002	0.036	-0.001
		(0.007)	(0.012)	(0.012)	(0.025)	(0.028)	(0.014)
	16+	0.128***	0.009	0.017	0.001	0.020	0.001
		(0.008)	(0.013)	(0.012)	(0.027)	(0.030)	(0.015)
	Missing	-0.089***	0.013	-0.020	-0.042	0.025	-0.031
		(0.011)	(0.018)	(0.018)	(0.027)	(0.031)	(0.019)
Constant		0.602***	-0.003	-0.003	-0.071**	-0.094***	-0.021
		(0.007)	(0.012)	(0.012)	(0.025)	(0.027)	(0.014)
			B. Adjusted Means				
Full Annual Employment		0.413***	0.413***	0.429***	0.380***	0.378***	0.416***
		(0.003)	(0.003)	(0.003)	(0.008)	(0.009)	(0.004)

Notes: N= 82,479 (1 Attempt: 31,340; 2: 15,921; 3+: 18,048; NR: 3,528). $R^2 = 0.21$. Sample: Stage A observations that were contacted and appeared in the administrative data, cell LA7 excepting those with missing age data. The table reports estimates from a single OLS regression. Dependent variable: 0/1 employment indicator (1 if worked all 12 months 0 o.w.). See page 14 for a full explanation of the table structure. (A) Estimated coefficients from a fully interacted regression: each regressor is interacted with each difficulty-to-reach category (omitted category: 1 attempt). Standard errors, clustered at the household level, in parentheses. (B) Adjusted means, calculated from panel A regression. Significant at ***p < 0.01, **p < 0.05, and *p < 0.1. Sources: Labor Force Survey, Education Registry, Resident Registry and Individual Income Registry 2012-2017.

Table 18: HES—ln(Income) including NR

Attempts		1	2	3+	1 NR	2 NR	3+ NR
			A. Regression with Interactions				
		Base	Interactions				
Age:	15-21	-1.554	-1.651	-1.484	1.076	1.049	-0.396
		(0.717)	(1.756)	(0.895)	(1.344)	(1.758)	(0.896)
	22-39	-0.274***	-0.020	-0.011	-0.088	0.242	-0.022
		(0.049)	(0.075)	(0.068)	(0.111)	(0.123)	(0.080)
	50-64	-0.207***	0.088	0.015	-0.194	0.307	0.014
		(0.047)	(0.071)	(0.066)	(0.111)	(0.120)	(0.077)
	65 and up	-1.293***	0.104	0.206	0.144	0.410*	0.132
		(0.064)	(0.097)	(0.089)	(0.151)	(0.156)	(0.106)
Educ:	Less than High School	-0.147**	0.076	-0.001	-0.001	-0.122	-0.049
		(0.052)	(0.082)	(0.075)	(0.116)	(0.130)	(0.087)
	13-15	0.490***	-0.015	-0.051	-0.064	-0.166	-0.154
		(0.049)	(0.075)	(0.069)	(0.121)	(0.125)	(0.081)
	16+	0.836***	0.064	0.063	0.009	0.078	-0.060
		(0.052)	(0.078)	(0.072)	(0.122)	(0.130)	(0.085)
Nat.:	Arab	-0.268***	0.095	0.211	0.257	0.137	0.262
		(0.049)	(0.086)	(0.088)	(0.104)	(0.131)	(0.102)
	Other	-0.200	-0.065	-0.017	0.197	0.135	-0.088
		(0.087)	(0.132)	(0.116)	(0.211)	(0.209)	(0.138)
Constant		8.882***	-0.054	-0.015	-0.037	-0.241	-0.013
		(0.045)	(0.068)	(0.062)	(0.104)	(0.114)	(0.072)
				B. Adjusted Means			
Total Income (log NIS)		8.776***	8.810***	8.830***	8.711***	8.759***	8.750***
		(0.018)	(0.021)	(0.018)	(0.040)	(0.041)	(0.024)
Total Income (NIS)		6477***	6701***	6836***	6069***	6368***	6311***
		(117)	(141)	(123)	(243)	(261)	(151)

Notes: N= 30,273 (1 Attempt: 8,016; 2: 5,994; 3+: 8,296; NR: 1,803). R^2 = 0.11. Sample: All households that appeared in the Individual Income Registry, this corresponds to cell HA13 in Figure 3. The table reports estimates from a single OLS regression. Dependent variable: ln(income of regestered property tax payer +1). See page 14 for a full explanation of the table structure. (A) Estimated coefficients from a fully interacted regression. Each regressor is interacted with each difficulty-to-reach category (omitted category: one attempt). Standard errors in parentheses. (B) Adjusted means, calculated from panel A regression. ***p< 0.01, **p<0.05, and *p<0.1. Sources: Household Expenditure Survey, Education Registry, Resident Registry and Individual Income Registry 2012–2016.

5 Conclusion

Heffetz and Reeves (2019) suggested one tool that a researcher might use to look for potential evidence of nonresponse bias in surveys is the gradient of the outcome variable across difficulty-of-reaching categories among respondents. They hypothesized that in some metrics nonrespondents may be "harder" to reach than the hardest-to-reach of the existing respondents. Our ability to connect nonrespondents of two Israeli national surveys to national administrative records allowed us to examine this hypothesis directly.

Generally speaking, nonrespondents did not look "harder to reach" than the hardest-to-reach respondent—either demographically or as measured by outcome variables. However, we did find statistically significant differences between respondents and nonrespondents on all our examined outcome variables. Additionally, as we examined nonrespondents by difficulty category, we also found significant differences. This suggests that while all nonrespondents may not follow the monotonic trend often observed in respondents, there might be classes of nonrespondent that do. It also highlights the fact that even for nonrespondents, difficulty of reaching measures seem to contain some information on heterogeneity that is not eliminated when controlling for observable demographics alone. These findings potentially imply that difficulty of reaching may still provide some insight into nonresponse bias, particularly if researchers are able to combine it with additional information about nonresponse in the survey, such as the reason for nonresponse.

Often, researchers think of administrative data as a better measure of "truth" than survey data—many researchers view it as more reliable and less prone to bias than surveys. Indeed, when we began this research project we believed that administrative data might be the "silver bullet" to understanding nonresponse bias and its relationship to difficulty of reaching. However, our findings show that there is an important caveat to this view. We find that for many administrative variables, those individuals who were nonrespondents in our two surveys also had higher rates of missing administrative data. Thus, administrative data could also potentially be prone to its own form of "nonresponse" bias and provide a biased measure of the underlying population. While our match rates are generally around 90% (on par with the response rate for large, well-

funded surveys), there is still room for meaningful bias in these administrative-data-based estimates. Particularly concerning is the group of individuals who seem more likely to be nonrespondents and to not appear in administrative data—a sort of "super" nonrespondent. This "dual coincidence" of nonreponse makes the standard assumption of "missing at random" suspect. Moreover, this group of individuals may lead to bias in both survey and administrative data estimates.

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A Appendix

A.1 Survey Response Rates

Table 19: LFS 2012–2017, Monthly Average Number of HH in the Survey

	2012	2013	2014	2015	2016	2017
Dwellings Sampled	11,483	11,767	12,062	12,115	12,213	12,206
Zero Cases	703	768	824	832	857	863
HH To be Surveyed	10,954	11,161	11,373	11,457	11,500	11,482
Not Surveyed	1,964	2,029	2,624	2,668	2,619	2,704
Response Rate	82.1%	81.8%	76.9%	76.7%	77.2%	76.4%

Notes: Source: Press releases of the ICBS. Response rates are calculated by households surveyed from "households to be surveyed". This table includes households in all stages.

Table 20: HES 2012-2017, Monthly Average Number of HH in the Survey

	2012	2013	2014	2015	2016	Total
Dwellings Sampled	11,664	12,910	13,068	13,110	13,199	63,951
Zero Cases	1,031	1,220	1,226	1,322	1,396	6,195
HH That Belonged to the Survey	10,794	11,814	11,899	11,897	11,909	58,313
Discarded During Editing	35	23	23	25	10	116
Not Surveyed	2,016	2,284	3,411	3,322	2,996	14,029
Response Rate	81.9%	81.3%	71.4%	72%	74.9%	

Notes: Source: Press releases of the ICBS. Response rates are calculated by households surveyed from "households to be surveyed". This table includes households in all stages. The HES processing includes an editing phase in which households with problematic questionnaires are dropped.