The effects of subsidized home-based long-term care on elders' health and their adult children labor supply

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February 5, 2022
PRELIMINARY

Abstract

We study the impact of subsidizing home-based long-term care on recipients' health and on the labor supply of their working-age children. We use administrative data from Israel on the universe of welfare benefit applications, linked with tax records of applicants and their adult children. To address the endogeneity of benefit recipients' health status, we instrument for benefit receipt using the leniency of randomly assigned evaluators who assess applicant's functional status and determine benefit eligibility. We find that for compliers—applicants who receive subsidy only from more lenient evaluators—subsidizing home-based care has weak positive effects on labor market participation and income of recipient children (the effect is more pronounced for daughters), but large adverse effects on recipient health. Taken together, results are consistent with both crowd-out of self-care and substitution between informal and formal care.

*Shai Gilat provided outstanding research assistance. We thank Oren Danieli and Yotam Shem-Tov for helpful comments and suggestions. We thank the Israeli Social Security administration for data access and financial support. Opinions expressed in this study represent only the authors and not the Administration. D.Z. acknowledges support from the the Foerder Institute For Economic Research.

1 Introduction

Population aging increases the need for home-based assistance and care among the disabled elderly. Elderly needs, which range from help with chores to extensive help with daily activities, are provided either formally—by a paid caregiver, or informally—mostly by family members. Because most adult children providing care to their frail parents are still in the working age, informal care has potentially high opportunity costs. As adult children are the mainstay of informal care, understanding the labor market consequences associated with informal care, the substitution patterns between informal and formal care, and care type impact on elderly health, are important for evaluating the overall costs and benefits of long-term care subsidies (Van Houtven et al., 2013). But estimating the causal impact of formal care subsidies or programs on adult children's work is complicated by the endogeneity of both the need for care and the access to formal and informal assistance.

In this study, we focus on the impact of subsidizing home-based long-term care on the recipient's own health and on the labor supply of working-age children, which we analyze by exploiting a unique combination of linked administrative data and institutional settings from Israel. Government subsidies for formal care often provide little scope for identification of causal pathways because they tend to be either near-universal, as in the Nordic countries, or fairly limited, as in the United States (Van Houtven et al., 2013). In Israel, eligibility is fairly extensive but also depends on individual assessment of need. Therefore, arbitrary variation between evaluators can be used as a quasi-experiment for the identification of true causal effects of formal care subsidies (seminal uses of this strategy include Gaudet et al., 1932; Imbens and Angrist, 1994; Kling, 2006). Further, we obtained access to administrative data from Israel's social security administration on the universe of 100,000 welfare benefit applications from 2010 to 2016, and match these data with the tax records of the applicants, their spouses, and their adult children. Combined, these setting and data allow us to estimate the causal impacts of care subsidies on precisely measured outcomes in an entire population.

The obvious identification concern is the endogeneity of assistance. We address it by instrumenting for benefit receipt using the leniency of randomly assigned professional evaluators, who assess applicant's functional status and determine benefit eligibility. After we adjust for all information that was available on the application forms that may have influenced evaluator assignment (such as the applicant's city of residence and language), the assignment of evaluators to applicants is uncorrelated with other observed applicant characteristics, supporting the instrument exogeneity assumption. Leniency is also fairly dispersed: the evaluator at the 90th percentile of the leniency distribution approves 72% of the applications, whereas the 10th percentile approves only 48%. This evidence suggests that conditional

assignment of evaluators is a suitable instrument for studying the impacts of home-based long-term care subsidies.

Using a flexible empirical specification, we find that subsidizing home-based long-term care has weak positive effects on labor market participation and income of recipient's children, but large adverse effects on recipient health. We estimate that subsidies increase the income of the applicant's children by 19% and the labor-market participation by 2.1 percentage points. Coefficients are similar in magnitude for sons and daughters but statistically significant only for daughters. Considering applicant's health, we estimate that eligibility for subsidy increases one-year mortality rate by 3.9 percentage points. We also conduct a placebo analysis, in which we estimate the impact on 60-day mortality—a horizon too short for subsidies to have an impact—and indeed find no effect, reducing concerns that estimated treatment effects are confounded.

Together, our findings suggest that subsidies are a mixed blessing: easing the burden on informal caregivers seem to improve children labor market outcomes but adversely impact recipients' health. This trade-off is consistent with a crowd-out effect, in which formal care substitutes for either (superior) informal care or self care (which helps non-recipients to maintain their fitness). It is worth noting that our leniency-IV estimates by construction come from marginal applicants who are deemed independent enough to not be eligible for a subsidy by at least some evaluators, and therefore may not apply to more severe cases.

An extensive literature studies the impact of care for elderly parents on their children's labor supply. Most works used survey data and have selected smaller samples from the perspective of either parents or children (i.e., samples are either elders who require care, or children who provide care). These studies find negative associations between informal and formal care (Bonsang, 2009), substitution between multiple chlidren providing care (Fontaine et al., 2009), and between caring for parents and labor market opportunities (Bolin et al., 2008; Ettner, 1995; Johnson and Lo Sasso, 2006; Van Houtven et al., 2013). A paper that is closest to ours is Løken et al. (2017), who studies a reform expanding government funding of formal home-based care for the elderly using administrative data from Norway. In contrast to our findings, the authors find that formal care expansion has no impact on mobility or employment of children, but it leads to an increase in hours worked, only for only-child daughters.[1] We contribute to this literature by using the quasi-experimental design with administrative data on the universe of applicants and children to provide precise causal estimates.

[1]In related work, Fadlon and Nielsen (2021) estimate a large (positive) response of spousal labor supply in response to fatal or severe health shocks within the households. But the trigger—a health shock—is quite different than subsidised care, and so are the likely mechanisms involved.

Existing evidence is also mixed regarding the impact of home-based care on recipients' health and different than our findings. Løken et al. (2017) find that the aforementioned reform had no impact on the health of elderly parents. In contrast, Barnay and Juin (2016), using the number and gender of children as an instrument for informal care, find that such care reduces the risk of depression. Our study adds to this literature new evidence from a unique setting which provides for a more cleanly identified estimates than many previous ones that could only be obtained under much stronger assumptions about observability and confoundedness.

This paper continues as follows. Section 2 provides background on home-based long-term care in general and on the institutional details of its provision in Israel. Section 3 presents the data. Section 4 presents the empirical specification. Section 5 presents our results. Section 6 further discusses the results and concludes.

2 Background

The elder population is large and growing fast, and their need for long-term care is increasing. By recent estimates, more than one-half of U.S. residents above the age of 65 develop disabilities that require long-term care (Johnson et al., 2021). But not all long-term care is the same. According to the National Institute on Aging (2021), most people prefer to stay in their own home for as long as possible, and most long-term care indeed is provided at home. Home-based long-term care (henceforth, home care for short) includes health, personal, and support services to help people stay at home and live as independently as possible. Home care can be provided either informally, by unpaid family members, or formally, by paid professional caregivers. Traditionally and still today, most home-based care has been provided informally. However, home-based services are increasingly provided by paid caregivers, perhaps because improvements in life expectancy, children's late retirement age, and growing labor force participation of women all make informal care more challenging and increase its opportunity cost. Supporting formal home care, which is generally cheaper relative to professional care provided in other settings, is also a priority for funding agencies anticipating an increase in the number of people in need of care. For all these reasons, public funding of formal home-based care is an increasingly central policy issue. Being a substantial financial burden, surveys show US voters overwhelmingly support budget increases to improve access to long-term home care (Nilsen, 2021). Similarly, The national expenditure on long-term care in Israel in 2015 was estimated at NIS 14.5 billion or about 1.2 % of GDP, and is likely to grow as its relatively young population ages (Rosen et al., 2018).

According to a report from the Committee on the Future Health Care Workforce for Older

Americans (Institute of Medicine, 2008), informal caregivers are predominantly spouses or middle-aged daughters. Due to ongoing demographic trends, spousal caregivers are older themselves, making children increasingly the primary caregiver, spending on average about 20–25 hours on care giving. Most adult primary caregivers do so while simultaneously working. Formal caregivers may include trained nurses, but are predominantly personal support workers with no formal geriatric training, hired through agencies that provide minimal screening and training in basic nursing and personal-care tasks. Some formal caregivers are migrant workers and thus may not share the applicant's native language.

Caregivers, either informal or formal, may assume many different responsibilities, including support with activities of daily living (ADLs, typically bathing, dressing, eating, toileting, and transferring; these activities are also used to assess physical functionality and formal care eligibility). Caregivers may also assist with instrumental activities of daily living (IADL, such as shopping, meal preparation, money management, light housework, and laundry), with health care management, and with monitoring of health status. The Institute of Medicine (2008) cites multiple evidence for benefits of the presence of informal care givers. For example, the availability of family has been linked to shorter lengths of hospital stays and its absence is associated with problematic hospital discharges and readmissions.

Subsidized formal care reduces the burden for adult children caregivers and could affect their labor market behavior on both the extensive and intensive margin. The impact of substituting formal for informal care on the health of the elderly is less straightforward and may depend on the quality and quantity of care provided. Formal caregivers may be available more regularly than family members. However, their ability to simultaneously fulfill additional support functions, such as providing emotional support, may be inferior. Further, receiving regular assistance from a formal caregiver may also reduce the elder's independence by crowding out activities that they could perform themselves.[2] Therefore, the overall impact of substituting formal for informal care on elders' health is unclear.

Our study takes place in Israel, which experiences trends similar to other developing countries: increasing demand for home-based long-term care, increasing reliance on formal care, alongside informal care, which continues to play a major role. In 1988, Israel increased the extent of subsidies for home care by legislation of the long-term care law. The subsidies are mainly used to cover the cost of a hired formal caregiver.[3] Eligibility is based on a com-

[2]Gitlin et al. (2009) find that increasing the independence of the elderly contributed to elders' health. In conversations we conducted with them, Geriatric specialists at the Israeli Ministry of Health also raised the concern that formal help may crowd out elderly independence, due to increased focus on safety and efficiency in the performance of household task, at the expense of elderly engagement.

[3]During the study period, 98.2% of subsidies were used for home care. In addition to subsidized home care, the subsidy may also be used for other services, including medical alert systems, laundry services, and transportation services. `https://www.btl.gov.il/Publications/Skira_shnatit/2012/Pages/default.`

bination of income eligibility criteria and applicant need. To be eligible, an applicant's own annual income must be lower than 1.5 times the Israeli average monthly wage (published in annual official statistics) for a single-person household and 2.25 times for a couple. Need is based on ADL assessment of functional performance in the areas of personal self-care and general activities in and around the home. Subsidies are administered by the Israeli National Social Security. To be eligible for home-care subsidies, the elders submit an application to central district offices using a standardized form (Appendix B lists the fields on this form). After submission, financial eligibility is verified using administrative data, and applications not meeting the income criteria are rejected. Financially eligible applicants are then visited by an assigned evaluator—nurse, occupational therapist, or physical therapist. Evaluators are randomly assigned to applicants, with some preference for assigning evaluators to geographically closer and same-language applicants. Israel's intermediate level of generosity in providing long-term care subsidies—which are mandated by law and provided on a per-need basis, but are not universal—facilitate identification of their impact, by exploiting arbitrary variation in the assessment of need.[4]

The evaluators visit the applicants in their home to assess the applicants' ability to perform ADL. They examine the house environment and follow a questionnaire asking about, for example, the ability to prepare food, get dress, move around independently, etc. They then score each answer and classify applicants into four levels of need: 0 (not eligible), 1, 2, and 3 (highest level). The level of subsidy (measured in caregiver hours) is increasing in the approved level of need. Subsidies for need levels 1, 2, and 3 cover 9.75, 19, and 22 weekly hours of home care, respectively. Applicants with above-median income are eligible for half the number of hours. Applications are typically processed within a few weeks. Subsidized caregivers are hired through private agencies, which are reimbursed by the government. The applicant or their family can pay out of pocket for additional hours beyond what is covered by the subsidy. The same agencies also provide services to applicants who are denied financial support.

3 Data

3.1 Sample

We combine data from two administrative sources: applications for home-based long-term care subsidies from the Social Security Administration, and income records panel (for children

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[4]The eligibility of applicants aged 80 years or older could also be determined by a geriatrician chosen by the applicant, and therefore we exclude them from the study.

of applicants) from the Israeli Tax Authority.

The population from which we draw our sample consists of the universe of all applications from 2010 to 2016. To construct the main sample, we restrict attention to first-time applications, by applicants under the age of 80 at the time of application (see footnote 4). The resulting sample contains about 100,000 applications. Panel A of Table 1 describes the characteristics of applicants in our sample. The average applicant is 71.8 years old and 96.1% of applicants are married or were married in the past. 75% of applicants have children.[5] Like many older Israelis, most applicants are foreign born. About half of the applicants list Hebrew as their main language (Arabic and Russian are the two other common languages among Arab citizens of Israel and immigrants from the former Soviet Union, see Appendix Table A1). Panel B describes the distribution of approval rates. Of all applications, 60% are approved, with 78% of approved applications deemed eligible for the basic level of support (level 1); the remaining approved applications are deemed eligible for higher levels of support.

When studying labor market outcomes of adult children, we further restrict attention to applicants with children. The resulting sample consists of 2.5 million observations on approximately 160,000 children of applicants who applied before 2015. For children, we observe labor market outcomes over time. We restrict attention to a balanced panel spanning seven quarters before and seven quarters after the application time. We include all children, including children who did no work and had no labor income during the study period or any subset thereof. Panel A of Table 2 describes the characteristics of children of applicants in our sample. The average applicant with children has four children. This average is high because lower-income populations, who pass the income eligibility criteria, include ultra-Orthodox Jews and Arabs, who have high fertility rates. The average child is 42 years old at the time of their parent's application. Most children are in their (prime) working ages.

To reduce noise in the measurement of evaluator leniency, we restrict attention to applications reviewed by any one of 558 evaluators who performed at least 50 evaluations. These evaluators reviewed 92.7% of the total applications. Appendix A provides additional details on the sample construction.

[5]Children who are born in Israel are registered on their parents file at birth. Even though 84% of applicants were not born in Israel themselves, 78% of linked children were born in Israel. Data on children might be missing for people who immigrated with already-adult children, but unlikely missing for people who immigrated with children under 18 since there are significant tax benefits for having children. See Appendix Figure A2 for the distribution of the number of children.

3.2 Main Variables

Labor Market Outcomes We observe both labor market participation and wages. We use the child national ID number to exactly match applicant's children with their income data from tax records. These records include both wage income and income of self-employment. Income is reported annually. For every calendar year, we observe total earnings and the list of months with any income reported. For each applicant-child-month in the study period, we define an indicator for whether the child was earning any income, and the monthly income (averaged over all months with reported income in a given calendar year) or zero for months without employment. Panel B of Table 2 describes these measures in our sample. During the study period, 82% of children are ever employed and 9.4% are ever self-employed. The average child is observed employed 70% of the time. This evidence is consistent with prior work showing that informal family caregivers often work while providing assistance to those in need.

Health Outcome Our measure of applicant health is all-cause mortality. We observe the date of death from administrative sources for all applicants in our sample, regardless of their subsidy eligibility status. We measure mortality one, two, and three years from the date of application. Panel C of Table 1 describes the mortality of applicants in our sample. Reflecting the frailty of long-term care applicants, this mortality rate is, unsurprisingly, fairly high: 8% die within a year and 18% die within three years from the initial application. It is even higher among approved applicants, for which the respective one- and three-year mortality rates are 12% and 23%. This highlights the need to account for endogeneity of subsidy approval, as we do later.

Control Variables As controls, we use other variables which are reported on the application form. We also use additional demographic variables on children provided by the social security administration.

The application form is the sole source of information on applicants for the social security field office.[6] We therefore use the coded variables on the form—application date, city, language, gender, birth date, number of people living in the household, number of children, income, marital status, and whether they are Israeli born—as control variables to make within-comparisons of applicants.

For children of applicants, we observe age, gender, city, martial status, and whether they are Israeli born. We use these variables to conduct heterogeneity analyses of the impacts of home-care subsidy on labor market outcomes by child characteristics.

[6]Form number 2600, "Claim for Long-term Care Benefits". See Appendix B for a detailed translation.

4 Empirical Specification

The main challenge with identifying the impacts of subsidized care is that subsidies are, obviously, endogenous: they are given to sicker applicants. To address this challenge, we use a leniency instrumental-variable (IV) design (Kling, 2006) that exploits the random assignment of evaluators to first-time applicants. That is, because conditional on information observed on the initial application form, evaluators are randomly assigned to applicants, differences in evaluator leniency generate random variation in the provision of subsidies. We use this variation to estimate the effects of elder's eligibility for subsidy on outcomes, by using the evaluator's (leave-one-out) approval rate of first-time applicants, conditional on all observed characteristics as an instrument for the actual approval of a subsidy. The rest of this section discusses the empirical specifications in detail.

Define the leniency of the evaluation of applicant i, who is evaluated by evaluator j, as the evaluator's leave-one-out application approval rate:

$$Leniency_{ij} = \frac{\sum_{i' \neq i} Approved_{i'j}}{\sum_{i' \neq i} Evaluate_{i'j}} \tag{1}$$

where *Approved* is an indicator that equals zero for rejected applications and one for approved applications of any level of need; $Evaluated_{i'j}$ is an indicator that equals one for any applicant i' evaluated by j, regardless of approval status. Because the evaluator and their associated leave-one-out leniency score are unique to i, we use the subscript notation $Leniency_{i,j(i)}$.

Using this definition, we estimate two-stage least squares specifications. For mortality, we estimate:

$$\begin{aligned} Eligible_i &= \alpha Leniency_{i,j(i)} + \eta_i'\gamma + \nu_i \\ Y_i &= \beta \widehat{Eligible}_i + \eta_i'\delta_1 + \epsilon_{1it}, \end{aligned} \tag{2}$$

Eligible is an indicator for the applicant eligibility; $Leniency_{i,j(i)}$ is the evaluator leave-one-out approval rate defined above; and η_i is a vector of individual fixed effects (which include the following applicant characteristics: gender, age, city, language, calendar year and month-of-year of application, income decile, immigrant status, marital status, household size). Y is one of several measures for applicant mortality (two-months, and one-, two-, or three-year all-cause mortality). The parameter of interest is β, the impact of home-based long-term care subsidy on outcomes.

For child labor-market outcomes, which we observe unfolding over time, we specify the

second stage more flexibly as:

$$Y_{it} = \alpha_i + \theta_t D_t + \tau_t D_t HighLeniency_{it} + \eta_i' \delta_2 + \epsilon_{2it}, \tag{3}$$

Where i now indexes children of first-time applicants, the index t refers to time (in months) relative to the time of application, $HighLeniency$ denotes a discrete version of $Leniency$: an indicator that gets the value 1 if the (residualized) $Leniency_j(i)$ of the evaluator assigned to i is at the top 40% and the value 0 if it is at the bottom 40%; the middle 20% values of $Leniency$ are omitted from the sample. D_t denotes a series of indicators, one for each quarter relative to the event time, Y is one of labor market outcomes (participation, defined as an indicator for any work during the quarter, or the log of average monthly wage), α_i is applicant fixed-effect, θ_t are flexible (event) time fixed-effects. Since some applicants have more than one child, we weight this regression so that the weights of children of each applicants sum to one. The parameters of interest here are τ_t, which capture how home-care subsidy impacts the labor market trajectory of the recipient's children upon its receipt.

The identification assumptions are, as usual for the leniency IV design: independence, exclusion, and monotonocity. Independence means that, conditional on observed applicant characteristics (namely, within cells defined by a combination of the fixed effects for these characteristics), the assignment of evaluator is independent of the potential outcomes of the applicant. In interviews with current administrators and evaluators, we learned that the assignment of evaluators is indeed conditionally random. Assignment is done at the local level, with a pool of evaluators responsible for each area. A new application is assigned an evaluator in that area that matches their spoken language. Formally, no other factors should underlie the match. However, as excess caution, to mitigate the possibility that other factors that are observed on the application forms (such as the applicant age, gender, ethnicity, or even income) do in fact influence the match, we also include specifications that condition on all these observed factors.

The exclusion restriction is that evaluator assignment only affects applicant outcomes through its impact on the treatment (in our case, the eligibility for subsidy), not directly. This seems plausible in our context, since most evaluators only meet the applicants once, for a structured assessment based on ADL questionnaire. Monotonicity means that if evaluator A is more lenient than evaluator B then A would approve every case that B approves. It is commonly assumed in similar studies . We argue that the fact that evaluators use a structured questionnaire makes monotonicity especially plausible in our context.

5 Results

Variation in Leniency

Before discussing our main results, we review evidence related to the key identifying variation: the approval rates of different evaluators. Figure 1 shows the distribution of our leniency measure among evaluators in our sample, after residualizing by all fixed-effects included in our specification, which account for information available through the application form. Residualized approval rates are fairly symmetric, ranging between 0.48 and 0.72 on the 10^{th}–90^{th} percentiles. Important for our design, approval rates exhibit a fair amount of dispersion, even conditional on applicant characteristics (Appendix Figure A1 shows the raw rates, which are slightly more dispersed, as expected). Since we focus on first-time applicants, it is unlikely that any additional information that could have affected the match was available before the first encounter with the applicant. This dispersion therefore most likely reflects between-evaluator noise (Kahneman et al., 2021). In further support of the independence assumption, Appendix Figure A3 shows that, conditional on observables, evaluator leniency does not depend on the number of children applicants have or their children's income – two variables that are unavailable on the application form and are unobservable at the application stage.

The Impacts of Home-Care Subsidies

Recipient Health. Table 3 shows estimates for the impact of receiving a subsidy for home-based long-term care on recipient one-year mortality. First, observe that subsidy recipients are sicker: OLS estimates suggest that applicants approved for subsidized home care are 8.8 percentage point more likely to die within a year compared to applicants who were declined. Obviously, this reflects the endogeneity of subsidy eligibility. However, IV estimates from equation (2) suggest that subsidy for home care does negatively impact applicant health: for the marginally recipient, receiving a subsidy is associated with a 3.9 percentage points increase in mortality in the year following the application. These estimates result from instrumenting for subsidy eligibility using evaluator leniency, conditional on applicant city, language, and time of application. Further supporting the independence assumption is the fact that estimates, presented in column (3), are unchanged when we saturate the set of fixed-effects to include all observed applicant characteristics (recall that because we focus on first-time applications, these are the same characteristics observed by the administration when evaluators are assigned).

To gain more insight into timing of the effect of home-care subsidy on mortality, Appendix

Table A2 shows additional estimates of the impact of a subsidy on mortality measured at different horizons. Two key findings emerge. First, consider mortality during the short term—the first two months after the application. While subsidy recipients have higher baseline mortality risk than non-recipients (the OLS estimate is 2.0 percentage points and highly significant), our leniency-IV estimate detects no significant impact of the subsidy on short-term mortality. This (null) result is akin to a successful placebo test: it suggests that there is no correlation between evaluator leniency and case severity, further supporting the independence assumption. Second, consider the impact of the subsidy on mortality over the longer term. We find that IV estimates for the impacts of a subsidy on two- and three-year mortality are very similar to its impact on one-year mortality: we estimate a 4.0 percentage point increase in two-year mortality and 4.4 percentage point increase in three-year mortality. Together, these results indicate that most of the (adverse) health effects of the subsidy accrue during the first year. At first glance, the finding that subsidizing formal home-based long-term care adversely affects elderly health may seem counterintuitive. However, as discussed in Section 2, formal care is most likely a substitute for both self care and informal care by family and friends of the recipient. Therefore, it is possible that subsidizing formal care crowds out these other forms of care, which may have detrimental impacts. We return to this discussion in Section 6.

Child Labor Market Outcomes. Figure 2 shows estimates for the impact of home-care subsidy on labor market outcomes of children, obtained from estimating the event-study model specified in equation (3) using the sample of adult children of applicants. Figure 2a shows the impact on participation. Figure 2b shows the impact on income. In both cases, the parallel trends assumption seems to hold: in the year and a half leading to the application, there is no discernible difference between the labor market outcomes of children of applicants whose (later) evaluators have high and low leniency. For the first year after the application date, we continue to see no difference between the groups. However, beginning with the fifth quarter after the application date, we estimate that the subsidy (earned thanks to being arbitrarily assigned to a higher leniency evaluator) increases labor market participation and income of applicant children. During quarters 5–7 after the subsidy application, the log income of children of applicants who were assigned to high leniency evaluators was 2.67% higher than that of children assigned to low leniency evaluators.

To scale the magnitude of this estimated increase in income of children of applicants who were assigned a high-leniency evaluator, note that the average (residualized leave-one-out) leniency difference between high- and low-leniency evaluators is 0.21 (0.69–0.48=0.21). According to the first stage results from Table 3, this difference in leniency gives the ap-

plicants in the higher leniency quintiles a 14.1% higher probability for subsidy eligibility ($0.21 \cdot 0.675 = 0.141$). A 2.67% increase in income caused by a 14.1% higher probability to be eligible, translates into a net effect of 19% higher income for recipients of a subsidy (although note that these estimates are fairly noisy). We find similar effects on the extensive margin: a subsidy earned thanks to higher leniency results in a 2.1 percentage points higher probability of earning any income from employment or self-employment during quarters 5–7 after the application (once again, this estimate is obtained by adjusting the reduced-form 0.29 percentage points increase in probability of work by the first stage from Table 3). In sum, we find that being eligible for home-based long-term care subsidy resulted in increased participation and income for adult children of the recipient, starting about a year from the time of initial application.

To gain more insight into what might be the potential mechanisms that underlie our findings, we perform additional heterogeneity analyses, in which we estimate the impact of the subsidy on different subgroups defined by all observed covariates. Figure 3 summarizes these results. Naturally, smaller subgroups yield lower statistical power, and many of these estimates are not significant. However, there are few noteworthy findings. First, the positive impact of the subsidy on child labor market outcomes are much more significant for adult daughters. Second, the labor-market gains from receiving subsidized home-care are higher for children that live in the same city as their parent. Both findings are consistent with prior evidence that formal care often substitutes for informal care, and that daughters are more likely than sons to serve as informal caregivers. The estimated impacts of subsidized home care are also higher for self-employed children and for children in large families, though the difference is not statistically significant.

6 Discussion and Conclusion

We studied the impact of subsidizing home-case long-term care on mortality of recipients and on the labor market outcomes of their adult children. Our design exploits the variation in subsidy eligibility induced by the quasi-random assignment of evaluators. We focused on first-time applications, on which the administration and evaluators have no prior information that we do not have, and show evidence that conditional leave-one-out evaluator leniency exhibits no systematic variation and no correlation with other factors that were not observed in real time but we observe in retrospect.

Using this IV design, we find that subsidizing home care seems to hurt recipients but help their children: we find that subsidizing home care leads to a worsening of health, as measured by greater one-year mortality risk. The same subsidy also leads to increased participation

and earnings of children, an effect that is more pronounced for daughters.

Why might a subsidy for formal home care result in greater mortality risk? One possible explanations is that formal care may crowd out self care. Recall that leniency-IV estimates identify the treatment effects for the marginal recipients, those whose level of independence is sufficiently high for some evaluators to consider them ineligible for a subsidy. For such high-functioning individual, having a formal care giver take care of things around the house may reduce the level of independence and physical exercise, leading to lower physical fitness and health deterioration over time.[7] An alternative mechanism, which is also consistent with the increased participation of children in the labor market, is that home-based long-term care by a hired caregiver substitutes for care by informal family caregivers, which may be of higher quality. Finally, formal care may also delay moving to a long-term care facility that might be better at extending life.

Our findings that a subsidy helps children participation and earnings is more straightforward. For example, they are similar to Løken et al. (2017), who find significant effect of formal-care eligibility on the earnings of daughters of recipients. While a 2% increase in participation is not negligible, one might expect the impact to be even larger. One possible reason for the impact to be smaller than expected is that employers are accommodating the need of informal caregivers (particularly daughters) in the first place. In addition, children of applicants in our sample are relatively young (as we focus on applicants younger than 79 years old, the average child age is 42). These children likely have children of their own and debt to serve, and hence may sacrifice leisure, not work, when serving as informal caregivers. In such case, the benefits of subsidized formal care would accrue mostly in the form of increased leisure.

We stress that our results should be interpreted with caution. Note that our parameters are identified by between-evaluator differences in the assessment of need for care. These local average treatment effects are identified by compilers, which in our context are the cases that would only be deemed eligible for a subsidy by some, but not other evaluators. These are likely the least severe cases. We are unable to say much about the impact of a subsidy for more severe cases, for which most if not all evaluators would approve some level of subsidy. The result may be quite different.

From a policy perspective, while we do not think that the current evidence is sufficiently

[7]This is a very real possibility in the eyes of geriatric specialists we consulted. For example, Gitlin et al. (2009) find that randomized intervention aimed at increasing the independence of elderly at home reduced mortality after two years by 7.6 percentage points. The largest effect—11.5 percentage points—was for participants defined ex-ante as moderate mortality risk. This group might be similar to our borderline recipients. In our context, the key concern is that formal workers may not take into account the value of engaging disabled individuals. It may seem simpler and safer to substitute for the elderly, even in tasks they are able to do, with the result being a deterioration of fitness by the subsidized elderly.

strong for overturning any existing policies, these results do suggest that there could exist a tradeoff between formal and informal care. They highlight the need to further understand the impact and substitution patterns related to subsidized formal home care, and the heterogeneity in such impacts, as it is possible that subsidized care has adverse impacts for low levels of disability but not for high levels. In particular, results call for special attention regarding the potentially inadvertent consequences of crowding out self and family care by supplanting them with formal care.

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Table 1: Descriptive Statistics for the Sample of Applicants

	Sample, by Application Approval Status		
	Approved (1)	Not Approved (2)	All (3)
A. Applicant Characteristics			
Age	71.9	71.6	71.8
Female (%)	63.7%	70.7%	66.5%
Living Alone (%)	40.5%	49.6%	44.2%
Marital Status (%)			
Single	3.5%	4.5%	3.9%
Married	58.7%	52.1%	56.1%
Divorced	13.4%	15.7%	14.3%
Widowed	24.5%	27.6%	25.7%
Number of Children (%)			
0	22.7%	28.1%	24.8%
1	12.2%	12.3%	12.3%
2	14.7%	10.9%	13.2%
3	17.8%	12.1%	15.5%
4	12.4%	9.9%	11.4%
5 or more	20.2%	26.6%	22.8%
Income (NIS)	5651	3551	4814
Native Hebrew Speaker (%)	58.4%	41.9%	51.8%
Israeli Born (%)	17.9%	14.4%	16.5%
B. Application Approval Rate			
Approved Level of Need (%)			
Declined	-	100.0%	39.8%
1 (Lowest)	78.2%	-	47.1%
2	12.3%	-	7.4%
3 (Highest)	9.5%	-	5.7%
Any (1–3)	100.0%	-	60.2%
C. Mortality (%)			
Within 1 year of application	11.5%	2.8%	8.1%
Within 2 years	18.2%	5.8%	13.3%
Within 3 years	23.4%	9.1%	17.8%
Observations	62,515	41,288	103,803

Notes: The table shows descriptive statistics for applicants in our sample. Different columns show different subsamples, by application approval status. For detailed sample and variable definitions, see Section 3.

Table 2: Descriptive Statistics for the Sample of Applicant Children

	Sample, by Application Approval Status		
	Approved (1)	Not Approved (2)	All (3)
A. Household Characteristics			
Applicant Number of Children	3.71	4.34	3.94
Percent of Female Children	48.9%	47.7%	48.4%
Percent of Children in Same City as Applicant	56.5%	62.9%	58.8%
Percent of Children born in Israel	79.2%	76.3%	78.1%
Children Age	42.4	41.4	42.0
Children Marital Status			
Single	15.9%	17.4%	16.5%
Married	72.5%	71.7%	72.2%
Divorced	10.8%	10.0%	10.5%
Widowed	0.8%	0.8%	0.8%
Percent of Children Self-Employed	9.8%	8.7%	9.4%
Share of Children Ever Employed	83.5%	80.0%	82.2%
Share of Months Employed	71.2%	66.5%	69.5%
Child Mean Monthly Income (NIS) at the Time of Application	8,551	6,747	7,886
B. Application Approval Rate			
Approved Level of Need (%)			
Declined	-	100.0%	36.9%
1 (Lowest)	79.0%	-	49.9%
2	12.3%	-	7.7%
3 (Highest)	8.7%	-	5.5%
Any (1–3)	100%	-	63.1%
Number of Applicants	27,389	16,037	43,426
Number of Children	96,398	65,042	157,077
Observations (Applicant-Child)	99,306	67,854	167,160

Notes: The table shows descriptive statistics for children of applicants. Different columns show different subsamples, by application approval status. Measures are weighted so that all families (namely, sets of children of one applicant) receive equal weights, regardless of the family size. For detailed sample and variable definitions, see Section 3.

Table 3: The Impact of Subsidized home-based long-term care on Applicant Mortality

	OLS (1)	*IV* (2)	*IV* (3)
A. IV First Stage			
		Dependent Variable: Subsidy Approved	
Evaluator Leave-One-Out Leniency		0.723***	0.675***
		(0.018)	(0.019)
F Statistic [d.f.]		1561.63	1299.91
		[1,557]	[1,557]
B. OLS and IV Second Stage			
		Dependent Variable: 1-Year Mortality	
Subsidy Approved	0.088***	0.039**	0.039**
	(0.002)	(0.015)	(0.015)
Included Fixed Effects:			
Applicant City		V	V
Applicant Language		V	V
Application Year		V	V
Application Month			V
Applicant Martial Status			V
Applicant Gender			V
Applicant Age			V
Applicant Income Percentile			V
Applicant Is Israeli Born			V
Applicant Is Living Alone			V
N Clusters (Evaluators)	558	558	558
N Obs (Applicants)	83,598	83,411	83,411

Notes: The table shows estimates of the impact of subsidized home-health care on applicant one-year all-cause mortality. The sample consists of all first-time applications. Column 1 shows OLS estimates (which do not adjust for selection). Columns 2 and 3 show IV estimates that use evaluator leave-one-out leniency as an instrument for subsidy approval, obtained by estimating equation (2) with different sets of fixed effects. For details of the sample and variable definitions, see Section 3.

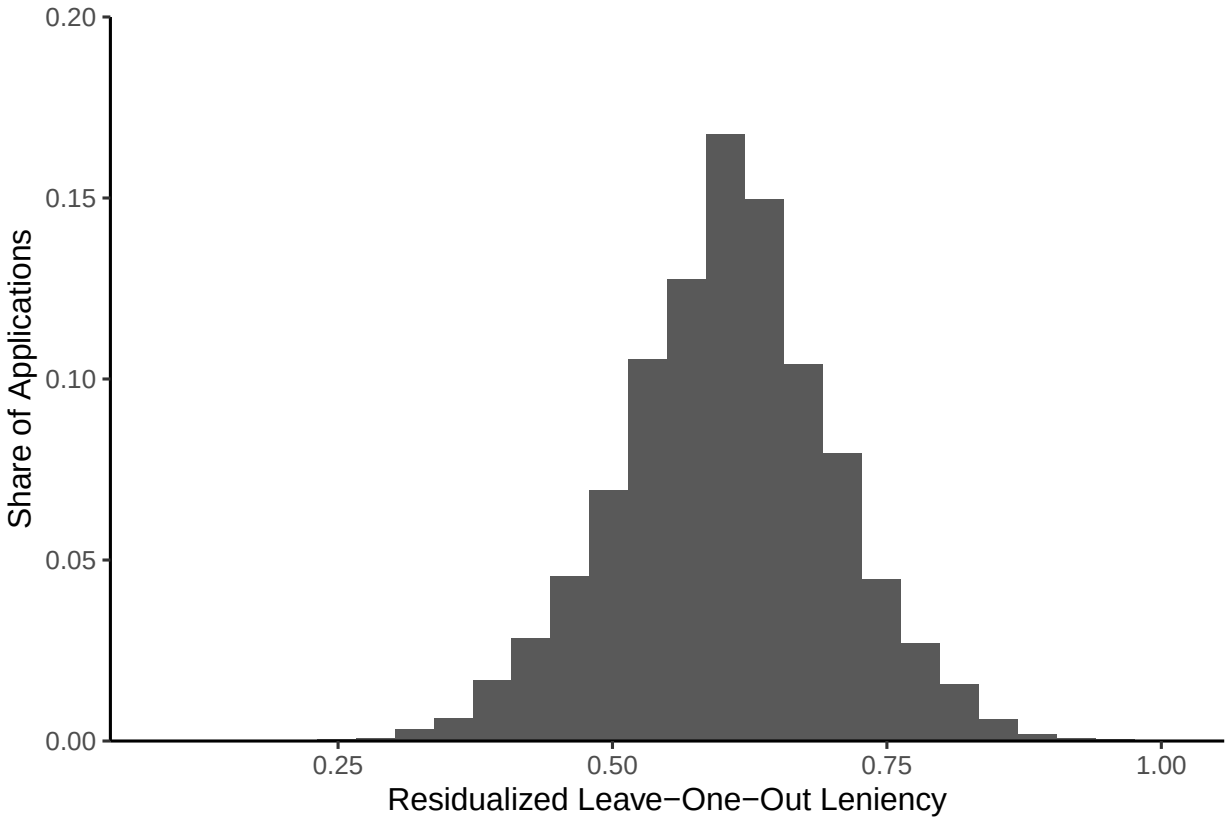
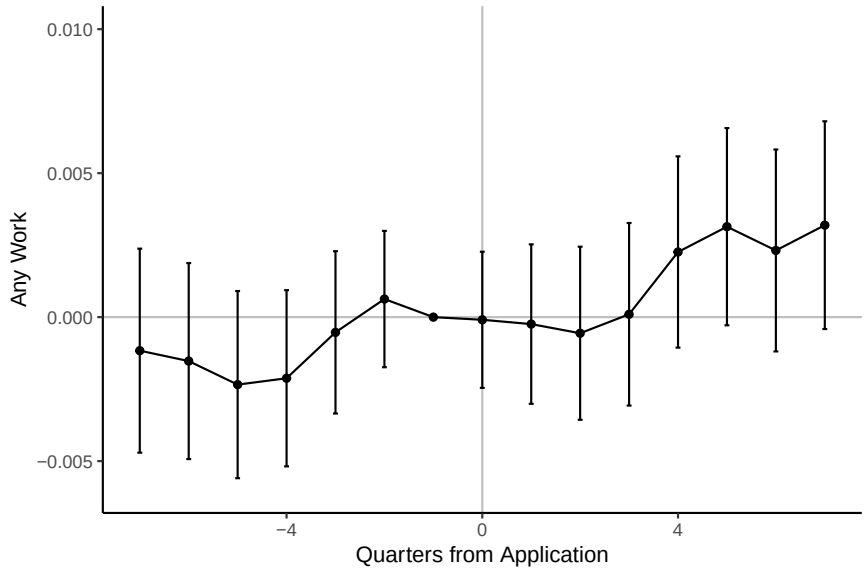


Figure 1: Distribution of Evaluator Leniency

Notes: The figure shows the distribution of evaluator application approval rates—our measure of evaluator leniency defined in equation (1). Leniency shown is residuzlied by applicant characteristics that appeared on the application form and therefore may have affected the assignment of evaluators. Raw rates are shown in Appendix Figure A1.

(a) Labor Market Participation



(b) Income

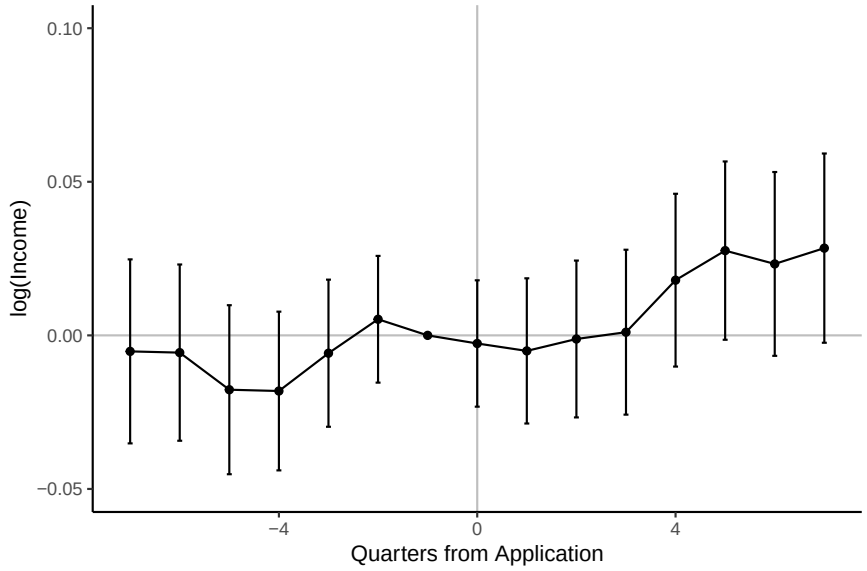


Figure 2: The Impact of Subsidized Home-Based Long-Term Care on Labor Market Outcomes of Applicants' Children

Notes: The figure shows estimates from equation (3) for the impact of subsidizing home-based long-term care on the labor market outcomes of children of subsidy recipients. Panel (a) shows results for labor market participation, where the outcome variable is an indicator for any income from employment or self employment during the quarter. Panel (b) shows results for income, where the outcome is log of the income from employment or self employment. Each point represents one quarter. The omitted quarter is the one just before the application was filed (months −3 through −1 relative to the months of application). Error bars show 95% confidence intervals for the point estimates. The sample consists of 123,474 children of applicants for the subsidy.

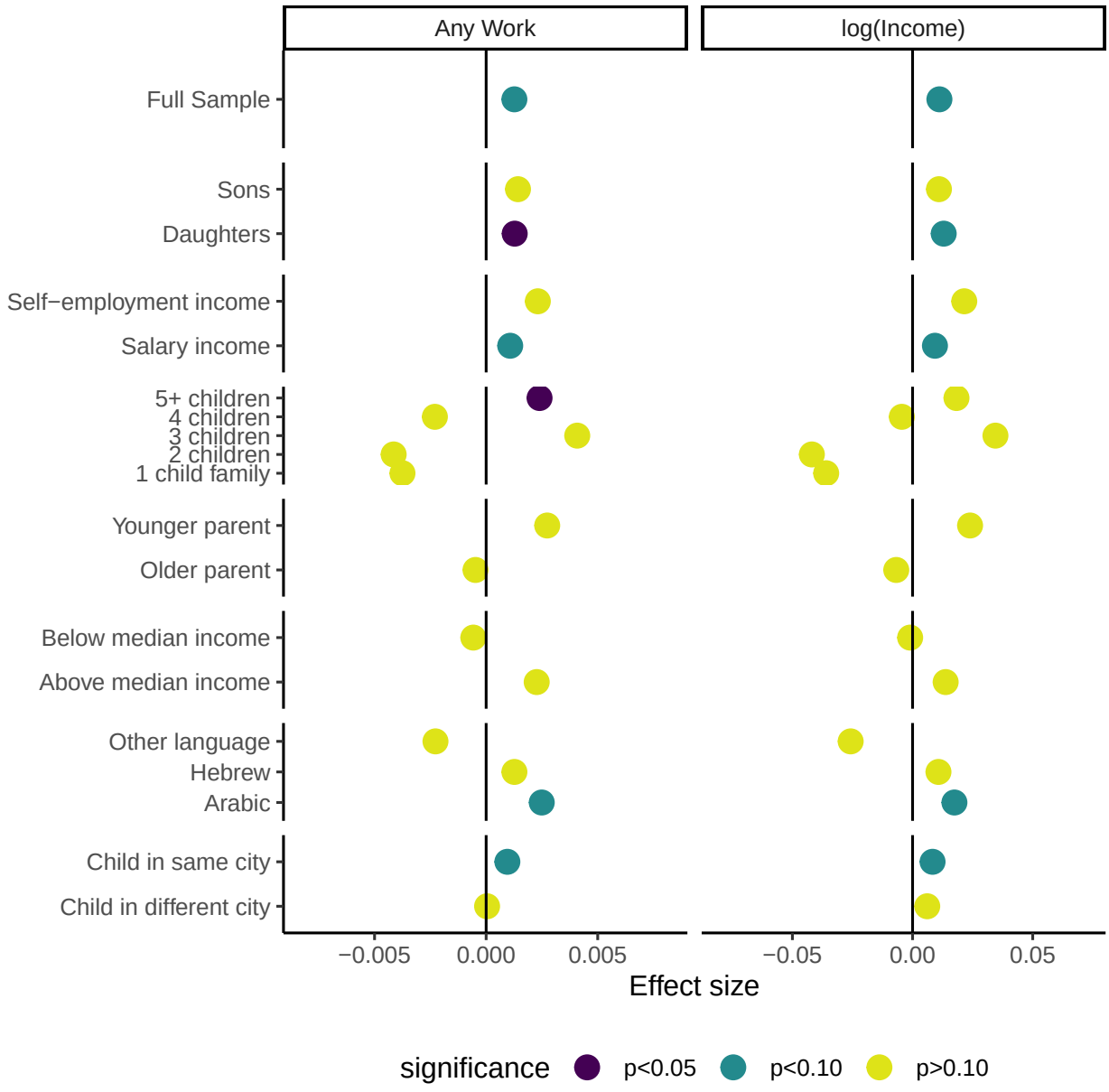


Figure 3: Analyses of Heterogeneity in Estimated Impact of Subsidized Home-Based Long-Term Care on Labor Market Outcomes of Adult Children

Notes: The figure summarizes the results of multiple heterogeneity analysis in which we reestimated eqation 3 for each labor market outcome using subsets by the observed covariates. The left panel shows results for labor market participation. The right panel shows results for income. Point values represent the point estimate for the impact of home-care subsidy on the outcome for the subgroup shown on the vertical axis. Point color reflects the statistical significance of the estimates, with darker color representing more significant estimate (see legend for exact values). The sample consists of all adult children of applicants for a subsidy.

Appendix A Construction of the Main Sample

Applicants Our study population consists of all 142,854 elders aged 67–79 who applied for LTC subsidy between 2010 and 2016. We restrict attention to the first application of each applicant, resulting in 125,938 applications. We include 123,419 applicants who at the time of application were living in a household of one or two members. 103,803 were eligible according to their income and could not be evaluated based on documents only, so they were evaluated by an evaluator—nurse, occupational therapist, or physical therapist. This is our main applicants sample as described in Table 1. 90,216 applied before the end of 2015, so we can include them in the calculation of mortality rate after one year. 83,598 were evaluated by evaluators that conducted more than 50 evaluations, so their measure of leniency is more reliable. This is the sample we use in Table 3. 187 observations were removed in columns 3 and 4 for reasons of collinearity.

Applicant children Of the 103,803 applicants in our main sample, 77,920 had children according to the records of the Ministry of Interior Affairs. Of these, 77,627 had children that were alive at the application date. For the event study design, we need 7 quarters before and after the application date. To keep a balanced sample, we included only applicants that applied until the first quarter of 2014 , leaving 47,031 applicants. 43,426 were evaluated by evaluators who conducted more than 50 evaluations, proving a morereliable measure of leniency. This is our main children sample described in Table 2. We excluded additional 81 applicants due to collinearity when evaluating the residualized leave-one-out leniency rate for each applicant. In the event study, we compare the applicants that had evaluators with leave-one-out leniency rate in the top 40% to the bottom 40%, so we exclude the middle quintile, leaving 34,131 applicants with 123,474 children used in Figure 2a and Figure 2b.

Appendix B Application Form

To initiate the process, applicants submit a form to any branch of the Israeli National Insurance. The fields in the application form include:

1. Applicant's details: name, ID number, birth-date, sex, and martial status.
2. Applicant's current location: home, hospital or other, address and contact details.
3. Address for mail (if different from home address).
4. Details of a family member or a guardian: name, connection to the applicant, contact details, checkbox for "interested to be present during evaluation visit."
5. Additional information: spoken languages, checkbox for "interest in advice of a volunteer," details of spouse (name and ID), checkbox for "the spouse applied for or eligible to long-term care subsidy."
6. Details of people living with the applicant: ID, name, relation, year of birth, eligibility for long-term care or other special subsidy.

7. Applicant and spouse's income details.

8. Constant expenses: payment for stay in an institution, alimony, and rent (rent is included only if the applicant has income from another apartment).

9. Activities of daily living: clothing, washing, eating, treatment of excretions. For each of the four, the applicant can mention if done independently or needs help. If checked "need help," there is place for a short explanation (this field is not mandatory and is rarely answered).

10. Checkbox for eligibility for veteran assistance from the ministry of defense.

11. Details of the nursing home or other institution where the applicant is staying in case the applicant is not staying at home, filled by the institution: approval of stay; date of entrance; type of license of the institution (Ministry of Welfare, Ministry of Health, no license); type of unit/department in the institution; services provided in the institution: food, cleaning, laundry; and whether the stay is subsidized.

12. Was the reason for the elder's dependency caused by an accident? If so, what type of accident? (car or other, date, place and circumstances); Was the police notified? was there a tort claim filed (details of representing lawyer, details of any compensation received).

13. Bank account details.

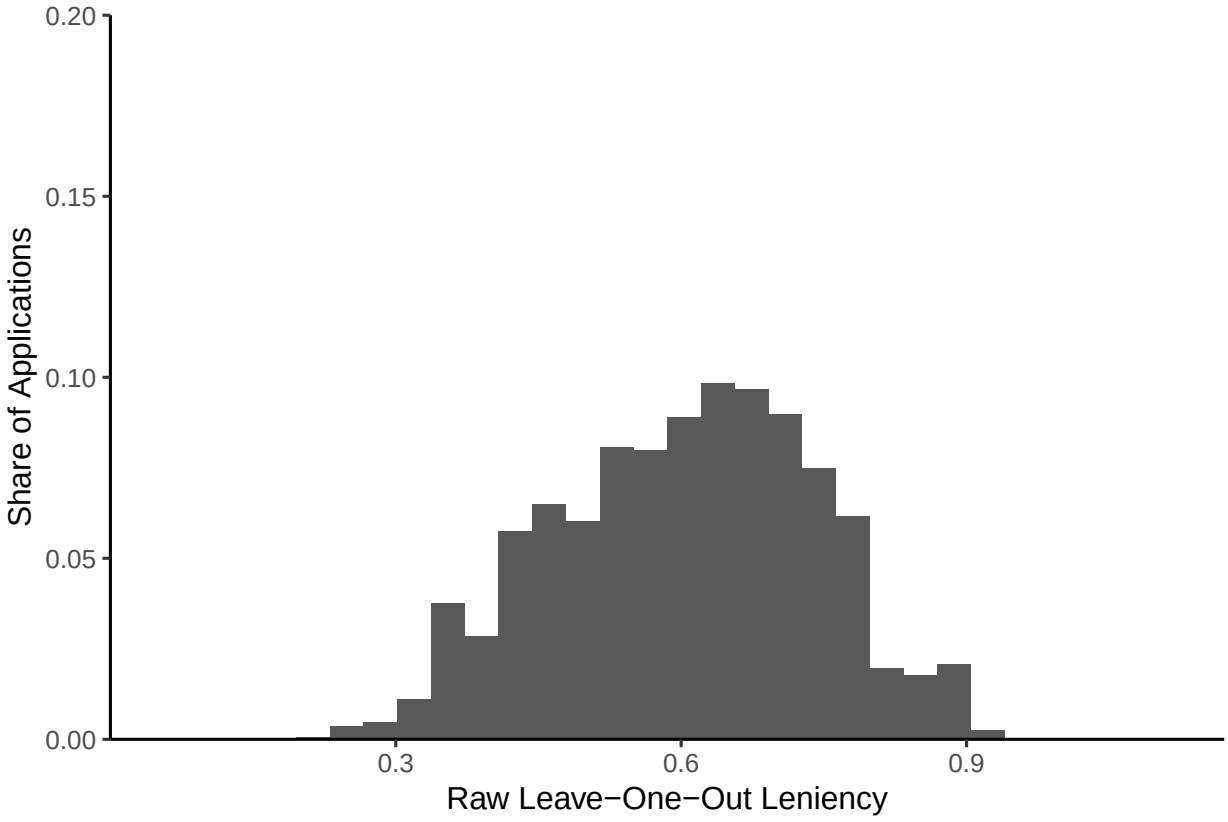
14. Signature and declaration that the content of the form is truth.

Appendix Table A1: Distribution of applications by year and language

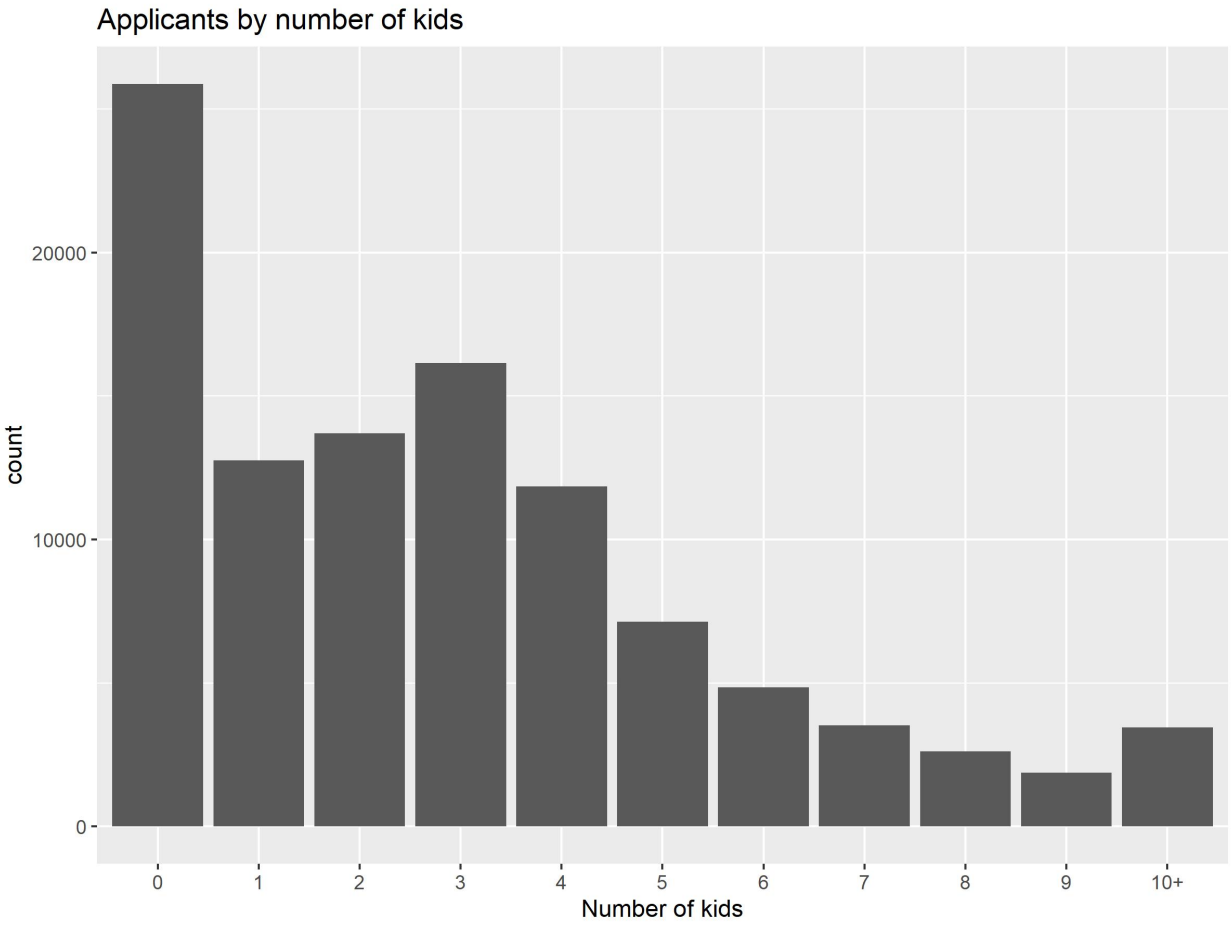
	N	Share
Panel A: Number and share of applications by year		
2010	15,103	14.5%
2011	14,277	13.8%
2012	14,934	14.4%
2013	15,536	15.0%
2014	15,135	14.6%
2015	15,231	14.7%
2016	13,587	13.1%
All	103,803	100%
Panel B: Number and share of applications by language		
Hebrew	53,453	51.5%
Russian	23,511	22.6%
Arabic	15,392	14.8%
Unknown	6,543	6.3%
Other	4,904	4.7%
All	103,803	100.0%

Appendix Table A2: The Impact of Subsidized Home Care on Alternative Mortality Measures

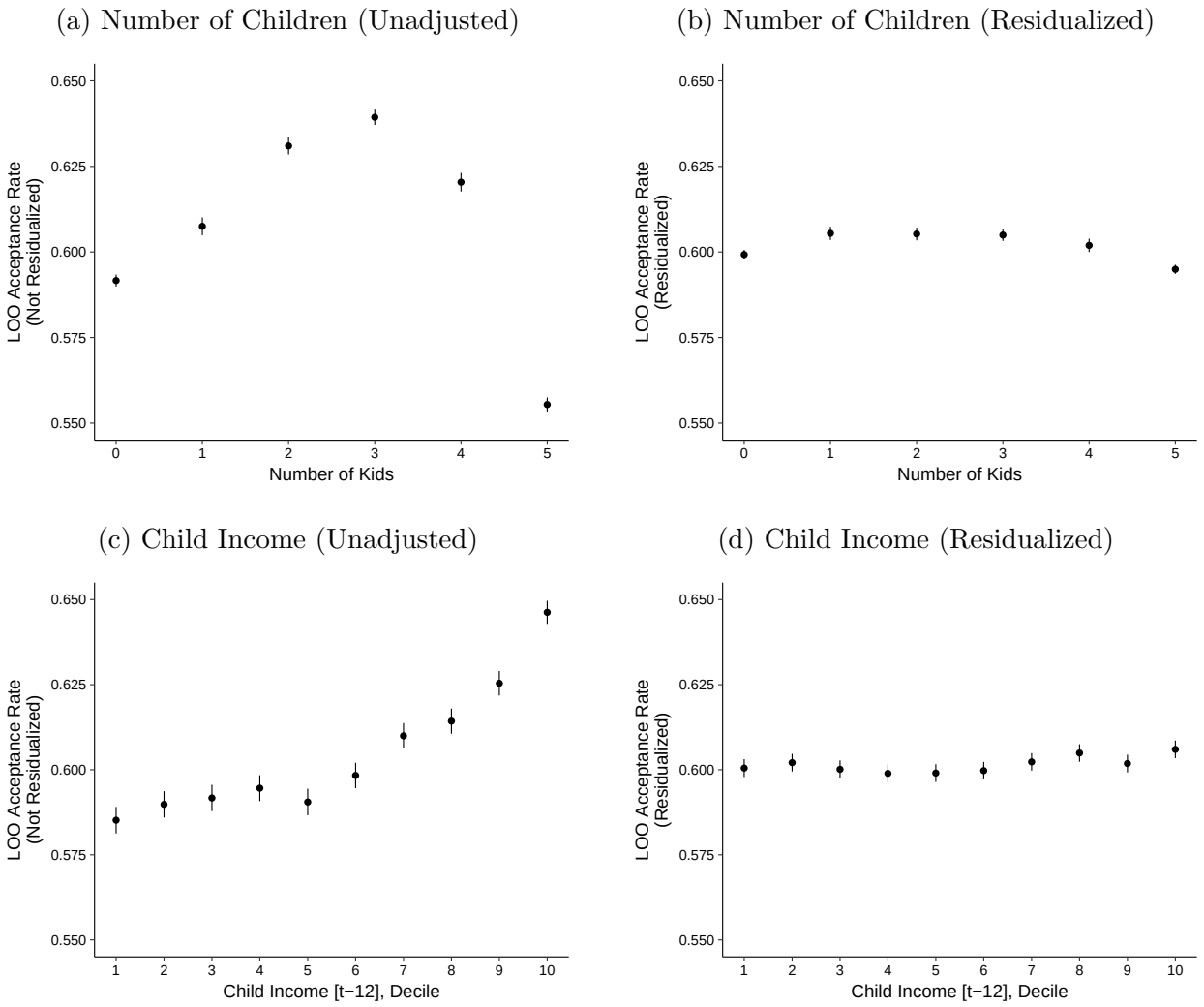
	OLS (1)	*IV* (2)	*OLS* (3)	*IV* (4)	*OLS* (5)	*IV* (6)
A. IV First Stage						
			Dependent Variable: Subsidy Approved			
Evaluator Leave-One-Out Leniency	—	0.659***	—	0.697***	—	0.723***
	—	(0.019)	—	(0.021)	—	(0.024)
F Statistic [d.f.]	—	—	—	1146.49	—	890.96
	—	—	—	[1,556]	—	[1,528]
B. OLS and IV Second Stage						
			Dependent Variable:			
	Two-Month Mortality		Two-Year Mortality		Three-Year Mortality	
Subsidy Approved	0.018***	0.007	0.125***	0.040*	0.143***	0.044*
	(0.003)	(0.007)	(0.003)	(0.020)	(0.004)	(0.024)
Included Fixed Effects:						
Applicant City		V		V		V
Applicant Language		V		V		V
Application Year		V		V		V
Application Month		V		V		V
Applicant Martial Status		V		V		V
Applicant Gender		V		V		V
Applicant Age		V		V		V
Applicant Income Percentile		V		V		V
Applicant Is Israeli Born		V		V		V
Applicant Is Living Alone		V		V		V
N Clusters (Evaluators)	540	540	557	557	529	529
N Obs (Applicants)	87,635	87,443	69,459	69,238	55,241	54,977



Appendix Figure A1: Distribution of Unadjusted Leave-One-Out Leniency



Appendix Figure A2: The Distribution of Number of Children per Applicant



Appendix Figure A3: Evaluator Leniency by Applicant's Characteristics

Notes: The figure shows the average leniency (leave-one-out average application approval rate) as a function of two applicant characteristics: number of children and average child income. These characteristics are not observed by the Administration before and evaluation is made, and thus serve as a way to evaluate the independence assumption. In Panels (a) and (c), we estimate non-parametrically the association between leniency and each of the two characteristics by showing the average leniency for each value separately, before adjusting for observables that may have affected the evaluator assignment. In Panels (b) and (d) we repeat this, but this time residualizing leniency by observed characteristics. For details of the sample and variable definitions, see Section 3.