

Limits to nudging home literacy environments - Quasi-Experimental Evidence from a Book Giveaway Program

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Abstract

Despite the importance of home literacy environments to educational inequalities, it remains unclear which types of interventions can motivate parents to provide stronger home literacy environments. This paper examines the potential of adapting a successful type of intervention (book giveaway program) into a cost-effective, easily scalable, nudge-style intervention. Based on a library-facilitated book giveaway program targeted children age 0-3, this paper studies whether the program decreased inequality by in particular motivating families with lower socioeconomic status (SES) or less established reading practices to increase their loan of children's library books. I use registry data from Danish public libraries and information on the staggered treatment of families in 3 municipalities compared with families in 33 never-treated municipalities. Results based on a difference-in-differences approach suggest that the program neither increased loans in high or low SES families or families with/without established reading practices. In contrast, the program had a small unintended negative effect among high SES families. I end by suggesting that if nudge-style interventions are to work, mapping and targeting the barriers that constrain families from providing more reading inputs is essential.

Keywords: Home literacy environment; Inequality; Nudge; Intervention; Registry data.

Conflict of interests: None

Introduction

Reading and the home literacy environment (books on the shelves, reading to/with children, talking about literature, etc.) are a central component of why children from homes with more cultural capital have improved educational outcomes as high-income and highly educated parents provide more reading inputs (Bianchi et al. 2004; Breinholt and Jæger 2020; Kalb and van Ours 2013; Sullivan 2001). While research shows that parental reading inputs are important to levels of inequality, we know much less about what works in terms of increasing reading inputs in disadvantaged families (Bianchi et al. 2004; Kalb and van Ours 2013; Kalil and Ryan 2020; Mayer, Kalil, Oreopoulos, et al. 2020). This paper incorporates ideas from the literature on "nudges" (Thaler and Sunstein 2008) and tests whether an effective type of intervention (book giveaway program) can be scaled down to a cheaper, easily implementable nudge-style intervention and improve parental inputs toward children's home literacy environments. Specifically, this paper studies a program facilitated by public libraries targeted children age 0-3 that attempts to positively impact children's home literacy environments by sending an offer to receive a free book directly to families and inviting them to come to their local library. This paper uses a difference-in-differences approach comparing treated families within municipalities to never-treated families within the same municipalities and never-treated families in municipalities without this type of program. I study whether the program had a positive overall effect, and whether the program decreased inequality by in particular increasing loans among low SES (income and education) families or families with less established reading practices (identified via prior library use).

Home literacy environments are a source of inequality as parents with higher education invest more time and resources towards reading to/with children, providing children with books, talking about literature, etc. (Bianchi et al. 2004; Blaurock and Kluczniok 2019; Kalil, Ryan, and Corey 2012) and these activities positively impact children’s educational outcomes (Kalb and van Ours 2013; Price and Kalil 2019; Sullivan 2001). DiMaggio (1982) argues with his model of cultural mobility that cultural resources (e.g. books and reading) can act as a path of mobility for disadvantaged students because these can increase access to skills and cultural repertoires that disadvantaged students lack. One way to reduce educational inequalities between children from homes high/low in cultural capital is then to increase disadvantaged parents’ inputs towards children’s home literacy environments. Despite this, we lack information about how to increase parents’ inputs into children’s home literacy environments as interventions more often target institutions that meet children outside of their homes (e.g. schools, after/summer school programs, or pre-schools).

Surveying previous interventions that seek to have parents read more to/with their children, Mayer et al. (2020:903) conclude that “*most of these programs have had modest success at best*”. Kalil et al (2020) argue that behavioral tools such as reminders, rewards, and goal-setting can be effective in supporting home reading practices. This approach draws on ideas from the nudge literature which propose that low-intensity interventions can change behavior by subtly manipulating social environments or cues to direct behavior toward a desired outcome (Damgaard and Nielsen 2018; Kalil et al. 2023; Thaler and Sunstein 2008). However, as Mayer et al (2020:112) note: *If parents cannot afford books, they will not read to their children no matter how many times*

they are nudged. A type of intervention that seeks to ensure that parents have material access to books is “book giveaway programs” that support home literacy environments by simply gifting books to families (de Bondt, Willenberg, and Bus 2020; Mol and Bus 2011). A meta-study have shown, that these types of programs are effective in improving home literacy environments and children’s reading skills (de Bondt et al. 2020). However, as these programs typically require several visits with families, teaching sessions and self-selection, they are not easily scalable.

Combining ideas from the nudge literature and book giveaway program, this paper studies whether a more scalable nudge-style intervention which incentivize improved access to books can increase parents’ inputs towards children’s home literacy environments. While there are clear socioeconomic gradients in the extent to which families read, research also suggest that most families across socioeconomic groups believe that providing a stimulating home environment (e.g. reading) is important for children (Bassok et al. 2016; Mayer, Kalil, Oreopoulos, et al. 2020). If families have an “unmet” potential for reading, it is plausible that smaller nudges that incentivize acting on this belief can be effective – in this case by offering a free book to come to the library and sign up as a loaner. Previous nudge-style interventions show that if parents are reminded of the importance of reading or of their own reading goals, they increase the time they spend reading (Barone, Fougère, and Pin 2021; Mayer, Kalil, Oreopoulos, et al. 2020). This program works by inviting all families with a child turning a specific age to come to visit their local library to receive a book present for the child. Treatment age varies from 6 months to 3 years across municipalities, but in the three cases I focus on, it was 6 months, 8 months and 3 years. While the initial nudge (the invitation and book offer) is cheap and low-intensity, the program’s strength lies in it providing sustained access

to a huge repertoire of books through library membership that families can draw on for free for years to come. If families show up to get the book and receive a library introduction, the program reduces information gaps in terms of which services local libraries offer, how to access them, and why reading is important to child development. The nudge program studied in this paper then differs from previous book giveaway programs in that the main effect does not lie in providing one (or more) books specifically, but in nudging families to sign up as members to give them long-term access to books. While the treatment is sent to all reaching a certain age in a municipality, taking the offer is voluntary, hence I focus on an ITT (intention to treat) effect of getting the book – though the effect could also be understood as the ATT (average treatment effect on the treated) for receiving the initial nudge/invitation.

I focus on the impact of implementing this program in three Danish municipalities compared to loan in the same period among families in 33 never-treated municipalities. Based on unique Danish registry data on library loans and a difference-in-differences approach focusing on the staggered implementation of the program, I find no evidence of a positive effect of the program on families' loans of children's books – in contrast, the program might even have had a small negative effect among high SES (socioeconomic status) families and families with established reading practices. The lacking effect among low SES families and those with no prior library use speaks to the ingrained nature of social inequalities and suggests that low-intensity nudge-style interventions are not enough to increase parental reading inputs in the form of library loans. If constraints in terms of habits, preferences, skills, resources or time are what hold families back from reading generally and using libraries specifically, then nudges such as the one introduced with this book

giveaway program might not be enough unless they map and target specific constraints more directly (Damgaard and Nielsen 2018).

Cultural capital, inequality in home literacy environments and educational outcomes

This paper focus on the intergenerational transfer of cultural capital, and whether families can be nudged to increase the inputs they provide towards children’s cultural capital. Bourdieu argued that children from homes strong in cultural capital, through schools, transfer cultural capital into advantageous school outcomes (Bourdieu 1986; Sullivan 2001; Weininger and Lareau 2003). Empirical studies building on Bourdieu’s work have shown that (a) there are socioeconomic gradients in families’ cultural capital (Falk and Katz-Gerro 2016; Mohr and DiMaggio 1995; Purhonen, Gronow, and Rahkonen 2011). Further, (b) cultural practices and preferences are transferred from parents to children (Georg 2016; van Hek and Kraaykamp 2015; Notten, Kraaykamp, and Konig 2012). While the process of transferring cultural capital from parents to children is not entirely clear in Bourdieu’s work, it need not be entirely intentional. When parents engage with their children, they draw on their habitus – i.e. internalized habits, practices, and preferences grounded in early socialization and past life experiences – and through this transfer e.g. a habit of reading, a preference for a particular type of music or particular educational expectations to their children (Dumais 2006; Reay 2004). Finally, (c) children from homes stronger in cultural capital have improved educational outcomes (Jæger and Breen 2016; Kaiser and Schneickert 2016; Kraaykamp and Notten 2016; Sullivan 2001). Here research shows that a strong home literacy

environment – e.g. availability of books, parents reading to and with their children and families discussing literature – have a positive effect on children’s school performance (Breinholt and Jæger 2020; De Graaf, De Graaf, and Kraaykamp 2000; Price and Kalil 2019; Sullivan 2001, 2007). While framed in different terms, these ideas are similar to those presented in research on unequal home environments. This literature argues that socioeconomic gradients in school outcomes stem – amongst other things – from differences in how cognitively stimulating home environments parents provide (Davis-Kean 2005; Duncan et al. 1998; Hoff and Laursen 2019; Potter and Roksa 2013). This research e.g. highlights that advantaged families (e.g. in terms of education and income) are more likely to read to their children, help them with their schoolwork and encourage their children to read.

While coming from homes with cultural resources might benefit children from advantageous backgrounds as Bourdieu argued, DiMaggio (1982) contends that redistributing access to cultural resources might reduce inequality as it gives children from disadvantaged backgrounds access to skills, information, and cultural repertoires that they can use to pursue social mobility (Kingston 2001). With the cultural mobility framework, DiMaggio argues that redistribution of cultural resources will benefit disadvantaged children the most. In contrast to (some interpretations of) Bourdieu’s work, cultural resources can within the cultural mobility framework work as transferable skills rather than as tokens of group membership only relevant to those who are already part of the club (DiMaggio 1982; Kingston 2001). Research on family scholarly culture argues that advantaged families are more likely to nurture a culture of reading at home, which means advantaged children train skills relevant to school success at home (e.g. reading skills, persistence, analytical thinking,

etc.) (Evans et al. 2010; Evans, Kelley, and Sikora 2014). Drawing on the cultural mobility framework, this literature also argues that redistributing access to books is likely to benefit disadvantaged children the most because it enables them to train skills they are (comparatively) behind on. Empirical studies support this depreciating return to cultural resources so that those with lower current levels stand to gain the most from an incremental increase (Brezna, Sauter, and Salikutluk 2020; Evans et al. 2010, 2014).

Summing up, research consistently show that highly educated and high income families are more likely to provide children with stronger home literacy environments. Families with more cultural capital and a stronger reading culture, are more likely to invest in children’s reading environments. Increasing home literacy environments among disadvantaged families can reduce inequality in children’s school outcomes through boosting disadvantaged children’s reading skills. As there is a depreciating return to cultural resources, interventions are likely most effective among disadvantaged families who research shows have weaker home literacy environments. This leads to the following three hypotheses about the effect of the library book giveaway program studied in this paper:

1: The program had an overall positive effect on parents’ loans of children’s books by incentivizing library use and membership

2: The program had a stronger effect among low SES families (no college degree or low income)

3: The program had a stronger effect among families with less established prior reading practices

Modifying inequality in home literacy environments – previous research

There have been many approaches to amending inequalities stemming from home literacy environments. I here define the home literacy environment to mean the reading culture and practices children are exposed to at home e.g. do parents read to/with children? Are there books available at home? Do parents read themselves? Is literature something that is discussed and valued at home? Most interventions targeted reducing inequalities stemming from home environments focus on the institutions children engage with outside of the home (e.g. schools, daycare, afterschool programs, etc.) (Dietrichson et al. 2021; Gorard, Siddiqui, and See 2017; National Institute for Literacy 2008; Xie et al. 2020). However, in the following, I focus on research about interventions targeted amending home literacy environments themselves – i.e. getting families to read more. In a meta-analysis, Barone et al (2019) find that most such interventions are ineffective in improving children’s language skills – only one type of intervention (dialogic reading) shows positive effects. Further, even within the short time windows studied (up to 6 months typically), effects often fade out. Additionally, rather than reduce inequality, some interventions increase inequality as effects are higher among high-SES groups – potentially due to differences in (quality of) implementation (Barone et al. 2019).

Kalil and Ryan (2020) argue that one can think of five different causes of socioeconomic gaps in home environments: i) Financial constraints, ii) time constraints, iii) information/values/preferences about parenting and child development, iv) family and environmental stress, and v) cognitive biases and decision making. They argue that to achieve lasting effects, interventions must target these sources of inequality. Kalil and Ryan (2020) and Mayer et al (2020) survey interventions related to each area and conclude that while some interventions have an effect, most programs have a very limited lasting impact.

A type of intervention that attempts to tackle financial constraints and information about child development, and has proven to be effective, is book giveaway programs. These programs gift books to children to directly improve home literacy environments and stimulate home reading practices (de Bondt et al. 2020). Most of these programs also involve an element of teaching e.g. through information pamphlets or coaching sessions about how and why to read with young children. While these programs invest directly in the physical element of home literacy environments (the number of books), the idea is for them to also stimulate home reading practices as research shows that families and children read more, if they have access to more reading materials (Bhatt 2010; de Bondt et al. 2020; Mol and Bus 2011; Ogg, Sundman-Wheat, and Bateman 2012). A meta-analysis finds that such programs have a positive effect on number of books in the home, but also on children and families' reading behavior and children's reading skills (de Bondt et al. 2020). While these programs can be effective, they have three main issues. First, they are rather expensive as they typically involve sustained interventions over a number of years and one-on-one contact with families in order to support reading practices. Second, these programs often require families to self-

select into the programs which means disadvantaged families might be less likely to participate. Third, these programs often pre-select books for families which reduces the likelihood of children finding books of the right type, topic and level of difficulty that suits them.

Another type of intervention draws on the popular literature on nudges (Thaler and Sunstein 2008) to argue that low-intensity interventions that target cognitive biases can help build family reading practices (Mayer, Kalil, Oreopoulos, et al. 2020). Studies find that nudges like goalsetting, social rewards or information about the importance of reading can help families build reading practices and improve children’s reading skills (Andersen and Nielsen 2016; Barone et al. 2021; Mayer, Kalil, Oreopoulos, et al. 2020; York, Loeb, and Doss 2019). This literature builds on an idea that in most families there is a latent desire to read with children, as most families know that reading is important to child development (Mayer, Kalil, Oreopoulos, et al. 2020). Given this latent potential, smaller nudges can provide just the little push to enable families cross some threshold that make them act on the latent potential and support home reading practices (more). Focus in these studies have typically been on either providing information about the importance of reading and/or techniques for reading, or goalsetting and reminders. The first type of approach works by reducing information deficits about (techniques for) reading and by reminding families of the importance of something they might already find valuable. The second type of approach works more specifically with parents stated preferences and goals for reading by providing reminders and incentives to help families stick to their goals that might otherwise get lost in the chaos of everyday family life.

Describing the intervention

Returning to the intervention this paper focuses on, it combines features from the book giveaway programs and nudge interventions described above. Rather than explicitly providing families with books, the program attempts to nudge library use and membership by sending an invitation to families inviting them to come to the library to receive a book present for a child. A family receives an invitation when they have a child that turns a particular age. The exact age varies across municipalities, in the three cases in focus here, they are 6 months, 8 months and 3 years old. Implementation also varies slightly in that some municipalities send out invitations via mail, while others deliver the invitation via health nurse or dentist checks that all children go through. If families after having received the invitation show up at the library, they will receive help with signing up as members, information about library services, and information about how to read with children and why this is important to child development. The nudge used in this program shares features from both of the approaches outlined above. By reminding parents that reading is important to child development and how and where they can make use of libraries, it seeks to reduce information deficits. By offering a gift for the child, the nudge also attempts to manipulate cognitive biases to become more in favor of making the time investment of going to visit libraries. If families show up at the library to get their present, and they sign up as members, the program attempts to reduce financial barriers to purchasing books by ensuring prolonged access to free books. Similar to other book giveaway programs, this program then seeks to stimulate home reading practices and children's early reading skills by providing families with better access to books (physical, digital, and audio).

The program has two main advantages compared to the book giveaway programs studied in previous research. First, the program is universal as all relevant families get invited to participate in the program. This means the program also reaches disadvantaged families that provide less stimulating home literacy environments, use libraries less, and are less likely to select into similar opt-in programs. Second, the program promotes sustained access to a huge collection of (digital and physical) books that families can make use of for free for years to come. This enables the program to have a long-term effect through sustained access to books, and for children to have a much higher chance of finding books that speak to them in terms of topic, genre, style, level of difficulty, etc. compared to when children are gifted books from a limited selection. It is important to reiterate that the program does not intend to impact children's reading through the one book they gift to children. Rather the idea is to incentivize families to come to the library where they will be able to see what the library has to offer and receive help signing up as members. The intention is that once parents see what libraries can offer and know how to access this resource, they will continue to draw on the resource going forward. The purpose is then to create long-term change in families' behavior and increase their inputs towards children's home literacy environments by increasing their loans of children's books going forward (de Bondt et al. 2020; Thaler and Sunstein 2008).

Data

I use registry data on all loans from all Danish public libraries to measure whether the library book giveaway program had an impact on parents' loans of children's books (as a measure of their inputs towards children's home literacy environments). The library registry data is unique in that it

contains universal information about loans of books from public libraries in Denmark. This means the study does not rely on self-reported information as is typical in studies on similar topics. The data contain information about each book taken out – e.g. who took out the book, when did it happen, and which book was is. I link the library data to information on family id, parent’s education, children’s ages, municipality, etc. from Statistics Denmark’s registries. As the outcome variable, I calculate the total monthly loan of books (digital and physical) from the children’s book collection and standardize this on a monthly basis within families with children of the same age (in months) to have a mean of zero and a standard deviation of one. This standardization nets out any (non-linear) impact of child age on number of library loans. Additionally, Table 1 and appendix Fig. 1 suggest that as the treated and never-treated groups are balanced according to age. To capture SES gradients in the impact of the program, I study the effect separately for families where at least one parent has at least a 3-year college degree vs. families where no parent has a 3-year college degree, and separately for families above and below median income. To test the effect dependent on prior home reading practices, I split the sample according to whether the family loaned any library books (adult or children’s books) in 2020 (i.e. prior to program implementation). Importantly, these splits test whether descriptively, the effect differs across groups, and not whether income, education and cultural capital has a causal effect on treatment effect. Finally, I collected survey data with the heads of local libraries to collect information on program implementation, etc. (response rate: 82%). I use (monthly) data from 2020 to 2022 and study the impact of programs implemented in 2021-2022. In total, 3 out of 97 municipal library systems implemented a book giveaway program in 2021-2022, and 33 never implemented the program. While online library use have been possible even

during lockdowns in Denmark, libraries were closed for considerable periods of time. As I compare loans for each month between treated and never-treated, the design should net out any impact of lockdown, as long the impact is the same across treated and never-treated families. However, in supplementary analyses (See Appendix Table A3 model 1-3 + Appendix Fig. A18), I run a robustness check including only months post April 2021 where libraries have not been under lockdown, and this does not affect the main results.

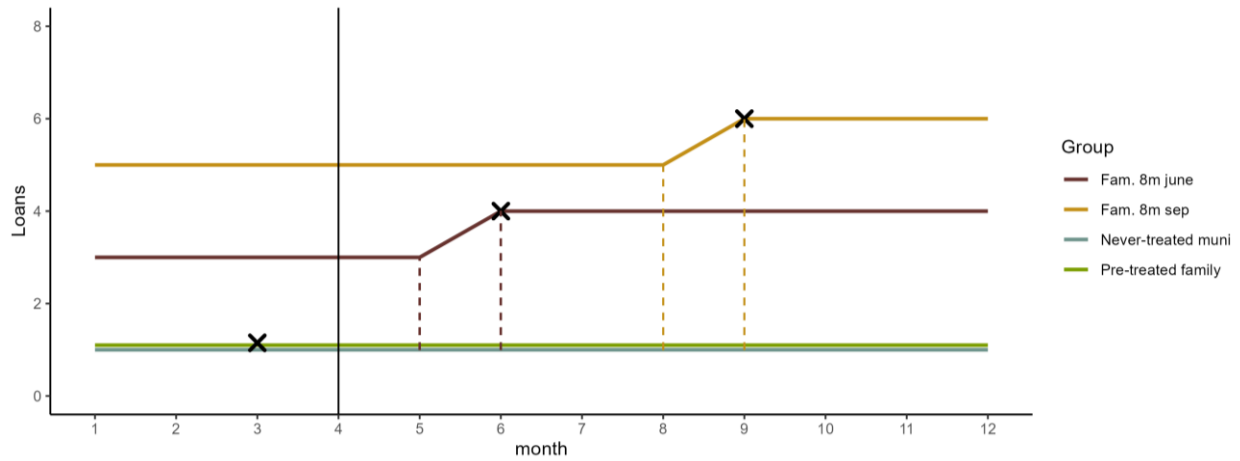
Design

I use a difference-in-differences approach with staggered treatment and analyze the impact of municipalities implementing the program. I use the Sun and Abraham (2021) approach which constructs 2*2 comparisons each month (change from one time period to the next for each the treated and never treated group) to account for potential dynamic treatment effects. This setup has the advantage that level differences in loans between treated and never-treated families is not problematic as long as they share a common trend (parallel trends assumption) (Goodman-Bacon 2021; Roth 2019; Sun and Abraham 2021). Further, as I compare loans in a specific month across treatment and control group, the design nets out any common time-trends in loans due to e.g. vacations. Identification comes from (a) comparing families in treated municipalities to families in never-treated municipalities, and (b) comparing families within treated municipalities that become treated, to those that are never treated due to children aging into treatment before treatment implementation or later than 2022. Figure 1 below illustrates the research design based on a case

where the program is implemented in April and targets children turning 8 months (marked by x). The figure shows that the never-treated are both families in never-treated municipalities, and families where the child reaches treatment age before program implementation. The figure then illustrates that treatment effect at $t=0$ (i.e. the month of treatment) equals the comparison between the length of the two same-colored dashed lines, and that these effects are staggered across months. In the event study graphs, the effect at $t=0$ (etc.) is then aggregated across families with different treatment timing.

In the main analyses, I study the effect of the program across a full year of data for each family (6 months before and 6 months after treatment). I zoom in on this period because (a) if any affect is present, it should show up close to treatment timing while it might fade out over a longer period and (b) this time-window ensures that a substantial proportion of treated families have information on the full pre and post treatment period (65% of treated families have information on loans 6 months post treatment, meaning they were treated at the latest June 2022). I show both the aggregated affect comparing 6 months pre/post treatment, and event-study graphs. These graphs show how the difference in loans between treated and never-treated families evolve pre/post treatment and then allows visually assessing whether the parallel trends assumption seems to be violated (which would present at a non-flat line prior to treatment timing at $t=0$).

Fig. 1. Illustration of research design



Context

Before describing the program in more detail, it is important to understand a little about the institutional context of the study. The intervention is implemented in Danish public libraries that are by law required to make children’s books available in all municipalities free of charge. Libraries are widely spread across the country, and the average distance between families with children and their closest local library is only a little more than 2 km (though of course the average distance varies between urban and rural areas). While libraries are freely available in all municipalities, this does not mean there are no institutional barriers to participation as individuals have to sign up as members to use libraries (though many school children will be able to use their school ID – UNILOGIN), late delivery fees apply and opening hours and staffing depend on local financing.

The intervention studied in this paper is common as at least 44 out of 97 municipal library systems have had it at some point –the earliest implementation dates back to 1985, and they have

been particularly popular since 2010. This type of intervention has typically been implemented as a way to reach out to current non-users of libraries and hence increase reading and library use in these homes, partly as a response to generally fading use of libraries across the period. I study the implementation in the three of these municipalities that implemented the program 2020-2022, where I have access to data on loans. The three treated municipalities are fairly different with two being rural areas (one rather average and one highly disadvantaged) and one being a more urban provincial area. I compare this to loan trends in 33 municipalities that has never implemented this treatment (treatment status is unknown or unclear for the remaining municipalities). Descriptive stats in Table 1 comparing treated and never-treated families to the population show that the never-treated match well with the population, while the treated have a little lower library use and are a little more disadvantaged in terms of parents' education and income. Importantly however, given how dependent reading is on child age, the treated and non-treated populations match closely on age (Appendix Fig. A1 shows the age distribution among treated and never-treated families). It is also important to note that as long as the trend over time within families in the treatment and control-group are comparable (parallel trends assumption), level differences in loans are not problematic as the design nets this out. As age is more likely to affect trends over time than less time-varying characteristics like parents' education and income, balancing on age is more important than balancing on socioeconomic composition. Supplementary analyses (Appendix Table A2 and Appendix Figure A2-A4) further show that results are robust to exploiting only variation within municipalities in families that are treated/never treated. Appendix table A1, show that treated and never-treated families within the same municipalities are more closely balanced in terms of SES and

library use, while they are less closely balanced in terms of age (due to age being what determines whether a family becomes treated or not).

Table 1. Descriptive statistics

Statistic	Treated sample			Never-treated sample			Total population		
	N	Mean	St. Dev.	N	Mean	St. Dev.	N	Mean	St. Dev.
*Number of children's books	61,524	0.73	3.51	2,183,256	1.05	4.26	5,378,940	1.14	4.45
*Number of children's books (standardized)	61,524	-0.07	0.83	2,182,810	0.002	1.00	5,378,494	-0.00	1.00
*Any loan of children's books	61,524	0.10	0.30	2,183,256	0.13	0.34	5,378,940	0.14	0.35
*College degree	61,416	0.53	0.50	2,178,540	0.61	0.49	5,365,764	0.62	0.49
*Family income above median	61,524	0.48	0.50	2,183,256	0.49	0.50	5,378,940	0.50	0.50
*Any library use in 2020	61,524	0.35	0.48	2,183,256	0.42	0.49	5,378,940	0.43	0.50
*Age focal child (in months)	61,524	16.20	16.57	2,183,256	16.92	16.97	-	-	-
*Focal child is female	61,524	0.49	0.50	2,183,256	0.49	0.50	-	-	-
*Focal child is firstborn	61,524	0.39	0.49	2,183,256	0.48	0.50	-	-	-

NOTE:* Indicate that means are statistically significantly different between treated and untreated samples at $p < .05$. Age of child can be negative because the family exists in the data before the child is born. In supplementary analyses (see Appendix Table A3 model 4-6) I drop observations where the focal child is not yet born.

Treatment assignment

The program consists of contacting a family when a child turns a particular age either via mail or via a scheduled visit with a healthcare provider (health nurse or dentist). In the three cases I focus on, the treatment age is, respectively, 6 months, 8 months and 3 years. I calculate treatment timing to be the month in which a child in a family reaches treatment age after the program has been

implemented in the municipality. In case more children in a family are within the sampling frame (born Jan. 1st 2018 to June 30th 2022), I code treatment timing as when the first child in the family is treated. As treatment timing varies across families within municipalities, it is spread-out across time and hence unlikely to be confounded by e.g. seasonal trends or impact of discrete events – which would be netted out by the design anyway as long as it impacts treated and never-treated families similarly. I use family and month fixed-effects and cluster standard errors at the family level in all models.

Sample selection

To consider that library use might differ substantially based on the age of children in a family, I only use information on families with children at an age relevant for this type of intervention. I select all families within the three municipalities starting a program 2021-2022 with at least one child born Jan. 1st 2018 to June 30th 2022 – i.e. all families have a child aged 6 months to 3 years at some point within the treatment period (2021-2022). While all families have at least one child born within this period, they can have older (or younger) children as well. In supplementary analyses (see Appendix table A3), I show that results are robust to focusing only on first-borns. I further drop all families who have not lived in the same municipality for the entire period to cleanly identify which treatment a family has been exposed to. This leaves a sample of 62,355 families (2,244,780 monthly observations) of which 1,709 are treated with the book giveaway program and 60,646 are not treated.

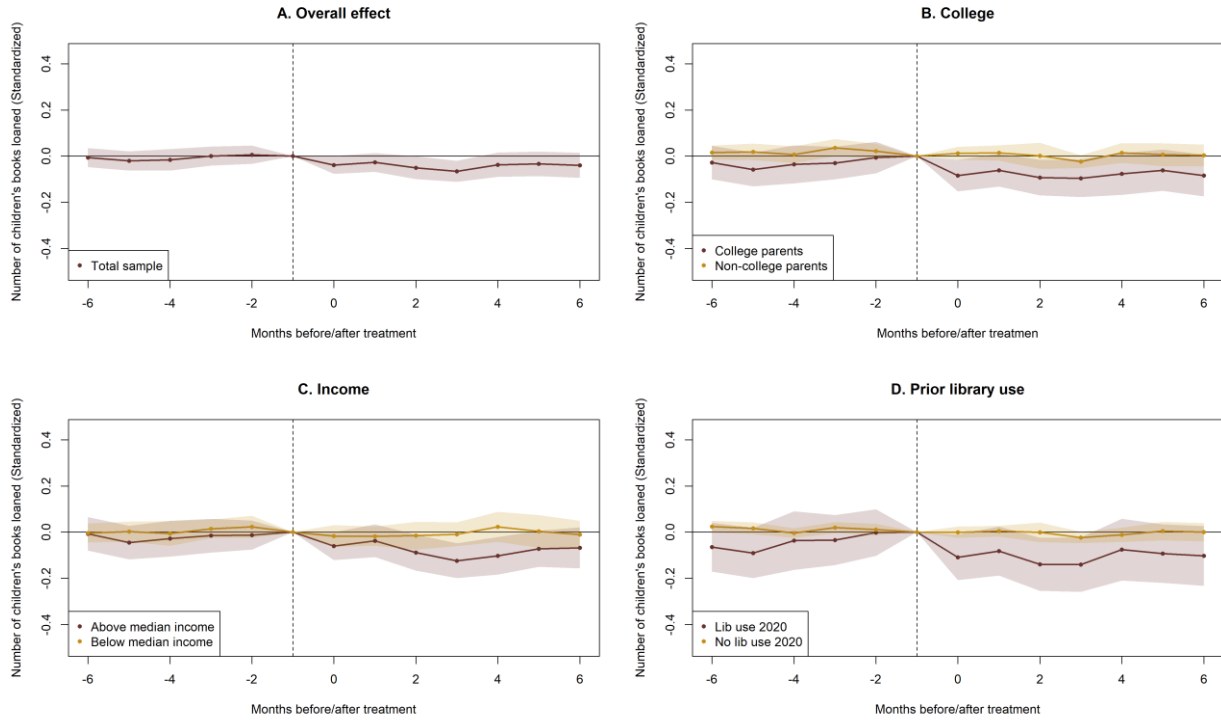
Main results

Fig. 2 show results using the event study approach suggested by Sun and Abraham (2021). $T=0$ (and the dotted line) represent the month in which a family gets invited to visit the library and receive a book gift. As the line is flat in Fig. 2 prior to treatment ($t=0$), the figure suggest that the parallel treatment trends assumption is not violated – i.e. prior to treatment, the trend in the never-treated treatment groups are comparable, and hence the post-treatment trend in the never-treated groups is an appropriate as a counterfactual for how loans would have progressed in the treatment group had they not been treated. As the lines are additionally flat post-treatment, and point-estimates for each period is generally not statistically different from loans in the month before treatment, the figure suggest no effect on families' loans of children's library books. To test the overall effect of the program, I aggregate the effect 6 months post-treatment relative to 6 months pre-treatment into an average treatment effect on the treated ($ATT=-0.032$ (0.011) **). This effect represent the ATT for receiving the nudge/invitation, but represent the ITT (intention to treat) for actually receiving the book and guidance from libraries. This result then suggest at small, and unexpectedly, negative effect of the program (ATT estimates presented in Appendix Table A2). Aggregating the effect across a longer period has the advantage of increasing power relative to estimating the month-by-month effect shown in Fig. 2.

To test whether the program reduced inequality in library loans, I test the effect of the program separately on families where at least one parent has a college degree and families without a college degree. These results are also illustrated in Fig. 2 (Panel B-D). There is no significant

effect across the post-treatment period for the non-college group, low income group or no library use in 2020 group of families. Fig. 2 panel B-D suggest that the negative main effect is driven by advantaged families, this is also supported by the ATT's presented in Appendix Table A2. Hence, the program neither had an overall positive effect on parents' subsequent investments in children's home literacy environments nor did it increase library loans particularly in families without a college degree. Unexpectedly, the program seem to have had a small negative effect on advantaged families. I discuss this finding more at the end of the paper. Appendix Table A2 model 8-12 shows results from models extending the period to 12 months before and after treatment and separate by each municipality (see also Appendix Fig. A2-A5). Results are similar to the main findings presented in Appendix Table A2 Model 1-7.

Fig. 2. Event studies. Effect of book giveaway treatment on loans of children’s books from libraries.



Robustness checks and result heterogeneity

In the following section, I explore the findings’ robustness to alternative model specifications.

First, I explore whether the results are robust to alternative outcome definitions (results presented in Appendix Table A3). The treatment could affect the propensity to use libraries rather than the number of books loaned. Appendix Table A3 Model 1-3 also shows results using a binary outcome variable. These models suggest only a negative effect among college-educated families (see Appendix Fig. A6). Further, while the treatment might not affect loans of children’s books generally, it might affect loans of picture books which are particularly relevant for the target age group (0-3

years). Appendix Fig A7 and A8 (and models 4-9 in Appendix Table A3) show that results are robust to focusing only on children’s picture books.

Second, another approach to constructing treatment and control groups is to only study at families where the child reaches treatment age close to treatment implementation. This approach would be similar to a regression discontinuity design, with the argument being that these families are more closely matched than comparisons across municipalities. Models 14-16 in Appendix Table A2 show results from models where I restrict the sample to families (within each treated municipality) with a child reaching treatment age 3 months pre or post-treatment implementation. Again, the results are similar to the main results, though these results are also much more noisy (in particular for the smallest of the municipalities) due to the much smaller sample size (see Appendix Fig. A9).

Third, Appendix Table A4 shows results exploring additional heterogeneities. In models 1-6, I only retain observations post April 2021 where libraries have not been closed due to lockdown, and observations where the focal child born in 2018-2022 is not yet born. Results are similar to the main results (see Appendix Fig. A10+A11). In models 7-24, I explore heterogeneity by child sex, birth order, and distance to the local library (see Appendix Fig. A12-A17). These results indicate that the negative effect is mostly driven by families with girls. This finding warrants further research into the gendered nature of how parents invest in their children, but it fits with previous research that shows that more women read and that reading is stereotypically a female activity (Gracia 2015; Griswold, McDonnell, and Wright 2005; Mohr and DiMaggio 1995). There is no evidence that the

treatment effect varies by whether the focal child is firstborn or the family lives close rather than far (above/below approx. 3 km) from the closest library.

Fourth, and finally, I run a pseudo-tests to test the validity of the design (model 10-18 in Appendix Table A3). I randomly sample families in the 33 never-treated municipalities to either simulate being treated remain never-treated. I then simulate the treatment effect of each of the three treatment variations (once for each of the three municipal variations in terms of treatment timing + age). Again, as these families were never treated, the results should show no effect for all three variations of treatment if the design is to be valid. As expected, none of the pseudo-tests shows significant treatment effects (see Appendix Fig. A17-A20).

Conclusion and discussion

This paper studied a book giveaway program facilitated by Danish public libraries to test whether an effective type of intervention, can be efficiently scaled down to a more implementable low-intensity nudge-style intervention and still increase parents' subsequent inputs into children's home literacy environments via loans of children's books. Based on the results presented above, I conclude that the program was not effective in incentivizing parents to increase their loans of children's books – neither among high or low SES families, nor among families with or without established reading practices. This means neither of the presented hypotheses are substantiated. As similar higher-intensity book giveaway interventions have shown positive effects on home literacy environments, children's reading and reading skills (de Bondt et al. 2020), the results indicate that low-intensity

nudge interventions are potentially not an efficient way of improving parental inputs towards home literacy environments.

Returning to Bourdieu's theoretical concepts, the results could reflect that the habitus, or everyday practices and preferences, in families are not compatible with parents providing substantially stronger inputs into children's home literacy environments than they already do – even if they are given access to further reading resources via libraries. For the advantaged families, there even seems to be a negative effect. The habitus concept would suggest that how parents parent and how they choose to invest in children's literacy environments are deep-rooted and habitual reflecting, in part, parents' early socialization into dominant (reading) culture, and hence not easily amenable (Bourdieu 1977; Reay 2004; Weininger and Lareau 2003). Since previous research has shown other book giveaway programs with more (and prolonged) interaction with families to be effective, one can speculate, that perhaps nudge-style interventions – or at least the nudge provided by this program – are simply too mild to change families' behavior (de Bondt et al 2020). Receiving a one-time invitation and offer of receiving a free book might simply be enough to change families' habits and behavior if library use does not fit meaningfully within their lives currently. Results from the nudge literature show that nudges work the best when they target the barriers that inhibit desired behavior (e.g. information deficits, unclear pathways, costs associated with action, etc.). The results from this paper then might suggest that what inhibit library use currently is not a lack of knowledge that the libraries exist and lack of a motivating reason to go there – which is mainly what the initial nudge (invitation and book offer) provides. The success of similar book giveaway programs potentially suggests that easier access to the books themselves and training in how to use books

with children better targets relevant barriers (e.g. time constraints, lack of knowledge about library services, lack of skills in engaging children in reading, etc.).

Surprisingly, the results indicate that there might even be a small negative effect of the program among high SES families and families with established reading practices. This finding could reflect that these families respond to the nudge by investing in home literacy environments via substituting library loans with purchasing children's books. Alternatively, the negative effect could reflect that these families are simply the ones most likely to pick up the free book and then use that free book as a substitute for a couple of library loans. Further, as college educated and high-income families generally use libraries more (Blaabæk 2023), they might not have any unmet need to fill by the intervention, which suggest it is important to think about potential ceiling effects for these types of treatments. Differentiating between these interpretations is not possible with the available data, but the tendency towards a negative effect among advantaged families does indicate that more research is needed to understand whether library loans substitute or supplement home libraries and how each affect children's reading and skills. At the same time, as books are fairly expensive in a Danish context, it is unlikely that the null effect among non-college and low-income families reflect that these families respond to the treatment by buying more books rather than loaning them from the library. Again, this statement cannot be directly tested with the available data. Meanwhile, survey data collected from a random sample of the adult population by Statistics Denmark suggest that reading at home, buying and loaning books are positively correlated which indicates that home libraries supplement rather than substitute library books (Appendix Table A4).

The results presented in this paper speak to the ingrained nature of social inequalities and suggest that scaling interventions down to smaller nudge-style versions is not necessarily a viable way of increasing parents' inputs toward children's home literacy environments. Drawing on Kalil and colleagues' work on barriers to investments in home environments and Bourdieu's habitus concept (Bourdieu 1977; Kalil and Ryan 2020; Mayer, Kalil, Oreopoulos, et al. 2020; Reay 2004), I have two suggestions for future similar interventions to be successful. First, when designing intervention, one should consider how they integrate with target families' habitus (existing norms, constraints, practices, and preferences). Second, it is important to map and target the barriers that currently constrain families from investing more in children's home literacy environments – e.g. do they find books or library fines to be too expensive? Do parents (or children) not like to read or do they struggle with reading? Can families not find books that are relevant to them? Are books not easily (enough) available? Can families not find the time to read? Etc. Each of these barriers likely requires different solutions. A promising way forward toward amending inequalities and supporting families lies in simply mapping the barriers that currently restrict families from investing more in children's home literacy environments.

Data availability statement

The data that support the findings of this study are available from Statistics Denmark. Restrictions apply to the availability of these data, which were used under license for this study. Data are available at <https://www.dst.dk/en/TilSalg/Forskningservice/Dataadgang> with the permission of

Statistics Denmark. Replication files including all recodes and analyses are available at https://osf.io/be8mp/?view_only=9873e14004cb4fe5aed5a136361141d3.

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Appendix Tables

Appendix Table A1. Descriptive statistics within treated municipalities

Statistic	Treated sample			Never-treated sample		
	N	Mean	St. Dev.	N	Mean	St. Dev.
Municipality 1: (Treatment age: 3 years. Start: September 2021)						
*Number of children's books	35,964	0.91	4.03	54,432	0.72	3.44
*Number of children's books (standardized)	35,964	-0.08	0.87	54,431	-0.06	0.87
*Any loan of children's books	35,964	0.12	0.32	54,432	0.10	0.30
*College degree	35,892	0.58	0.49	54,324	0.56	0.50
*Family income above median	35,964	0.53	0.50	54,432	0.49	0.50
*Any library use in 2020	35,964	0.38	0.49	54,432	0.39	0.49
*Age focal child (in months)	35,964	25.87	11.35	54,432	13.55	18.04
*Focal child is female	35,964	0.48	0.50	54,432	0.48	0.50
*Focal child is firstborn	35,964	0.43	0.49	54,432	0.52	0.50
Municipality 2: (Treatment age: 8 months. Start: January 2021)						
*Number of children's books	19,044	0.51	2.50	20,484	1.06	4.37
*Number of children's books (standardized)	19,044	-0.04	0.76	20,484	-0.06	0.89
*Any loan of children's books	19,044	0.09	0.28	20,484	0.13	0.34
*College degree	19,044	0.48	0.50	20,484	0.45	0.50
Family income above median	19,044	0.48	0.50	20,484	0.50	0.50
*Any library use in 2020	19,044	0.33	0.47	20,484	0.36	0.48
*Age focal child (in months)	19,044	2.60	12.36	20,484	26.64	14.77
*Focal child is female	19,044	0.49	0.50	20,484	0.46	0.50
Focal child is firstborn	19,044	0.33	0.47	20,484	0.33	0.47
Municipality 3: (Treatment age: 6 months. Start: April 2022).						
Number of children's books	6,516	0.43	2.88	16,164	0.48	2.50
*Number of children's books (standardized)	6,516	-0.08	0.82	16,163	-0.16	0.57
*Any loan of children's books	6,516	0.06	0.24	16,164	0.08	0.26
*College degree	6,480	0.35	0.48	16,164	0.29	0.45
Family income above median	6,516	0.20	0.40	16,164	0.25	0.43
*Any library use in 2020	6,516	0.24	0.43	16,164	0.29	0.45
*Age focal child (in months)	6,516	2.55	13.85	16,164	22.57	15.98
Focal child is female	6,516	0.54	0.50	16,164	0.53	0.50
*Focal child is firstborn	6,516	0.33	0.47	16,164	0.39	0.49

NOTE:* Indicate that means are statistically significantly different between treated and untreated samples at $p < .05$.

Appendix Table A2. ATT estimates main models (relative to entire pre-treatment period)

Model	Test	Sample	Estimate	Std. Error	P	Stars
Model 1	Main model	Full sample	-0.032	0.011	0.003	**
Model 2	Main model	College	-0.050	0.018	0.006	**
Model 3	Main model	No college	-0.010	0.011	0.359	
Model 4	Main model	Above median income	-0.055	0.017	0.001	**
Model 5	Main model	Below median income	-0.011	0.013	0.422	
Model 6	Main model	Lib use 2020	-0.064	0.027	0.016	*
Model 7	Main model	No lib use 2020	-0.013	0.008	0.103	
Model 8	Main model - Longterm	Full sample	-0.041	0.011	0.0001	***
Model 9	Main model - Longterm	College	-0.057	0.018	0.002	**
Model 10	Main model - Longterm	No college	-0.013	0.009	0.153	
Model 11	Split by municipality	Municipality 1	-0.031	0.014	0.025	*
Model 12	Split by municipality	Municipality 2	0.011	0.024	0.657	
Model 13	Split by municipality	Municipality 3	-0.016	0.038	0.671	
Model 14	Birthday +/- 3 m event	Municipality 1	-0.024	0.030	0.431	
Model 15	Birthday +/- 3 m event	Municipality 2	0.043	0.082	0.605	
Model 16	Birthday +/- 3 m event	Municipality 3	0.027	0.073	0.709	

Notes: ATT effects aggregated across entire post-treatment period relative to entire pre-treatment period.
~p<.10,*p<.05,**p<.01,***p<.001.

Appendix Table A3. ATT effects models using alternative outcome definitions.

Model	Test	Sample	Estimate	Std. Error	P	Stars
Model 1	Binary outcome	Full sample	-0.012	0.005	0.013	*
Model 2	Binary outcome	College	-0.018	0.008	0.020	*
Model 3	Binary outcome	No college	-0.003	0.006	0.587	
Model 4	Picture books only	Full sample	-0.038	0.012	0.002	**
Model 5	Picture books only	College	-0.067	0.021	0.001	**
Model 6	Picture books only	No college	-0.001	0.011	0.961	
Model 7	Picture books + binary outcome	Full sample	-0.012	0.004	0.001	**
Model 8	Picture books + binary outcome	College	-0.016	0.006	0.013	*
Model 9	Picture books + binary outcome	No college	-0.005	0.003	0.104	
Model 10	Pseudo: Treatment 1 in non-treated municipalities	Full sample	0.004	0.004	0.303	
Model 11	Pseudo: Treatment 1 in non-treated municipalities	College	0.003	0.006	0.616	
Model 12	Pseudo: Treatment 1 in non-treated municipalities	No college	0.005	0.004	0.211	
Model 13	Pseudo: Treatment 2 in non-treated municipalities	Full sample	0.001	0.003	0.795	
Model 14	Pseudo: Treatment 2 in non-treated municipalities	College	-0.002	0.005	0.609	
Model 15	Pseudo: Treatment 2 in non-treated municipalities	No college	0.005	0.003	0.114	
Model 16	Pseudo: Treatment 3 in non-treated municipalities	Full sample	0.004	0.007	0.626	
Model 17	Pseudo: Treatment 3 in non-treated municipalities	College	0.001	0.011	0.892	
Model 18	Pseudo: Treatment 3 in non-treated municipalities	No college	0.007	0.008	0.383	

Notes: ATT effects aggregated across entire post-treatment period relative to entire pre-treatment period.
~p<.10,*p<.05,**p<.01,***p<.001.

Appendix Table A4. ATT effects from models on different samples.

Model	Test	Sample	Estimate	Std. Error	P	Stars
Model 1	Exclude covid months	Full sample	-0.028	0.011	0.014	*
Model 2	Exclude covid months	College	-0.040	0.018	0.031	*
Model 3	Exclude covid months	No college	-0.014	0.011	0.232	
Model 4	Exclude months where focal child is not yet born born	Full sample	-0.033	0.011	0.003	**
Model 5	Exclude months where focal child is not yet born born	College	-0.052	0.018	0.005	**
Model 6	Exclude months where focal child is not yet born born	No college	-0.009	0.011	0.381	
Model 7	Split by sex	Female - Full sample	-0.039	0.016	0.016	*
Model 8	Split by sex	Male - Full sample	-0.026	0.015	0.073	
Model 9	Split by sex	Female - College	-0.071	0.027	0.009	**
Model 10	Split by sex	Male - College	-0.031	0.023	0.176	
Model 11	Split by sex	Female - No college	0.0002	0.014	0.987	
Model 12	Split by sex	Male - No college	-0.020	0.015	0.202	
Model 13	Split by birthorder	Firstborn - Full sample	-0.034	0.009	0.0001	***
Model 14	Split by birthorder	Not firstborn - Full sample	-0.030	0.017	0.074	
Model 15	Split by birthorder	Firstborn - College	-0.045	0.016	0.005	**
Model 16	Split by birthorder	Not firstborn - College	-0.053	0.027	0.046	*
Model 17	Split by birthorder	Firstborn - No college	-0.017	0.006	0.003	**
Model 18	Split by birthorder	Not firstborn - No college	-0.004	0.018	0.834	
Model 19	Split by library distance	Below mean distance - Full sample	-0.034	0.016	0.036	*
Model 20	Split by library distance	Above mean distance - Full sample	-0.029	0.015	0.051	
Model 21	Split by library distance	Below mean distance - College	-0.049	0.028	0.088	
Model 22	Split by library distance	Above mean distance - College	-0.050	0.023	0.027	*
Model 23	Split by library distance	Below mean distance - No college	-0.013	0.013	0.332	
Model 24	Split by library distance	Above mean distance - No college	-0.006	0.016	0.717	

Notes: ATT effects aggregated across entire post-treatment period relative to entire pre-treatment period.
~p<.10,*p<.05,**p<.01,***p<.001.

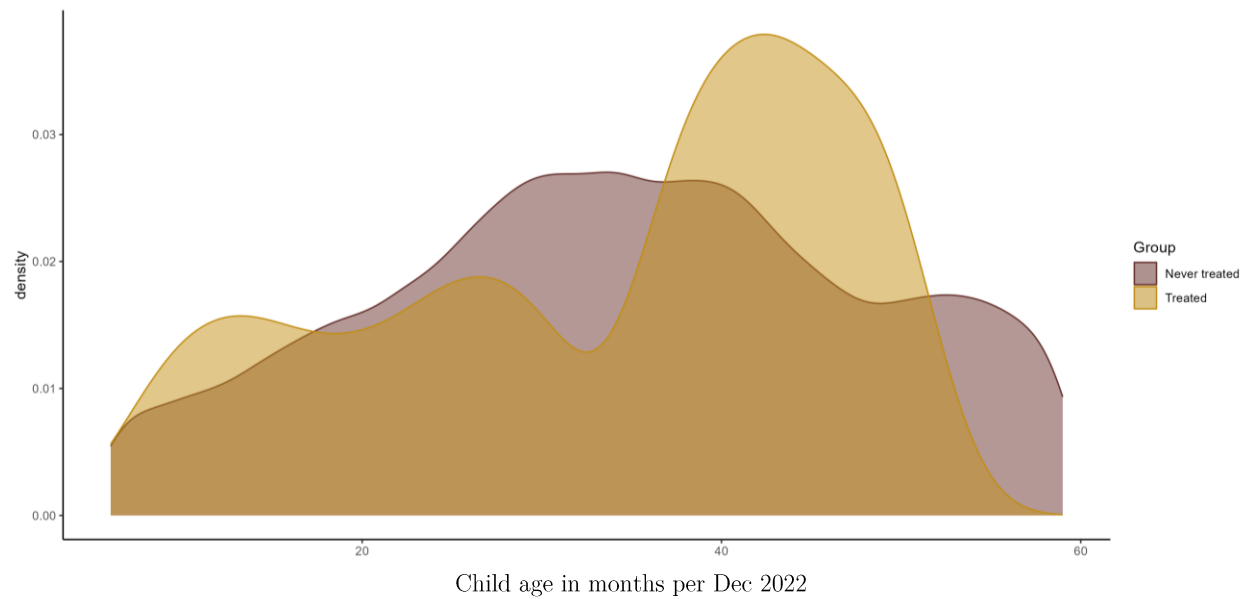
Appendix Table A4. Polychoric correlation between adult use of libraries and survey data of reading practices and preferences.

	<i>Borrowed at least one book 2020 to 2021 (registry data)</i>
Home reading (survey data)	
Visits libraries ^a	0.69***
Reads fiction books ^a	0.44***
Buys books ^a	0.19***
<i>N</i>	20,575

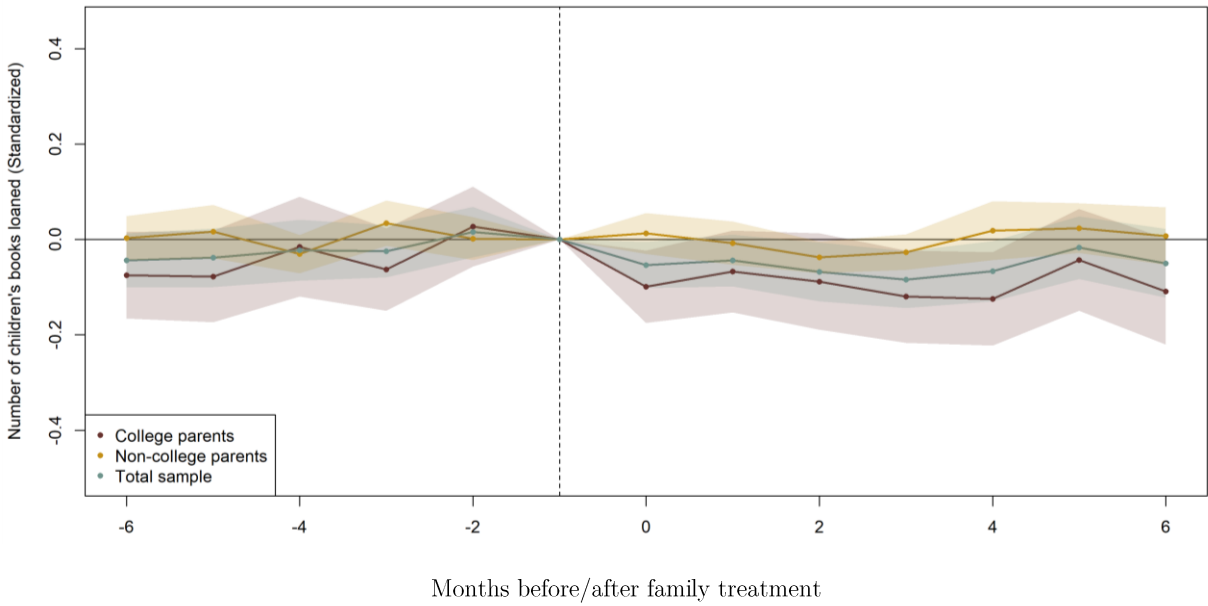
Notes: Survey data come from the Cultural Habits Survey (2019-2021 omitting periods with Covid-19 lockdown), ^aDummy variables for having engaged in each a particular activity in the last 3 months. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Appendix Figures

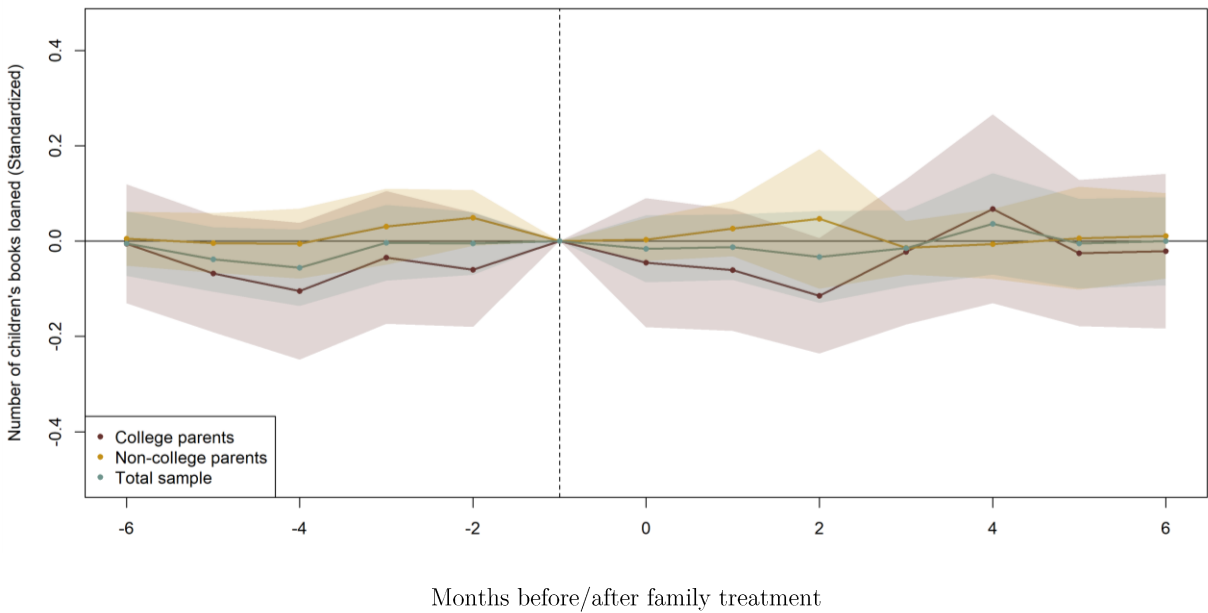
Appendix Fig. A1. Density plot of focal child age pr. Dec 2022.



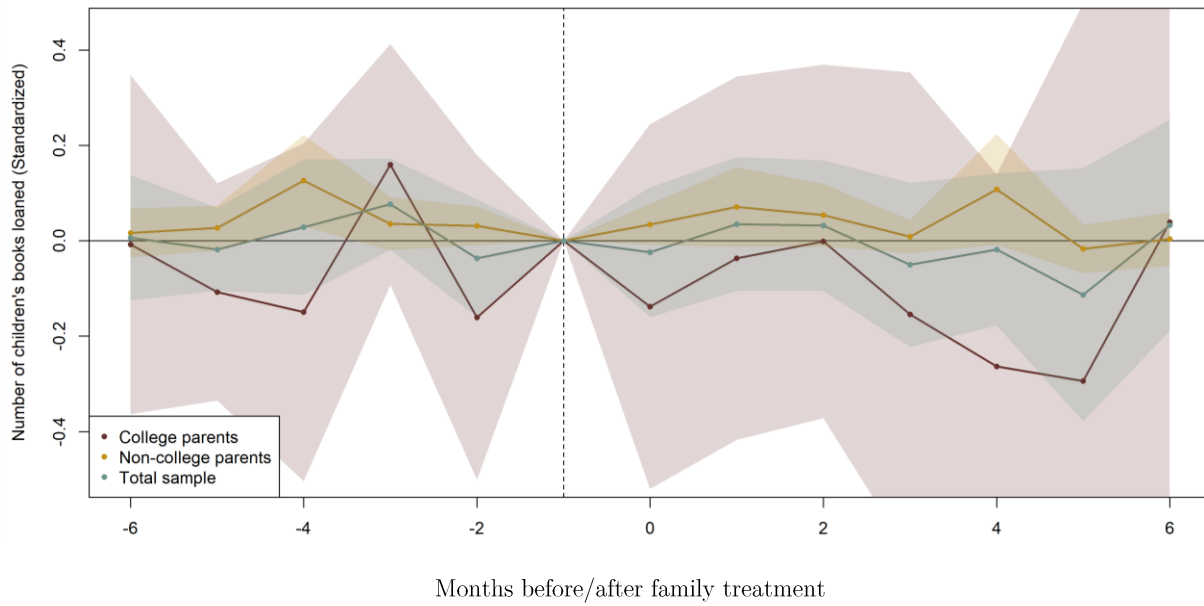
Appendix Fig. A2. Event study: Municipality 1. Effect of book giveaway treatment on loans of children’s books from libraries.



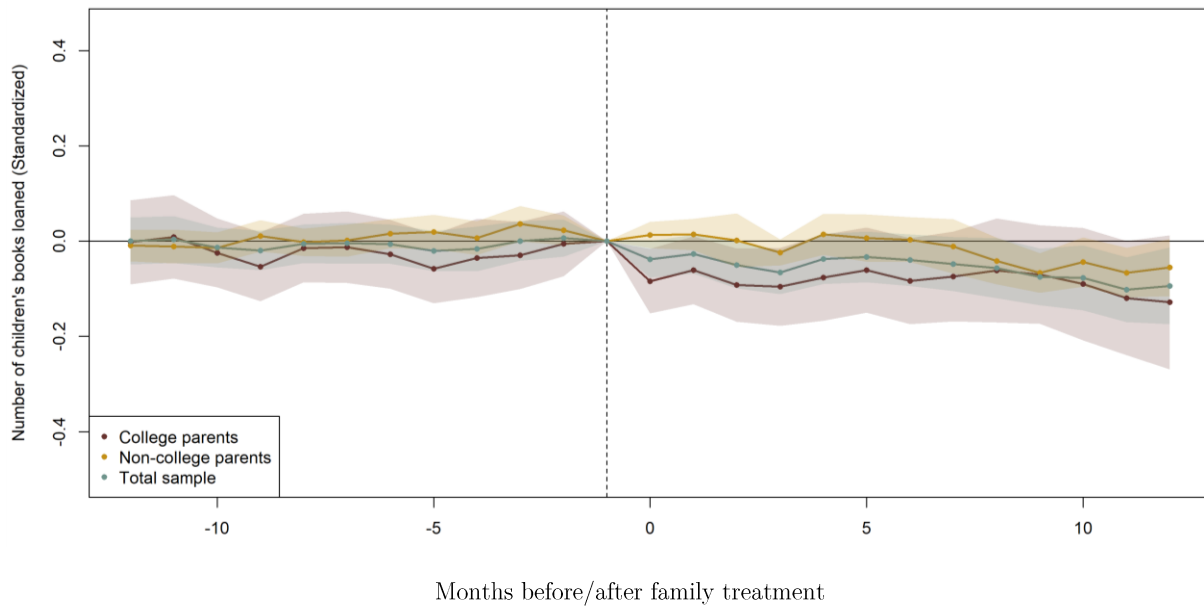
Appendix Fig. A3. Event study: Municipal 2. Effect of book giveaway treatment on loans of children’s books from libraries.



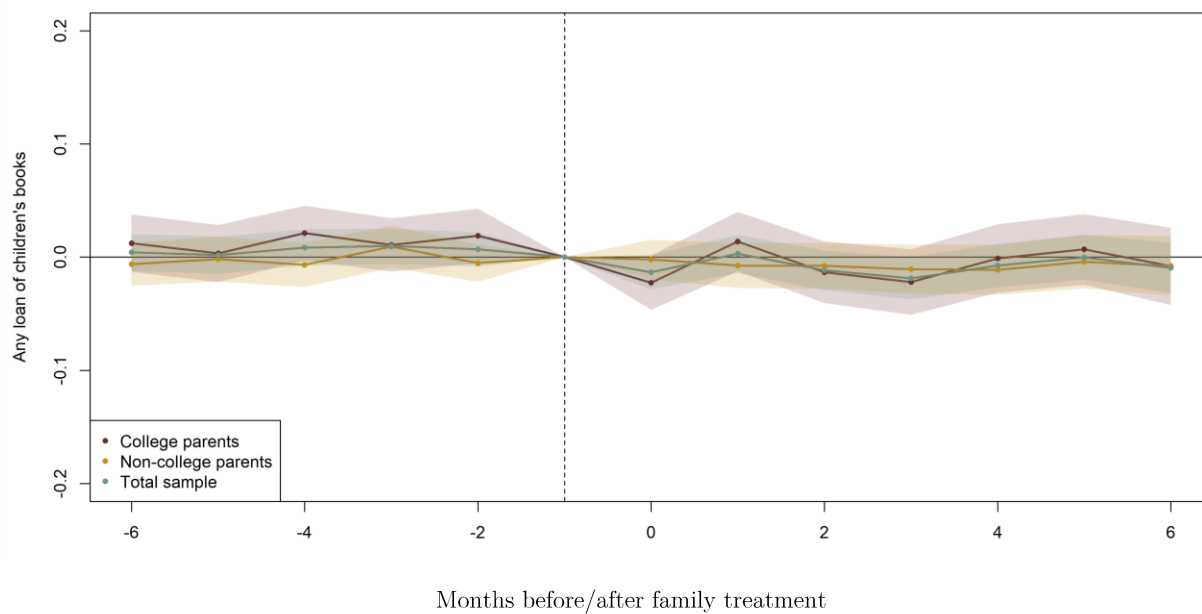
Appendix Fig. A4. Event study: Municipality 3. Effect of book giveaway treatment on loans of children's books from libraries.



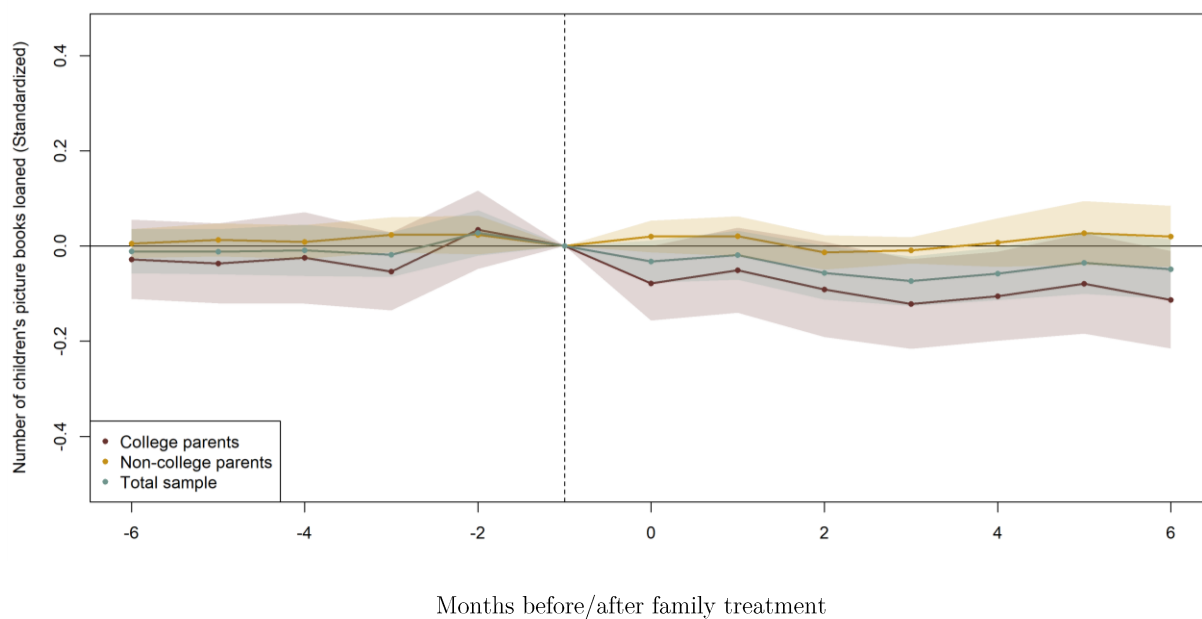
Appendix Fig. A5. Event study. Long-term (12 m) effect of book giveaway treatment on loans of children's books from libraries.



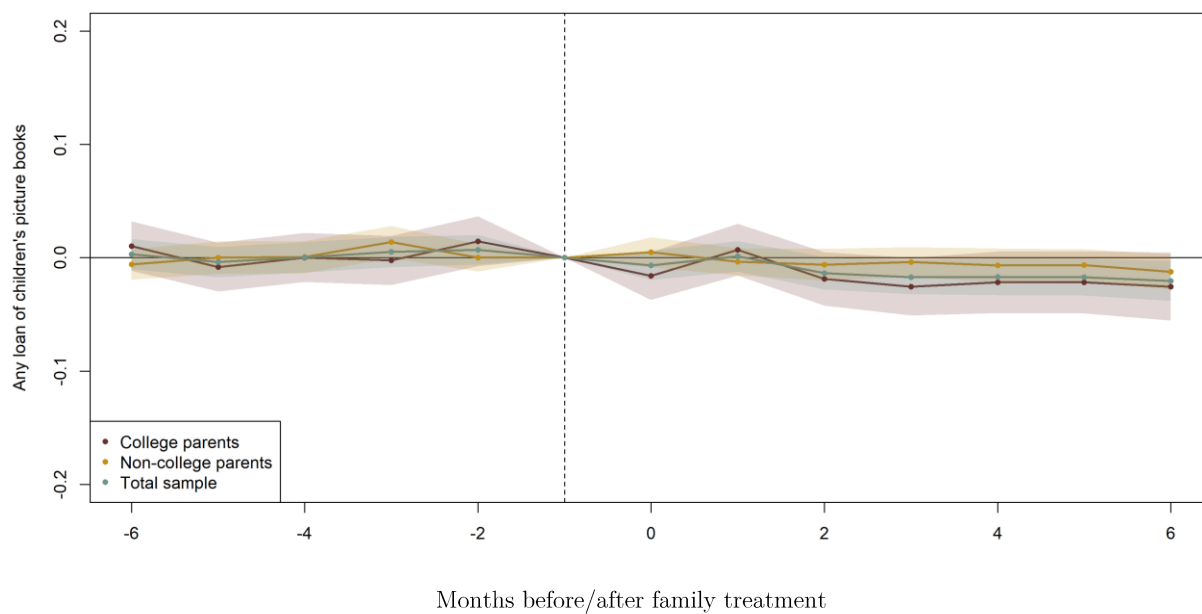
Appendix Fig. A6. Event study. Effect of book giveaway treatment on any loan of children's books from libraries (binary outcome).



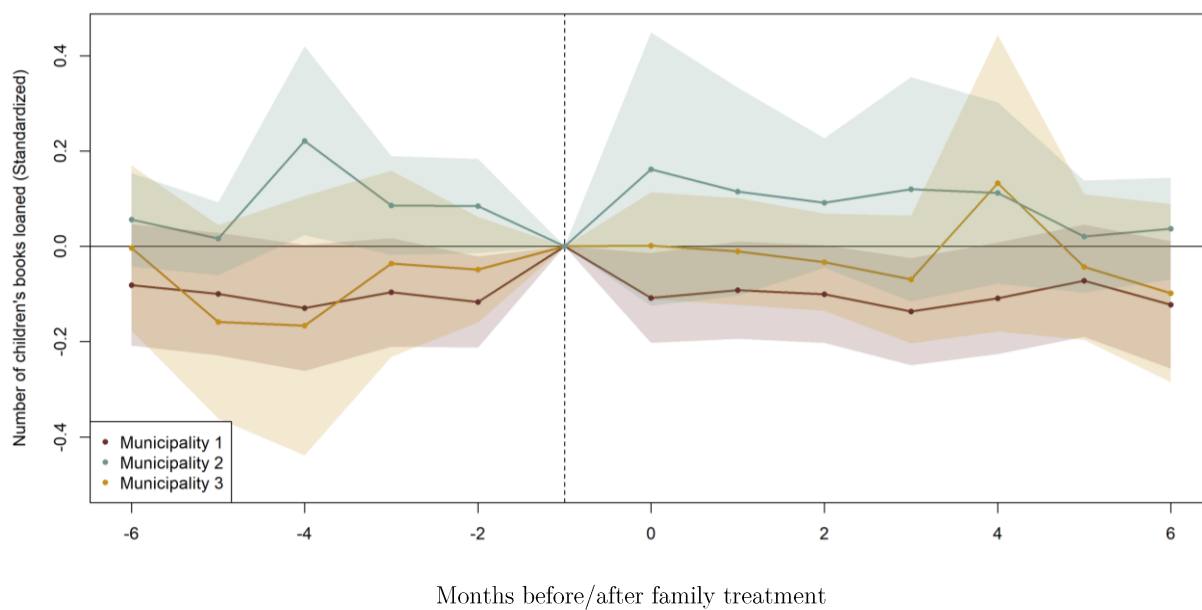
Appendix Fig. A7. Event study. Effect of book giveaway treatment on loan of children's picture books from libraries.



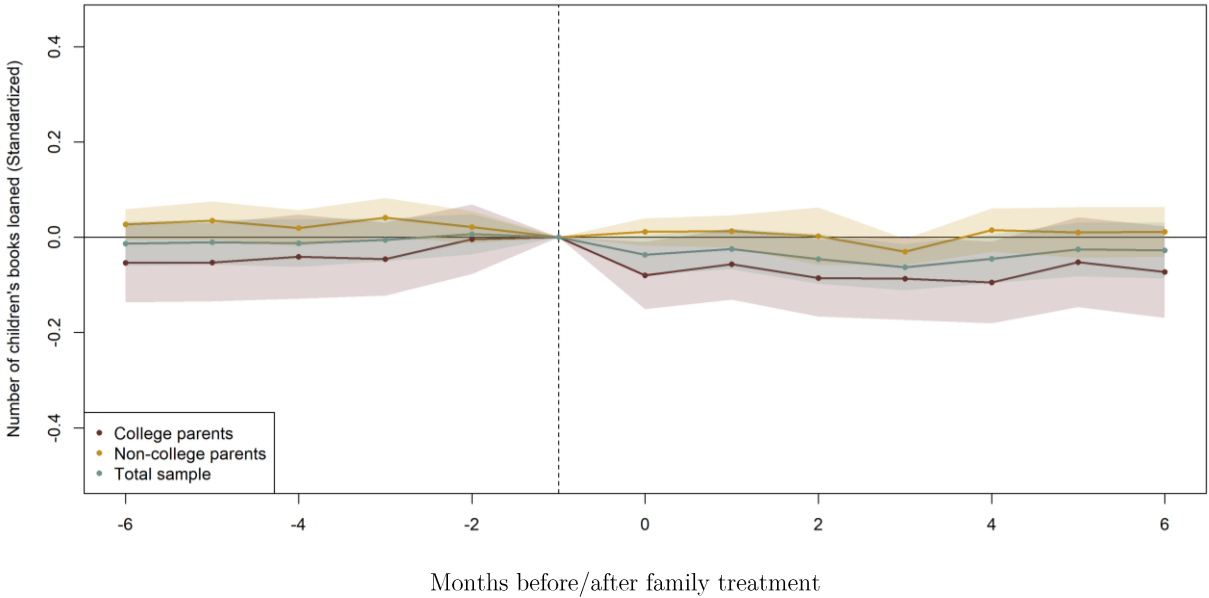
Appendix Fig. A8. Event study. Effect of book giveaway treatment on any loan of children's picture books from libraries (binary outcome).



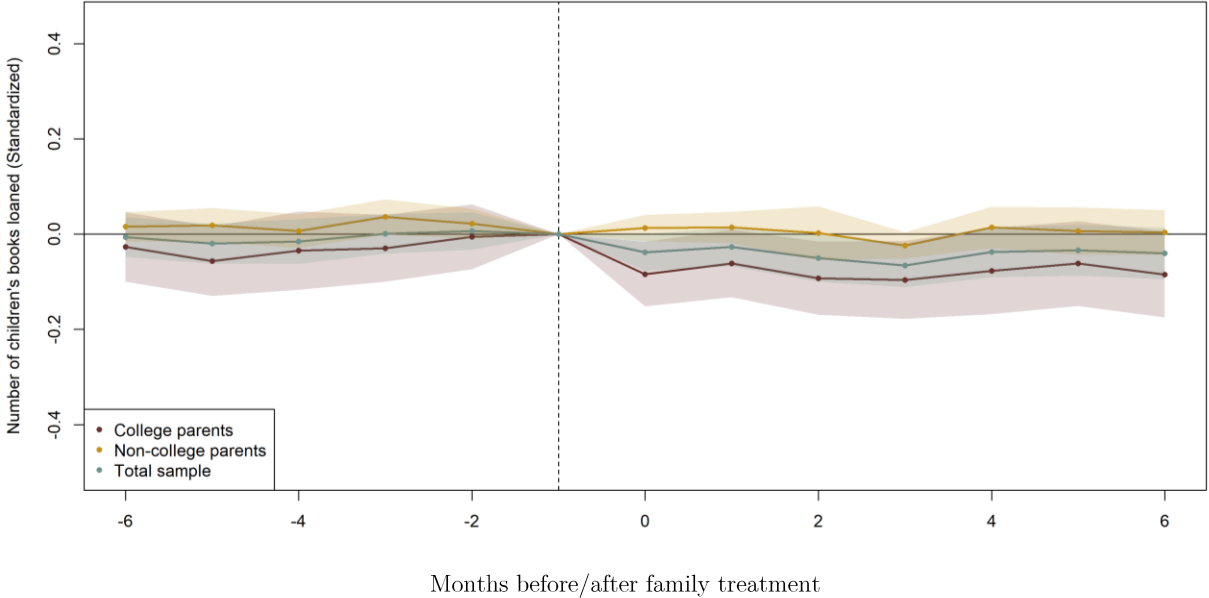
Appendix Fig. A9. Event study: Birthday \pm 3 months from program implementation. Effect of book giveaway treatment on loans of children's books from libraries.



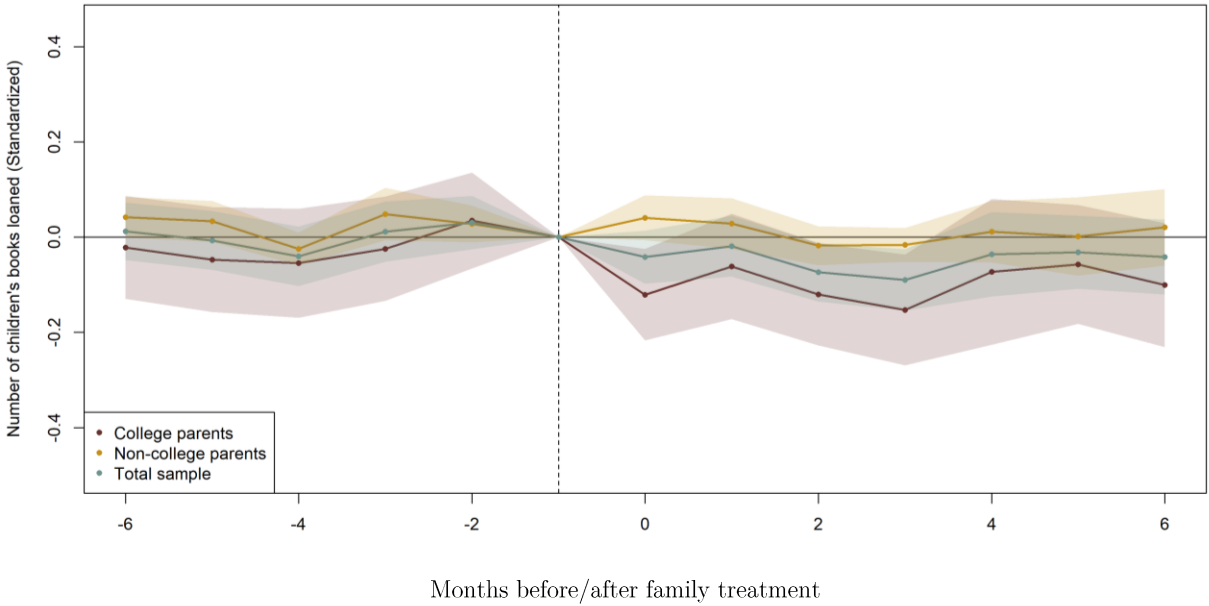
Appendix Fig. A10. Event study. Effect of book giveaway treatment on loan of children’s books from libraries. Only post lockdown data



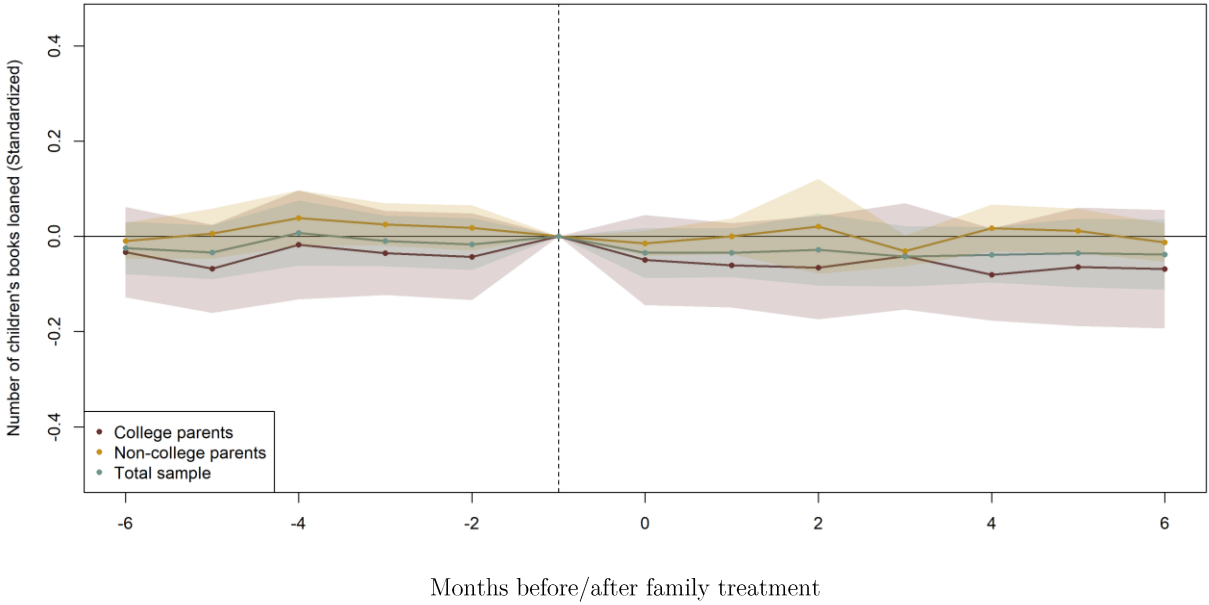
Appendix Fig. A11. Event study. Effect of book giveaway treatment on loan of children’s books from libraries. Exclude observations where focal child is not born.



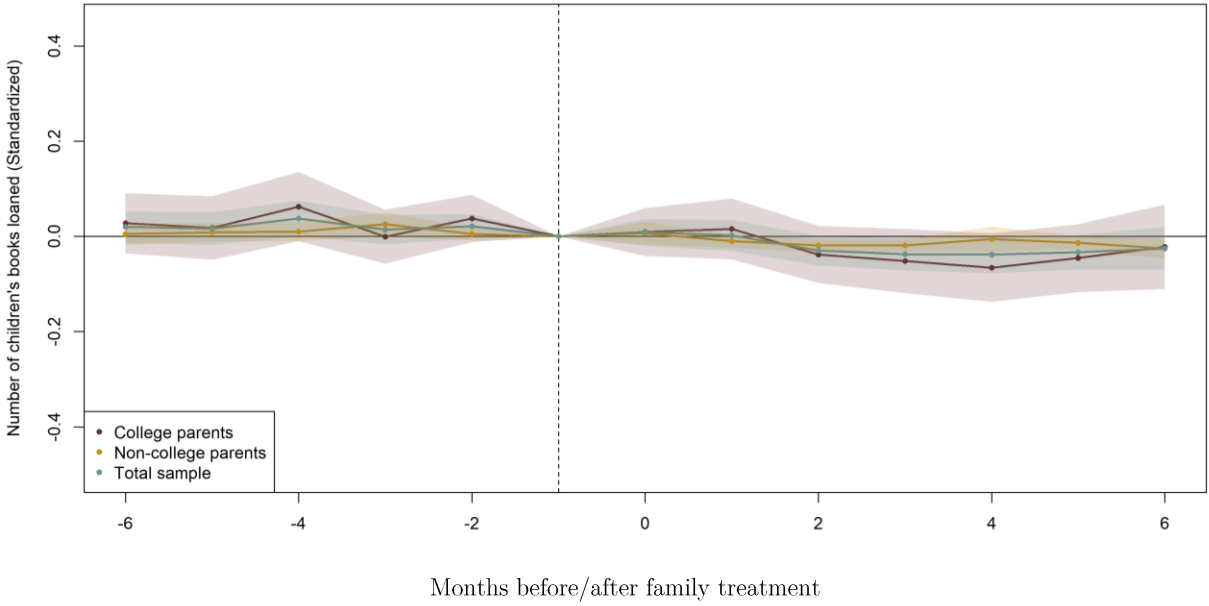
Appendix Fig. A12. Event study. Effect of book giveaway treatment on loan of children's books from libraries. Sample: Girls



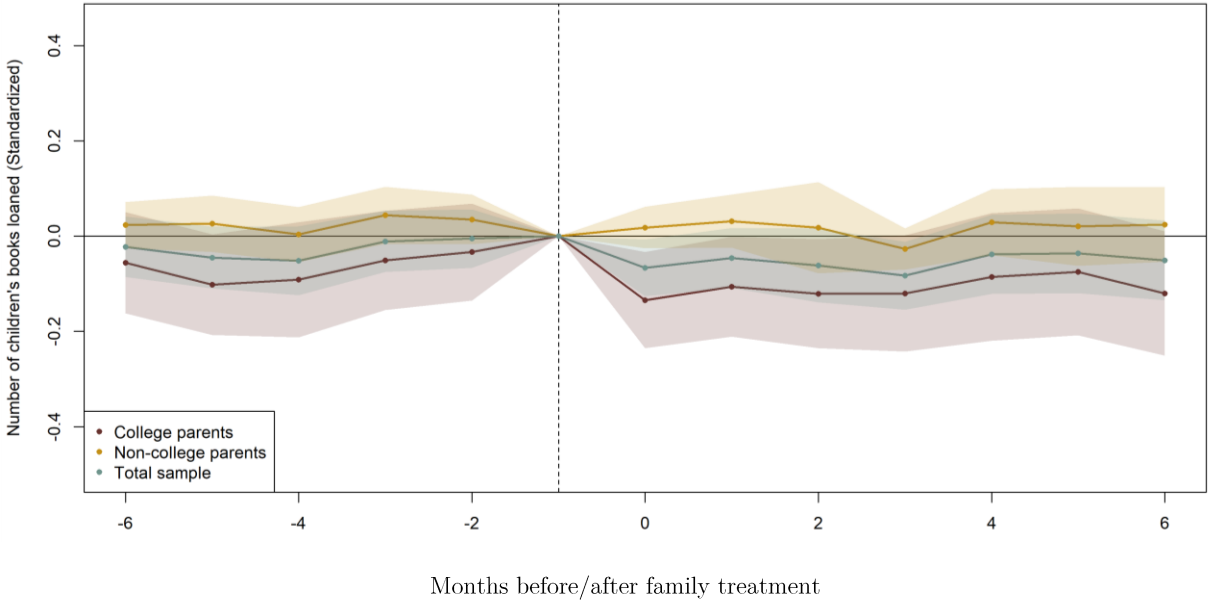
Appendix Fig. A13. Event study. Effect of book giveaway treatment on loan of children's books from libraries. Sample: Boys



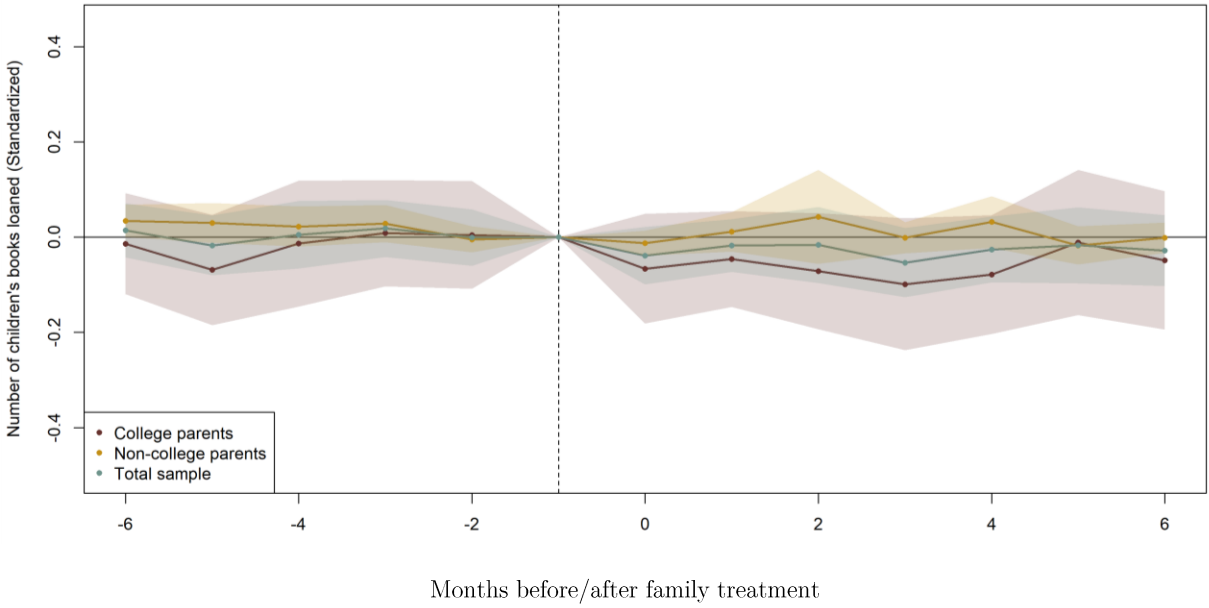
Appendix Fig. A14. Event study. Effect of book giveaway treatment on loan of children’s books from libraries. Sample: Firstborn



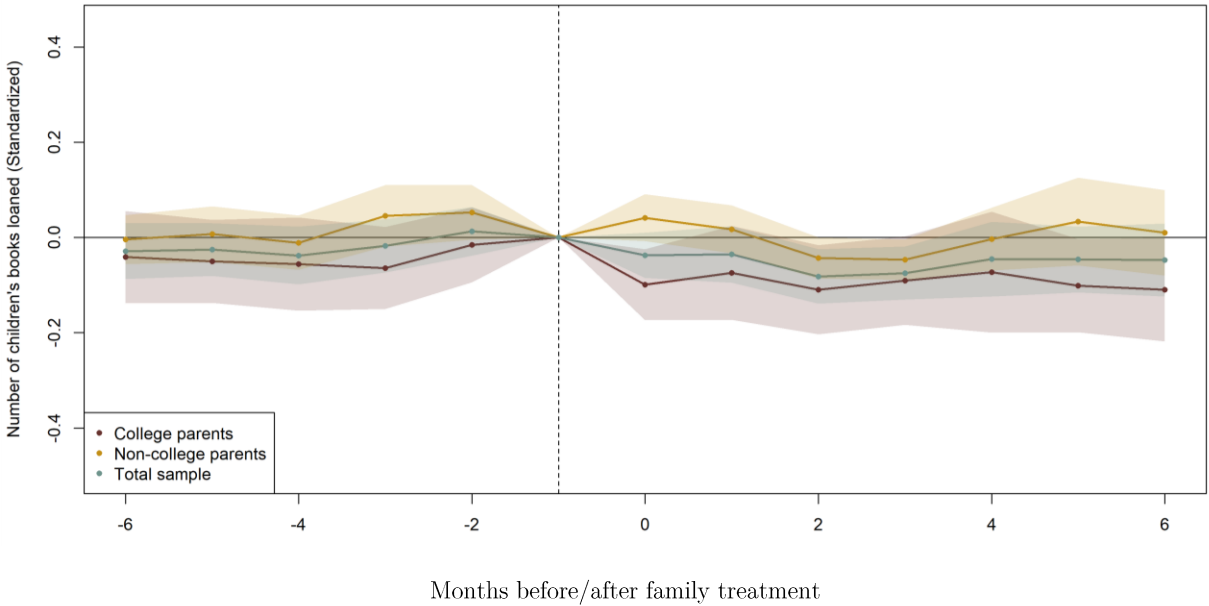
Appendix Fig. A15. Event study. Effect of book giveaway treatment on loan of children’s books from libraries. Sample: Not firstborn



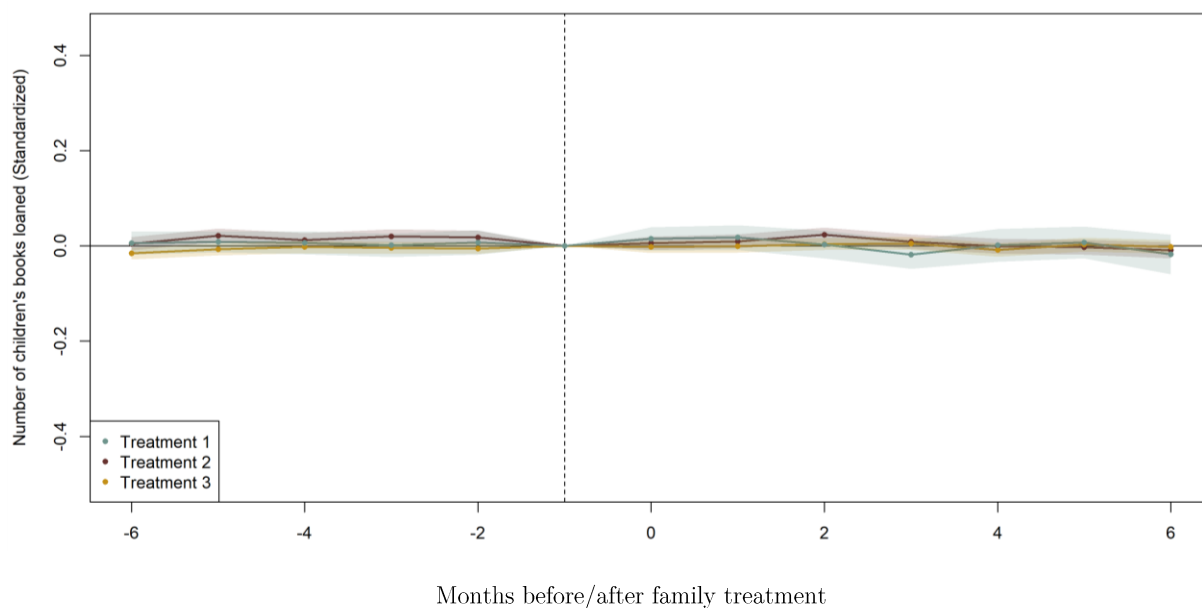
Appendix Fig. A16. Event study. Effect of book giveaway treatment on loan of children’s books from libraries. Sample: low distance to library



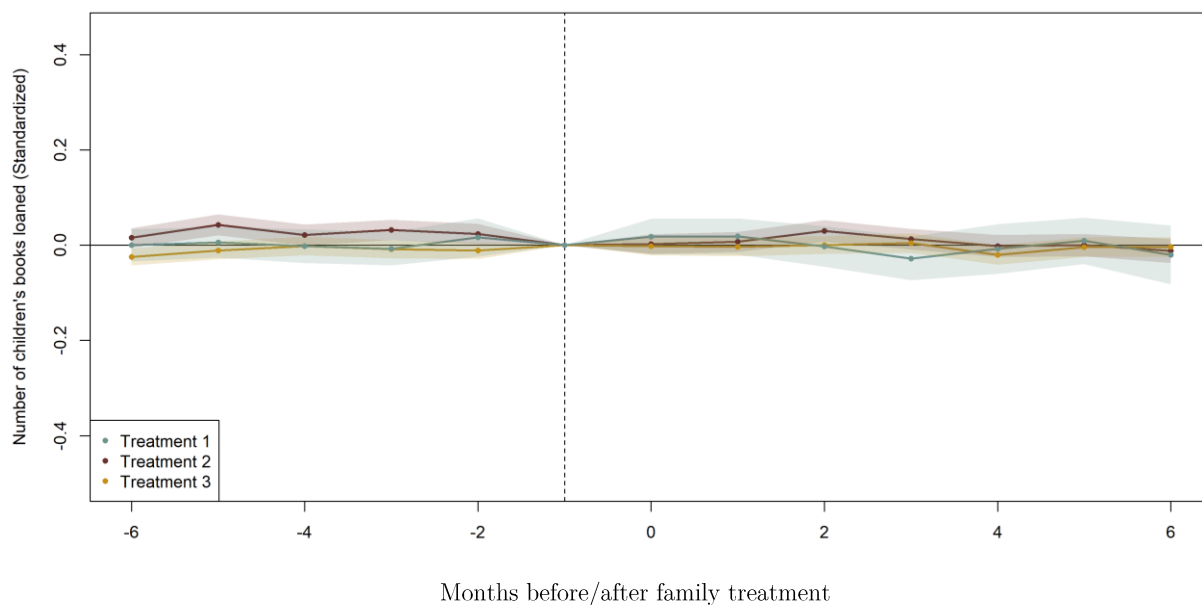
Appendix Fig. A17. Event study. Effect of book giveaway treatment on loan of children’s books from libraries. Sample: high distance to library



Appendix Fig. A18. Event study: Pseudo-treatment (replicate treatments in never-treated municipalities). Effect of book giveaway treatment on loans of children's books from libraries.



Appendix Fig. A19. Event study: Pseudo-treatment (replicate treatments in never-treated municipalities). Effect of book giveaway treatment on loans of children's books from libraries (College families)



Appendix Fig. A20. Event study: Pseudo-treatment (replicate treatments in never-treated municipalities). Effect of book giveaway treatment on loans of children's books from libraries (Non-college families)

