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ORIGINAL PAPER

Family foster care or residential care: the impact of home environment on children raised in state care

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Abstract

This study investigates how family foster care, compared to residential care, affects the outcomes of adolescents raised in state care. Using Hungarian administrative panel data, we contribute to the literature by examining previously unmeasured adult outcomes, conditioning on a rich set of variables observed in childhood. We show that adolescents raised in a foster family have substantially better outcomes as adults. Compared to similar peers in residential care, they are more likely to complete secondary education and have lower probabilities of using mental health medication and spending extended periods without either working or studying. For girls, teenage childbirth and abortion are less likely. Oster bounds indicate that selection on unobservables would need to be implausibly strong to explain away the estimated effects. Further evidence suggests that local child protection systems with more-abundant foster parents lead to better outcomes for children raised in state care.

Keywords State care · Foster care · Residential care · Institutional care · Child protection

JEL Classification J12 · J13

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1 Introduction

When children are neglected, abused, or lack a protective family for some other reason, governments have the option to remove them from their families and place them in state care. Children who spend time in state care are a vulnerable group: compared to the general population, their average outcomes related to health, education, employment, homelessness, substance use, and contact with the criminal justice system are worse (McDonald et al. 1996; Bald et al. 2022b). The two primary forms of state care are residential and family foster care.[1] In residential care, groups of children live together in an institution and are cared for by a team of child protection workers. In foster care, professional parents raise children in their own homes. In the United States and other English-speaking countries, residential care is thought of as a last resort for children with severe mental or behavioral problems, unfit for foster care (del Valle 2014). Child protection experts have long argued for the de-institutionalization of children, and foster care has started to spread in other countries as well. However, residential care remains the standard in many parts of the world, including both developing and industrialized countries: worldwide, 2.7 million children live in such settings (Petrowski et al. 2017). In most European countries, more than 25% of children in state care live in residential care, and their share exceeds 50% in some countries, including those where a relatively large proportion of children are in state care overall (Fig. 1).

There is convincing randomized controlled trial evidence that psycho-social deprivation experienced by young children raised in institutions has detrimental effects on their future lives (see, e.g., Wade et al. 2019; Stamoulis et al. 2015). Evidence comparing the outcomes of children who live in residential care or a foster family as an older child is scarce, however, with mixed results on few outcomes (e.g., Taylor 2021 and the review Lee et al. 2011). In our research, we ask how previously unexplored adult outcomes related to education, the labor market, and health are associated with the type of care children lived in as teenagers. To answer this, we analyze data from Hungary. In this high-income country, foster care and residential care co-exist; at the beginning of our observation period, in 2008, 56% of children were in foster care and 44% in residential care. Similar to other developed countries, foster parents are in short supply in Hungary (SOS Children's Villages Hungary 2023). As a consequence, many children who do not exhibit severe behavioral problems and would be fit to live in foster families are raised in residential care. This circumstance creates an empirically ideal setting to compare similar children living in residential care and family foster care.

We use individual-level monthly administrative panel data on employment, education, doctor's visits, and purchases of prescription drugs to measure the outcomes. These data are linked to the National Assessment of Basic Competencies, a standardized mathematics and reading test conducted annually on the whole population of 6th, 8th, and 10th-grade students, with information on the home type (own family, foster care, or residential care) and a rich set of variables measuring cognitive and non-cognitive skills, including indicators of behavioral problems.

[1] The literature also refers to residential care as institutional, congregate, or group care.

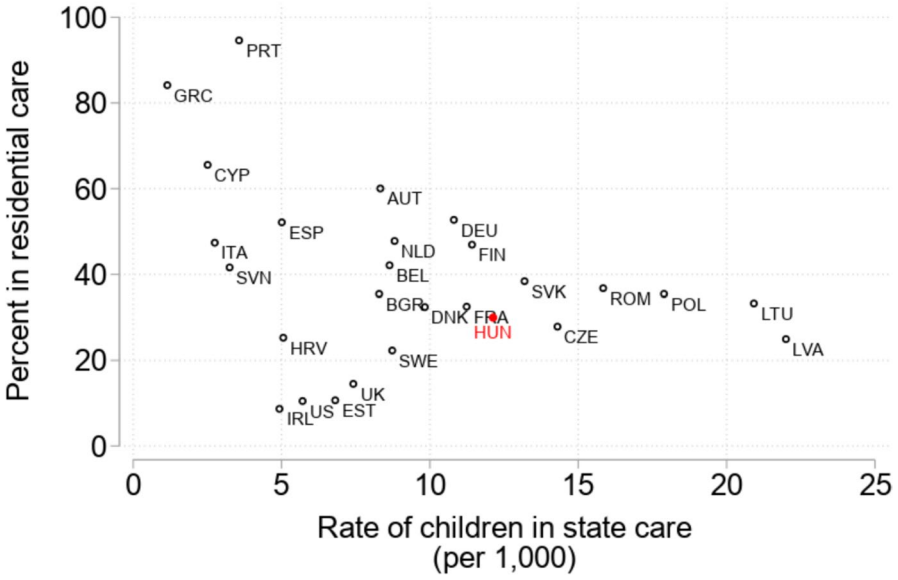


Fig. 1 Rate of children in state care and percent in residential care in high-income countries, 2019. Note: Data source for Europe: Datacare project of UNICEF and Eurochild (UNICEF 2022), for the US: (Bald et al. 2022b)

We first document that the average outcomes of children raised in foster care are substantially better than the outcomes of children raised in residential care. These significant raw differences in the average outcomes are partly due to selection: foster parents are more likely to refuse to take care of older children and children with severe behavioral problems. Thus, children living in residential care are a selected sample of more problematic children with worse potential outcomes as adults.

To address the selection issue, we estimate OLS regressions of adult outcomes on home type and a large set of control variables observed in 6th grade (around age 13), in particular, rich measures of behavior: indicators of psychological and behavioral problems and disabilities, and school grades for effort and behavior. The OLS estimates using these controls show that by age 19, young adults who were raised in family foster care are 8.3 percentage points more likely to finish secondary education than comparable youth raised in residential care. They are 5.8 percentage points less likely to have ever been prescribed antidepressants or tranquilizers and 11.4 percentage points less likely to spend more than 6 months without either working or studying at age 19. For girls, teenage births and abortions are less likely by 11.5 and 12.1 percentage points, respectively. To address the problem of testing multiple outcomes, we estimate regressions of a composite index of the outcomes, and we again find a large and statistically significant positive coefficient on foster care (0.217).

We show that the results are robust to omitted variable bias: we calculate bounds based on Oster (2019) and show that under the usual assumption that unobserved and observed characteristics are equally related to the placement into foster care

(i.e., the coefficient of proportionality is 1), the bounds of the treatment effect of foster care do not contain zero for any of the outcomes.

We further show that children placed with foster mothers with at least academic secondary education exhibit better outcomes than comparable children placed with foster mothers with lower levels of education for most outcomes. However, the difference is only statistically significant in the case of teenage births. Importantly, the outcomes of children placed with low-educated foster mothers are still significantly better than the outcomes of children in residential care. We also show that the better outcomes for children in foster care hold across different subgroups by gender and special education needs.

Exploiting the large regional variation in foster mother supply, our analysis reveals that in counties where foster mothers are more abundant, the population of children living in state care has better outcomes than children living in similar counties but with less abundant foster parents. A placebo test on children living with their biological families confirms that omitted county-level characteristics cannot account for this difference. Keeping county characteristics constant, a child protection system with more abundant foster parents leads to better outcomes for children in state care.

Our results contribute to the literature on the economics of foster care (see Bald et al. 2022b). This literature mainly assessed the causal effect of removing a child from her own family (Doyle Jr., 2007; Gross and Baron 2022; Bald et al. 2022b, a). Evidence about the consequences of being raised in different types of care is more limited, with the recent study of Taylor (2021) showing that the outcomes of children raised in congregate care are worse than those raised in foster care in the US. In the European context, where state care relies much more heavily on residential care, even conditional correlational evidence about the differences between children raised in residential and foster care is scarce. Studying these systems separately is particularly important because their structure and logic differ fundamentally from those in the US: in many European countries, including Hungary, residential care is not exclusively used for children with the most severe behavioral or mental health problems. Instead, it is a common form of placement even for children without serious difficulties, making comparisons between care settings more informative about the broader consequences of placement type.

We also add to research from psychology, social work, and sociology on children living in different types of state care. Strong causal evidence shows that institutional care harms babies and toddlers (Nelson et al. 2014; Wade et al. 2019; Stamoulis et al. 2015), but evidence on older children is primarily descriptive and documents that children in residential care exhibit worse outcomes, but without controlling for baseline differences (see McDonald et al. 1996 and Li et al. 2019). The few studies comparing children with similar characteristics in residential and foster care find mixed evidence for some outcomes (Lee et al. 2011). We add to this literature by showing results for new adult outcomes controlling for baseline differences with a rich set of indicators, including behavioral characteristics, and by formally addressing concerns about omitted variable bias using Oster bounds.

Our findings contribute to the policy discussion on child welfare by providing quantitative evidence on the outcomes of children raised in foster and residential care. While we do not identify precise causal effects, our results suggest that expanding foster care could be one way to improve outcomes for children in state care. As foster care is generally less costly than residential care (see Eurochild (2015), and our cost–benefit

calculations in Section 8), a shift towards foster placements could improve the allocation of resources within existing budgets.

The rest of the paper is organized as follows: Section 2 reviews the literature in more detail, Section 3 discusses the Hungarian institutional background, and Section 4 describes the data and the descriptive differences between individuals raised in foster care and residential care. Section 5 presents the empirical strategy followed by the results in Section 6. Section 7 reports robustness checks; Section 8 presents cost–benefit calculations; and we conclude in Section 9.

2 Review of the literature and contribution

The focus of the economics literature in relation to children in state care has been on estimating the effect of removal from the biological family on future outcomes. The results are mixed: Doyle Jr. (2007) finds a negative insignificant effect on outcomes related to crime, labor market, and teenage pregnancies; Gross and Baron (2022) a positive effect on crime outcomes, and Bald et al. (2022b, a) a positive effect on education outcomes for girls, and no effect for boys. In the European context, the recent work of Helénsdotter (2025) shows large adverse effects of court-ordered removal on the mortality, mental health hospitalization, and crimes of the marginal child. These studies use the removal tendency of child protection workers or judges as an instrument to detect causal effects. The mixed results might reflect that the impact of child removal depends on the specifics of the given child protection system and, in particular, on the characteristics of the marginal child on the brink of removal.

More closely related to our research, evidence on how placement type affects future outcomes remains limited. As Bald et al. (2022b) highlight in their review, further research is necessary. In the following, we review this literature, distinguishing between countries where family foster care is the dominant form of state care (primarily Anglophone countries) and those where residential care is the dominant form of state care. This distinction is important because, in the former, residential care is typically reserved as a last resort for children with severe behavioral problems. Consequently, findings from these countries may not generalize to broader populations of children living in state care in those child protection systems where residential care is more widespread.

2.1 Results on placement type on future outcomes in foster-care-dominated systems

2.1.1 Causal results

To our knowledge, only one paper estimates the causal effects of being raised in foster versus residential care. Taylor's (2021) analysis, based on US administrative data, uses county-level heterogeneity of exits from foster care—a proxy of opening "slots"—as an instrument of exogenous variation of the shortage of foster parents. He finds evidence that placement matters: by age 20–21, homelessness, substance abuse, and incarceration are much higher if a child is placed in congregate care.

2.1.2 Conditional correlations

In the context of the US, Lee et al. (2011) reviewed the literature comparing residential care to other care types. Most of the reviewed papers focus on specialized interventions to provide alternatives for congregate care for troubled youth, for example, placing them in special treatment foster care. More relevant to our analysis, three observational studies compare the effect of (general) foster care versus group care. All three find better outcomes for children placed in foster care. DeSena et al. (2005) evaluated the Safe Homes program, during which children between 3 and 12 years of age were placed in group care instead of foster care as a first placement. They found that children placed in group care experienced more placements during the following year than matched children in foster care. Friedrich et al. (2005) use panel data from two time periods and find that problematic sexualized behaviors tend to persist more for youth placed in residential care. Ryan et al. (2008) find that youth placed in residential care are more likely to be arrested in the 5 years following the placement than matched youth placed in foster care. Results for the United Kingdom are also available. Using the 1970 British Cohort Study survey data, Dregan and Gulliford (2012) analyze the outcomes of adults raised in different types of state care. They find that children who spend time in residential care are more likely to be convicted of crimes as adults and to experience depression compared to the general population of children. However, the estimates are not statistically significantly different from the outcomes of children raised in foster care.

Overall, findings from the US and the UK generally point to a beneficial effect of foster care compared to residential care. However, as residential care is reserved for troubled children in Anglophone countries, it is unclear whether these results generalize to the broader population of children in residential care in systems where it is more common and includes those without behavioral problems. On the one hand, children without behavioral difficulties may benefit even more from a family environment than those with severe issues, who might face poor outcomes regardless of placement. On the other hand, institutional settings may be less harmful for children without special needs, as they may require less individualized care to thrive. In addition, in contexts where problematic children live together in groups, adverse peer effects are a concern (Dodge et al. 2006), even though their effect on youth seems to be moderate in the context of US congregate care (Font and Mills 2022). The nature of peer effects also might differ when less problematic children live together in residential care. Thus, it is essential to gain insight into the two types of care in the context of systems where residential care is more common.

2.2 Results on placement type on future outcomes in child protection systems where residential care is more common

2.2.1 Causal results

The Bucharest Early Intervention Project (BEIP), the only randomized controlled trial to date comparing foster care to institutional care, provides causal evidence for the gains from family foster care for children who are removed

from their birth families as babies and toddlers in Romania. During the BEIP, from 136 previously institutionalized babies and toddlers, 68 were selected to live with foster parents, highly trained and paid by the project. For other children, care as usual continued: most of them stayed in residential care until the age of 5, and later in childhood, some of them still lived in institutions, while others were reunited with their birth families or were living with regular foster families of the Romanian child protection system (Wade et al. 2019). Children in the project participated in follow-up psychological assessments at 30, 42, and 54 months, 8 years, 12 years, and 16 years, and further follow-up studies are planned for the future as well. An extensive series of papers documents that the children who stayed in the institutions have worse outcomes: for example, delays and abnormalities in brain development, lower IQ, problems with attachment, and higher incidence of psychiatric disorders (see Wade et al. 2019; Smyke et al. 2010; Nelson et al. 2014).

2.2.2 Conditional correlations

Using Danish administrative data, Bolvig and Thorsager (2024) investigate the effect of different placement types on educational attainment and find that girls who live in municipalities with a higher inclination to place children in foster care are more likely to enroll in upper-secondary education. The meta-analysis of Li et al. (2019), which includes results from countries where residential placement is standard, concludes that children placed in residential care have worse outcomes than children placed in foster homes. In particular, Damnjanovic et al. (2011) document that the mental health of Serbian children in a cross-sectional survey is worse for those living in residential care than for those who live in foster care. Ajduković and Franz (2005), using a cross-sectional survey sample, show that behavioral and emotional problems are more prevalent among children living in residential care. Nowacki and Schoelmerich (2010) show, on a small sample, that adult mental health outcomes are worse for those who were raised in residential care. Sim et al. (2016) document that Singaporean children living in residential care have higher needs (life functioning needs, school needs, behavioral and emotional needs) and a higher prevalence of risk behaviors after controlling for socio-demographic characteristics and psychological strengths.

We contribute to this literature by providing evidence on a broader set of adult outcomes—secondary education attainment, mental health medication prescriptions, teenage pregnancies and abortions, and NEET status—measured at age 19 when most children have already exited the child protection system. While previous research focuses primarily on childhood outcomes and relies on survey data, we use administrative records, allowing for more precise measurement. In addition, the correlational evidence above uses a limited set of control variables or no controls at all. We enhance the analysis by conditioning on a rich set of behavioral variables and formally assessing omitted variable bias. This strengthens the case that our results are unlikely to be driven by unobserved child characteristics.

3 Institutional background

In Hungary, similarly to other developed countries, the primary reason for removing children from their biological families is parental neglect, accounting for 70% of all placements (KSH 2012). In principle, state care is a temporary solution until the child's own family is ready to take care of her again or until the child is adopted.[2] In practice, however, biological parents can rarely resolve the underlying problems preventing reunification, and children older than 10 are rarely adopted. Thus, children typically spend years (5.5 on average before turning 18) in state care (SOS 2015). The number of children raised in state care has slowly increased in the last decades, from 17 thousand in 2006 to 21 thousand in 2019 (1 to 1.2% of all children). According to estimates, every third child is taken into state care for reasons closely related to poverty (Ajbh 2017). These children are either placed in residential care or family foster care.

In family foster care, children are placed in the private homes of trained and paid professional temporary parents. Kinship care is outside the formal childcare system in Hungary, and in our analysis, when we refer to "foster care," we always mean non-kin foster care. In Hungary, foster parents can raise a maximum of 7 children in their homes, including their biological children. To become a foster parent, they complete a 60-h training and comply with other eligibility criteria (age between 24 and 65, passing a psychological test, and suitable living conditions). They work under county-level foster parent networks maintained by the state, churches, or nonprofit organizations. Foster parent wages are low: the base salary is 30% of the minimum wage, with an increase of 20% of the minimum wage for every additional foster child. Despite this, the share of children living in foster families among all children in state care steadily increased from less than 40% in 1996 to over 70% in 2020 (Figure A1 in the appendix). However, foster parents are still in short supply: in 2021, 5,863 individuals were employed in this role. Despite efforts to prioritize family-based placements, child protection professionals report that the shortage of foster parents limits their ability to follow this principle in practice. According to their estimates, at least 2,000 additional foster parents are necessary to place all children in foster care whom they consider suitable for it.

In the period covered in our data, 44% of children in state care lived in residential care. The main form of residential care is the children's group home. Group homes can accommodate a minimum of 12 and a maximum of 40 children who live in small and typically mixed-age and mixed-gender groups of a maximum of 12 children. A team of childcare professionals looks after the children 24 h a day, but they do not live together with the children (Decree No. 15/1998 (VI. 3.) 1998).

When a child enters state care, the local authorities decide the child's placement. According to the law, children should be primarily placed in foster families and, if this is not possible, in residential care (Act XXXI 1997). The younger the child, the more authorities prefer placement into foster care. When multiple siblings need to be

[2] Adoption is only possible when the birth parents do not have custody rights anymore, which happens in 8% of all cases.

placed, the authorities attempt to keep them together. As children are often removed from large families with many siblings, finding a foster parent who is willing to take care of all of them is challenging. Placing the child close to her previous home is also important, as there are compulsory regular meetings with the biological parents, and placements outside the county of the child are extremely rare (Vígh 2015). Foster parents decide to take in a child based on information about their age, gender, and disabilities, and foster parents typically prefer young and healthy children.

The institutional setting has two important consequences for our empirical analysis. First, many children who would be capable of living in foster families are placed in residential care because not enough foster families are available locally at the time they need to be placed. As a consequence, there are many children in Hungary in residential care who are comparable to children in foster care. Second, children in residential care are a selected sample: they got into state care older, have more siblings, and are more likely to have disabilities and behavioral problems, on average.

4 Data and sample

Our primary data source is an administrative individual-level monthly panel hosted by the Databank of the Centre for Economic and Regional Studies, Budapest.[3] The data set contains information on a 50% random sample (5.17 million people) of the Hungarian population. The sample is aging: the panel started in 2003 and was traced until 2017, and no new observations were included. Administrative records of individuals from the National Health Insurance Fund Administration, the Hungarian State Treasury, the National Tax and Customs Administration, the Ministry of Finance, and the Educational Authority are linked based on social security numbers (for more details see Sebők 2021). The data includes information on employment, school enrollment, and completed education. We also observe ICD codes from medical visits, specifically from outpatient specialist and inpatient care, which we use to measure abortions and pregnancies. In addition, we use data on purchases of prescribed drugs to measure mental health. These outcomes related to healthcare were only available between 2009 and 2017.

We observe the care type of the children in the 2008–2017 waves of the National Assessment of Basic Competencies (NABC), which are linked to the administrative data. The NABC is an annual standardized mathematics and reading test conducted on the whole population of 6th, 8th, and 10th-grade students. A background survey accompanies the tests with a rich set of questions about the student and her family environment. Two questions in the survey help to identify the home type of the children: first, respondents (the caregivers) enumerated all the members whom the child is living with; second, they characterized the family type of the child as being one

[3] The administrative database used in this paper is a property of the National Health Insurance Fund Administration, the Central Administration of National Pension Insurance, the National Tax and Customs Administration, the National Employment Service, and the Educational Authority of Hungary. The Databank of the Centre for Economic and Regional Studies processed the data.

of the given three alternatives (own family, foster family, residential care). As shown in the procedure followed by Table A1, we tried to avoid inconsistent, insufficient, vague definitions or cases irrelevant to our present analysis (for example transitory home of families). The most important case we dropped from the analysis is placement in kinship care. Kinship care is not ordered or overseen by an administrative or judicial authority and exists only as an informal and private family arrangement in Hungary.

Using the NABC to identify home type means we do not have information on the full population of children in state care because of missing responses. Children take the NABC background questionnaire home to complete it with their caregivers, but filling it out is not mandatory. In the full population, there is a 20% non-response rate among 6th graders, which increases as the caregivers' education level decreases. It is impossible to provide precise estimates of the non-response rate in the subpopulations of foster children and residential care children: The Hungarian Statistical Office reports only the total number of children in various types of state care and the overall age distribution of children in state care for a given year, but it does not break this down by home type. In the first row of Table A2, we estimate the number of 6th grade children in different care types by taking one-third of the 12–14 age group as the total number of children in state care, assuming the same age distribution for both foster and residential care. Our data includes around 80% of 6th graders who live with their own parents, 65% of those in foster care, and 39% of those in residential care. These are rough estimates, but they suggest that the sample we observe is not fully representative. To mitigate concerns about missing data, and argue that the results plausibly generalize to the full population children in state care, in Section 7.2 we provide suggestive evidence that including children with missing information about family type in 6th grade in the analysis would not yield significantly different results.

From the pool of children with observed home type in 6th grade, we include those we can observe as young adults in the administrative data until the end of age 19. The last step in our sample selection was to keep only those children who had not changed their home type. This criterion applies to 86% of children in state care within our sample. By doing so, we focus specifically on children in long-term foster care or long-term residential care during their teenage years, excluding those with only short-term stays in state care. This restriction can also introduce some selection problems: for example, we exclude those children as well who started to live in foster care but, for some reason, continued to live in residential care. It is possible that these children are especially problematic, and their foster parents let go of them. To ensure that excluding these children is not an essential issue in our analysis, we run robustness checks including children who have changed home type and using 6th-grade home type as an explanatory variable.

Our final sample consists of 890 children born before 1998, 616 children in foster care, and 274 in residential care.

Table 1 shows the descriptives: the means of variables observed in 6th grade and the means of the outcomes at age 19 for children raised in foster care and residential care. It is clear from the table that children in foster care and children in residential care are already different by the 6th grade. They are older on average, have more

siblings, their grades and test scores are typically lower, and they are more likely to exhibit psychological problems. One reason could be that these variables are already outcomes of the different types of care. Another possible mechanism is that children with special needs and psychological problems are more likely to be placed into residential care, as foster parents willing and capable of taking care of these children are even more in short supply than regular foster parents. However, the differences are moderate and, in some cases, not statistically significant. For example, in 6th grade, the mathematics test scores of foster and residential care children are not statistically significantly different.

The differences between youth raised in foster and residential care are larger for adult outcomes. Children raised in foster care are twice as likely to complete secondary education by the age of 19 (40% versus 20%). In addition, children raised in

Table 1 Means of variables by care type

	Foster care	Residential care	Difference
Control variables			
Age in 6th grade	12.9	13.3	−0.45***
Boy	0.49	0.49	−0.004
Number of siblings	3.24	3.50	−0.26**
Mathematics test score	1343	1324	18
Reading test score	1342	1302	40**
Mathematics grade	2.65	2.41	0.24***
Grammar grade	2.96	2.72	0.24***
Literature grade	3.29	2.98	0.40***
Behavior grade	3.73	3.44	0.30***
Effort grade	3.32	3.02	0.30***
No special needs	0.807	0.741	0.07**
Mild mental disability	0.003	0.015	−0.011
Physical disability	0.003	0.004	−0.000
Speech impairment	0.002	0.007	−0.007
Psychological problems	0.117	0.161	−0.044*
Behavior or learning problems	0.068	0.073	−0.005
Outcome variables			
Secondary education	0.401	0.208	0.193***
Using mental health medication	0.135	0.197	−0.062**
Birth	0.221	0.400	−0.179***
Abortion	0.141	0.300	−0.149***
NEET at least 6 months	0.372	0.526	−0.154***
Index of all outcomes	0.105	−0.223	0.329***
N	616	274	

For the statistical significance of the differences, we use robust standard errors, *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. Grades are measured on a 1 to 5 scale, with 5 being the best grade. In the regression, test scores and grades are included as categorical dummies with a separate category for missing values. Fertility outcomes are calculated in the sample of girls

foster care are six percentage points less likely to purchase mental health medication during their teenage years (14%) than children raised in residential care (20%). The difference is also striking in terms of fertility: 40% of girls in residential care give birth in their teens, as opposed to 22% in foster care. Abortions are also less frequent among girls raised in foster care (14%) than among girls raised in residential care (30%).

To capture the effects on young adults' labor market situation, we use an indicator of being NEET for at least 6 months during age 19 (not in employment, education, or training). We prefer this outcome to the share of employed individuals, as successful youth might not work but still study at this age. Individuals raised in residential care are 15 percentage points more likely to spend at least 6 months as NEETs at age 19.

In addition, we construct an index of all outcomes to mitigate concerns about multiple testing and estimate an overall effect. To calculate the outcome index, we first redefine the outcome variables so that larger values show better outcomes: an indicator for obtaining secondary education, an indicator of *not* using mental health medication, and an indicator of spending less than 6 months as NEET at age 19, and for girls an indicator of not having a teenage pregnancy (where we include births and abortions as well). Except for adolescent pregnancies, there are no missing values on the other outcomes, as our sample includes, by construction, all individuals we can observe in the administrative records at age 19. Then, we calculate the z-scores of these variables by subtracting the mean and dividing by the standard deviation over the sample of children living in state care. Then, we construct the index by taking the mean of all variables (using only the available variables for boys). In robustness checks, we also use alternative definitions for this index. It is clear from the table that the index of adult outcomes is significantly better for children raised in foster care (by 0.329).

5 Empirical strategy

In our empirical strategy, we start by estimating the following linear probability model:

$$Y_i = \alpha + \beta foster_i + X'_{i,gr6}\gamma + u_i \tag{1}$$

where Y is the outcome: an indicator for finishing secondary education, an indicator of mental health problems, births, and abortions, and being NEET for at least 6 months at age 19. The primary explanatory variable is *foster*, an indicator of living in long-term foster care as a teenager, with living in residential care as the reference group. X is a set of controls measured in 6th grade: gender, age, number of siblings, county indicators, calendar year indicators, measures of cognitive ability (standardized mathematics, and reading test scores, grades in mathematics, literature, and grammar), and measures of non-cognitive ability (grades for behavior and effort in school, and the presence of the following special education needs: mild mental

disability, autism, physical disability, speech impairment, psychological problems, and behavior or learning problems). We include grades and test scores as categorical dummies (6 categories for grades, 8 for test scores) with a missing value as a separate category.[4] In some specifications, we only include a subset of the above-mentioned variables in X. We report heteroskedasticity-robust White standard errors.

As we use multiple outcomes, the probability of Type I error is higher than the simple p-values. We tackle this problem using two methods: first, we estimate the regression of a composite index, which combines all outcomes, to check whether this variable is affected statistically significantly. In addition, we calculate Benjamini-Krieger-Yekutieli sharpened two-stage q-values for false discovery rates based on Benjamini et al. (2006).

The coefficient of interest is β, which would identify the effect of placement type if, conditional on the variables in X, care type was independent of potential outcomes. There is some randomness in the placement decision, as described in Section 3, and the set of controls we use is very rich, providing some support for the assumption of unconfoundedness. Still, β is plausibly a biased estimate of the true effect of foster care, first, because some variables in X are bad controls: cognitive and non-cognitive ability in 6th grade can already be outcomes of the earlier placement. In the appendix (Section B), we argue that under plausible assumptions, these proxy controls bias gains from foster care *downwards*. In addition, we present a specification in a robustness check, where late measurement is not an issue.

A second threat to identification is the presence of omitted variables that can affect both placement type and future outcomes. Important unmeasured variables include ethnicity, unobserved elements of behavioral problems, and the history of previous placements, with the age at which a child is removed from the biological family being one of the most significant omissions. Although our dataset lacks information on the age of first placement, in a separate dataset on children in state care from Nógrád County, Hungary (Darvas et al. 2016), we observe that children in foster care are typically removed from their biological families at a significantly younger age, with first placements occurring at 4.2 years, compared to 9.1 years of age on average for children in residential care. The direction of the bias caused by this omitted variable is not straightforward, as it ultimately depends on whether children are better off in their biological families or state care. To study the role of this specific omitted variable in a robustness check, we re-estimate Eq. (1) on a small sample taken into state care between 6 and 8th grade (156 children) to take the age of placement under control.

To assess omitted variable bias, we apply Oster's (2019) approach. Oster develops a method for measuring the extent of omitted variable bias by jointly considering the

[4] Grades in the Hungarian school system can vary from 1 to 5, and on top of these categories, we include a 6th category for missing grades. The standardized test scores are categorized by the Hungarian Educational Authority into seven levels, 1 being the highest achievement level and 7 being the lowest. We include an 8th category for missing values. For grades in different subjects, 6–7 percent of our sample has missing values, and for test scores, less than 1 percent, but every child has a non-missing value at least on one of these variables. We can keep more observations by allowing for missing values on some of the variables.

stability of the coefficient after the inclusion of observed controls and the associated change in the R-squared. Specifically, we consider the following equation:

$$Y_i = \alpha + \beta foster_i + W_1 + W_2 + u_i, \tag{2}$$

where W_1 is an index for the observed variables and their respective coefficients, and W_2 is an index for unobserved ones. The relative degree of selection on observed and unobserved variables is represented by $\delta = \frac{cov(foster,W2)}{var(W2)} / \frac{cov(foster,W1)}{var(W1)}$. We estimate the uncontrolled regression

$$Y_i = \alpha + \beta foster_i + u_i, \tag{3}$$

and compare the estimated coefficient of *foster* (denoted as $\dot{\beta}$) to the estimated coefficient from Eq. (1) (denoted as $\widetilde{\beta}$), along with the R^2 values of the respective regressions (denoted as $\dot{R}$ and $\widetilde{R}$). For $\delta = 0$ (i.e., no important unobserved variables), the real treatment effect is $\widetilde{\beta}$. First, we follow the usual assumption that the upper bound of δ is 1, i.e., observed characteristics explain as much of the selection as unobserved ones. We believe this assumption is plausible in our case as we observe a rich set of observables, including detailed measures of behavior, which are probably the most important endogenous determinants of living in foster or residential care. The bound on the treatment effect can be approximated by

$$\beta^* \approx \widetilde{\beta} - \delta\left(\dot{\beta} - \widetilde{\beta}\right)\frac{R_{max} - \widetilde{R}}{\widetilde{R} - \dot{R}}, \tag{4}$$

where R_{max} is the R^2 if we included the full control set in (2). The theoretical maximum of R_{max} is 1, but it is unlikely to be achieved in empirical settings. Following the suggestion of Oster (2019), we used $R_{max} = 1.3\widetilde{R}$ to calculate the bounds. Along with calculating β^* under the assumption that $\delta = 1$, we report the $\widetilde{\delta}$ value, the smallest value of δ under which β^* would be 0.

In addition, we run a version of this analysis, where for the "uncontrolled" regression, we estimate a version of Eq. (3), where we include a subset of our full set of X as controls (denoted as m in Oster (2019)). In m, we include controls that we regard as essential to account for selection, which we term baseline and behavioral controls. Thus, when we calculate the Oster bounds in this setting, we assume that the remaining selection explained by unobserved characteristics is proportional to the selection explained by non-essential controls by δ, which we term cognitive controls in our setting.

Motivated by the fact that there is a significant spatial variation in the availability of foster parents, we complement our analysis by comparing the outcomes of children in state care who live in counties where foster parents are more abundant. We define foster mother capacity as the number of foster mothers in the county per 100 children living in state care in 2015.[5] We split the 19 counties into two categories, at the median foster parent capacity (23 per 100 children in state care). The idea is

[5] The Hungarian Statistical Office reports the number of children in state care per county in 2015. We use 2015 because we have observed foster parents as a separate occupation only since then.

that counties similar in other respects can have low or high foster parent capacity. In our strategy, we compare similar children in state care who live in similar counties with different foster mother capacities. We follow a similar approach to Bolvig and Thorsager (2024), and estimate reduced form equations on children who live in state care:

$$Y_i = \alpha + \beta highcapacity_c + C'_{i,gr6}\gamma + X'_{c,gr6}\gamma + u_i, \tag{5}$$

where *highcapacity* is an indicator of living in a county with high foster mother capacity. Y denotes the same outcomes as in Eq. (1). In X, we include all individual-level controls from Eq. (1) but not county-fixed effects, as *highcapacity* varies at the county level. Instead, we include county-level controls, C measured in grade 6 (employment, unemployment, mean wage, birth rate, and a composite development indicator of the county). Including these controls is essential as foster parent capacity negatively correlates with county development (Figure A2). The coefficient β measures how living in local child protection systems operating with relatively more foster parents affects the outcomes of children who live in state care if foster parent capacity is uncorrelated with important unobserved county characteristics.

6 Results

6.1 Main regression results with Oster bounds

Table 2 shows the OLS regression results for the outcomes with different sets of control variables. Model (1) shows the raw differences, and Models (2) through (5) introduce subsets of controls. Model (6) shows our preferred estimates with the full set of controls. In the last columns, we calculate Oster bounds using the $\dot{\beta}$ estimates from Model (1) and the $\widetilde{\beta}$ estimates from Model (6) and also report the $\widetilde{\delta}$ values that would invalidate the results.

In the first row, the outcome is an indicator of obtaining secondary education by the end of age 19. Completing secondary education is a key determinant of the children's future, as without secondary education, their labor market prospects are dire. The raw difference between children raised in foster care and residential care is 19.3 percentage points, which decreases to 8.3 percentage points in our model with a full set of controls. This effect is statistically significant and large: a 40% increase compared to the baseline share of 21% of secondary school graduates in residential care. Compared to Model (1), in Model (6) the R-squared increases substantially, from 0.035 to 0.232, and the Oster bounds with $\delta = 1$ do not include 0. Our $\widetilde{\delta}$ estimates indicate that the proportionality between unobserved and observed should be as high as 2.4 to invalidate the results.

In the second row of Table 2, we show that young adults raised in foster care are 5.8 percentage points less likely to have ever bought prescribed mental health medication than comparable children in residential care. Generally, the absence of prescription drug use can suggest the lack of a mental health problem, but it may also indicate the presence of an untreated one. However, the likelihood of

Table 2 OLS estimates for the differences between children raised in foster care and residential care

Outcome		Mean in res. care	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Oster bounds	$\tilde{\delta}$ for $\beta^* = 0$
Secondary education			0.193***	0.150***	0.110***	0.169***	0.082**	0.083**	[0.027,0.083]	1.40
		0.208	(0.032)	(0.035)	(0.032)	(0.033)	(0.035)	(0.039)		
R-Squared			0.035	0.107	0.144	0.098	0.201	0.232		
Mental health medication			−0.062**	−0.070**	−0.050*	−0.049*	−0.059*	−0.058*	[−0.058,−0.056]	6.10
		0.197	(0.028)	(0.030)	(0.029)	(0.028)	(0.031)	(0.031)		
R-Squared			0.006	0.067	0.042	0.039	0.096	0.116		
Teenage abortion			−0.149***	−0.141***	−0.133***	−0.145***	−0.121**	−0.121**	[−0.121,−0.102]	2.82
		0.300	(0.044)	(0.048)	(0.046)	(0.046)	(0.051)	(0.053)		
R-Squared			0.030	0.099	0.085	0.082	0.156	0.207		
Teenage birth			−0.179***	−0.201***	−0.131***	−0.145***	−0.142**	−0.115**	[−0.115,−0.074]	2.00
		0.400	(0.048)	(0.055)	(0.050)	(0.048)	(0.055)	(0.058)		
R-Squared			0.034	0.139	0.092	0.103	0.198	0.251		
Neet 6 M			−0.154***	−0.155***	−0.100***	−0.116***	−0.114***	−0.114***	[−0.114,−0.094]	3.35
		0.526	(0.036)	(0.039)	(0.037)	(0.037)	(0.039)	(0.040)		
R-Squared			0.021	0.096	0.089	0.106	0.166	0.202		
Outcome index			0.329***	0.306***	0.266***	0.273***	0.221***	0.217***	[0.154, 0.217]	2.40
		−0.223	(0.047)	(0.051)	(0.048)	(0.049)	(0.053)	(0.054)		
R-Squared			0.050	0.118	0.152	0.143	0.215	0.246		
Controls	Baseline		No	Yes	No	No	Yes	Yes		
	Behavior		No	No	Yes	No	Yes	Yes		
	Cognitive ability		No	No	No	Yes	No	Yes		

OLS estimates for living in foster care as an adolescent (β in Eq. (1)) using different sets of controls. The reference group lives in residential care. $N = 890$ (and $N = 457$ for outcomes related to fertility). Baseline controls are county and year fixed effects, number of siblings, age at 6th grade, and gender (when appropriate). Behavior controls are indicators for the presence of mild mental disability, autism, physical disability, speech impairment, psychological problems, behavior or learning problems, and school grades for behavior and effort. Cognitive ability controls are grades in school subjects and test scores on standardized tests. White robust standard errors in parentheses ($^*p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$). Oster bounds are calculated by comparing Model (1) and Model (6) using R_{max} (where $\tilde{R}$ is the R-squared from Model (6)) and $\delta = 1$. $\tilde{\delta}$ is the delta value that would make $\beta^* = 0$ in Eq. (4)

untreated mental health issues among children in our sample, particularly while under state care, is small, as children both in foster care and residential care have regular meetings with psychologists. Thus, the negative coefficient estimates indicate that mental health issues are less likely to appear among children placed in foster care. Model (6) estimates are very similar to the uncontrolled estimate of β (−0.062), and a $\widetilde{\delta}$ of 6.1 would be needed for the Oster bounds to include zero. Note though that this estimate is only statistically significant at the 10 percent level.

In the third and fourth rows, the results on births and abortions are presented, estimated on the sample of girls. We consider these outcomes important as teenage motherhood harms teen mothers' prospects (see, for example, Ashcraft et al. 2013), and their children are more likely to have adverse outcomes as well (see, for instance, Aizer et al. 2020). In the context of children in state care, teenage motherhood is possibly even more difficult, as the girls lack a supportive family background. Wall-Wieler et al. (2018) find that children of teenage mothers in state care are more than seven times more likely to lose custody of their babies by the time children are two years old, creating a cycle of involvement with child protection services. Even if the pregnancy is terminated, having an abortion as a teenager can be painful both mentally and physically. Our estimates show that girls who live in foster care as teenagers are 12–12 percentage points less likely to give birth or have an abortion as teenagers compared to similar girls raised in residential care. These results would survive a $\widetilde{\delta}$ of 2.0 and 2.8.

Similarly to previous outcomes, we find that foster care is associated with substantially better labor market outcomes for youth raised in state care (row 5). Conditional on 6th-grade observables, foster youth are 11 percentage points less likely to spend at least 6 months as NEET at age 19. Also, the Oster bounds do not contain 0 for this outcome, and $\widetilde{\delta}$ is 3.35.

Lastly, in row 6, we estimate Eq. (1) on a standardized index of four outcomes (secondary education, mental health, pregnancy, 6 months as NEET, larger for better outcomes). The estimate is large (0.217) and highly statistically significant for this composite outcome as well, supporting that significant results on the other outcomes are not an artifact from multiple hypothesis testing. To further support this, we show Benjamini-Krieger-Yekutieli sharpened two-stage q values for false discovery rates in Table A3 in the appendix, calculated with the code of Anderson (2008). Using a 5% threshold for false discovery, the estimates for all outcomes are statistically significant.

To gain even more insight into the effect size, we also estimate a version of Eq. (1) where we add children to the sample who live with their own parents: in this specification, the difference between children living with their own parents and children in foster care is comparable in magnitude to the difference between children in foster care and residential care, and in some cases, it is even larger (Table A4 in the appendix).

In addition to the results mentioned above, note that the differences between the estimates for Model (5) and Model (6) are remarkably similar. Model (5) includes the controls we consider essential to capture the selection into foster care. In "baseline" controls, we include variables related to the child's characteristics known to

the prospective foster parents before deciding to take in a child (gender, age at 6th grade, and the number of siblings) and year and county fixed effects. In the controls we term "behavior" ones, we include psychological and behavioral problems, which plausibly alter the probability that a child remains in her foster family once she has gotten there. The remaining controls, which are also added in Model (6), are measures of cognitive ability. These measures are not directly related to child selection in foster families but could be indirectly correlated with foster placement. As expected, adding baseline and behavior controls decreases the coefficient measuring the difference between children raised in foster care and residential care. However, the addition of the cognitive controls on top of these leaves the coefficient estimates of living in foster care virtually unchanged, while the R-squared values increase. This suggests that the baseline and behavior characteristics capture selection into foster care well. We re-calculate Oster bounds under $\delta \leq 1$ and $\widetilde{\delta}$ values using Model (5) as the uncontrolled regression and present the results with Table 5. The $\widetilde{\delta}$ values are very large and indicate that unobserved confounders would have to be 2 to 25 times more important in explaining selection than the rich measures of cognitive ability.

To sum up, we have large coefficient estimates on foster placement, which are statistically significant at the 5% level for all outcomes except mental health. It is plausible that foster care per se improves the outcomes, as the large $\widetilde{\delta}$ values imply that the role of unobserved characteristics in selection into foster care would need to be extremely important to invalidate these estimates.

6.2 The role of the education of foster mothers

Evidence in the literature shows that foster parents' education matters (Berlin et al. 2019). In the following, we analyze the differences in the outcomes by home type, separately by the educational attainment of the foster mother. Specifically, instead of an indicator of residential or foster care in Eq. (1), we include a dummy with three categories: living in residential care, living in foster care with a foster mother with primary or vocational secondary education, and living in foster care with a foster mother who has academic secondary education or university diploma. Children with more educated foster mothers live under better financial conditions and receive more attention from their foster parents (see Table A6 in the appendix); thus, their educational attainment plausibly correlates with their care quality.

We present the results in Table 3. The first key finding is that the coefficient of foster care is positive regardless of the foster mother's education. Children raised by foster mothers with low levels of education perform better than children in residential care: they are significantly more likely to finish secondary school (8.2 percentage points), less likely to have an abortion (−15.1 percentage points), and 12.3 percentage points less likely to spend at least 6 months as NEETs at age 19. The estimate on the index of the outcomes is also positive and statistically significant (0.215). Mental health problems and births are also less likely among children placed with foster mothers with low education than children in residential care, but the differences are not statistically significant.

Table 3 OLS estimates for differences between children raised in residential care and foster by foster mothers' education

	Secondary education	Mental health medic	Birth	Abortion	NEET for at least 6 months	Outcome index
	(1)	(2)	(3)	(4)	(5)	(6)
Low educ foster mother	0.082**	−0.055	−0.070	−0.151***	−0.123***	0.215***
	(0.039)	(0.034)	(0.063)	(0.058)	(0.043)	(0.057)
High educ foster mother	0.094**	−0.064*	−0.208**	−0.122**	−0.113**	0.242***
	(0.048)	(0.037)	(0.060)	(0.063)	(0.049)	(0.068)
N	855	855	438	438	855	855
Adj. R squared	0.158	0.024	0.098	0.048	0.113	0.172
Mean in residential care	0.208	0.197	0.400	0.300	0.526	−0.223

The table shows estimates of a modified version of Eq. (1):$Y_i = \alpha + \beta_1 foster_loweduc_i + \beta_2 foster_higheduc_i + X_{i,gr6}{}'\gamma + u_i$,with children living in residential care as the reference category. We excluded 35 children for whom we did not observe maternal education. Low-educated foster mothers obtained maximum vocational education. The following controls (measured at 6th grade) are included in all models: gender; age; number of siblings; county indicators; calendar year indicators; standardized mathematics-, and reading test scores; grades in mathematics, literature, behavior, and effort; indicators for the presence of mild mental disability, autism, physical disability, speech impairment, psychological problems, and behavior or learning problems. Robust standard errors in parentheses, $*p<0.10$, $**p<0.05$, $***p<0.01$

The other finding is that the beneficial effects seem larger for children living with more educated foster mothers for most outcomes. However, the difference compared to children with less educated foster mothers tends to be small and only statistically significant in the case of teenage births. Girls living with more educated foster mothers are 21 percentage points less likely to become teenage mothers than girls in residential care and 14 percentage points less likely than girls residing with less educated foster mothers. One concern is that the results may be driven by selection, where less problematic children are more likely to be placed with more educated foster mothers. However, as shown in Appendix Table A7, children placed with more educated foster mothers perform better on cognitive ability tests in 6th grade but are also more likely to have special needs and disabilities, suggesting a mixed pattern that makes strong selection effects unlikely.

Other than the features of foster care, specific groups of children can be affected differently by the two types of care. The following section analyzes the differential effects of gender and special education needs.

6.3 Heterogeneous effects for different groups of children

In this subsection, we re-estimate Eq. (1) with the inclusion of interaction terms to see whether specific groups of children benefit more from foster care. First, we estimate heterogeneous effects by gender, as various results from the literature indicate that state care can affect girls and boys differently (Gross and Baron 2022; Bolvig and Thorsager 2024). Table 4 shows that the point estimates are smaller for girls for all outcomes measured for both genders. While these differential effects are not significant for any outcome, they are large for finishing secondary school and using mental health medication. In the appendix, we also show heterogeneities by the presence of any special needs: psychological, behavioral problems, or disabilities (Table A8). The coefficient of the interaction term alternates in sign and is insignificant and close to 0 in most cases. These results reveal that regardless of gender and the presence of special needs, the estimates indicate that children placed in foster care have better outcomes.

6.4 Comparing counties with different foster mother capacities

Next, we estimate the effect of living in a county where the child protection system operates with more abundant foster parents. We estimate Eq. (5) and show the results in Table 5. Except for the prevalence of abortions, most outcomes are better on average for children living in state care in counties with high foster mother capacity. Similar children living in state care are 10 percentage points more likely to finish secondary education, 2 percentage points less likely to use mental health medication, 5 percentage points less likely to give birth as teenagers, and 9 percentage points less likely to spend 6 months as NEETs at age 19 if they live in counties where foster parent capacity is high. These point estimates are large, albeit only statistically significant for obtaining secondary education and NEET status, as well as the index of the outcomes. We

Table 4 OLS estimates for the differences between children raised in residential care and foster care by gender

	Secondary education	Mental health medic	NEET for at least 6 months	Outcome index
	(1)	(2)	(3)	(4)
Foster care	0.126**	−0.080*	−0.119**	0.239***
	(0.050)	(0.046)	(0.056)	(0.079)
Foster care × Girl	−0.084	0.043	0.010	−0.042
	(0.066)	(0.059)	(0.074)	(0.100)
N	890	890	890	890
Adj. R squared	0.157	0.028	0.122	0.171
Mean in residential care	0.208	0.197	0.526	−0.223

The table shows estimates of a modified version of Eq. (1):$Y_i = \alpha + \beta_0 girl + \beta_1 foster_i + \beta_3 foster \times girl_i + X_{i,gr6}\prime\gamma + u_i$,with children living in residential care as the reference category. The following controls (measured at 6th grade) are included in all models: age; number of siblings; county indicators; calendar year indicators; standardized mathematics-, and reading test scores; grades in mathematics, literature, behavior, and effort; indicators for the presence of mild mental disability, autism, physical disability, speech impairment, psychological problems, and behavior or learning problems. Robust standard errors in parentheses, $*p<0.10, **p<0.05, ***p<0.01$

Table 5 Estimates for the effect of foster parent capacity on children living in state care

	Secondary education	Mental health medic	Birth	Abortion	NEET for at least 6 months	Outcome index
	(1)	(2)	(3)	(4)	(5)	(6)
Lives in a county with high foster parent capacity	0.100**	−0.022	−0.047	0.052	−0.092**	0.182**
	(0.044)	(0.038)	(0.058)	(0.050)	(0.046)	(0.059)
N	869	869	443	443	869	869
Adj. R squared	0.145	0.010	0.038	0.030	0.111	0.123
Mean outcome in low capacity counties	0.305	0.163	0.263	0.212	0.417	−0.118

Estimates of β in equation $Y_i = \alpha + \beta\, highcapacity_c + C'_{c,gr6}\gamma + X'_{i,gr6}\gamma + u_i$,where high capacity is an indicator of living in a county with an above-median foster parent capacity. Foster parent capacity is defined as the number of women with occupation code foster parent in 2015 in the given county over the number of children living in state care in the county in 2015. The following county-level controls are included in all models: employment, unemployment, mean wage, birth rate, and a composite development indicator of the county, and the following individual-level controls: age; number of siblings; county indicators; calendar year indicators, standardized mathematics-, and reading test scores; grades in mathematics, literature, behavior, and effort; indicators for the presence of mild mental disability, autism, physical disability, speech impairment, psychological problems, and behavior or learning problems. White robust standard errors in parentheses, $*p<0.10, **p<0.05, ***p<0.01$

estimate placebo regressions to show that omitted county features like local labor market opportunities or local school quality do not drive these differences. Table 6 shows that the coefficient estimates of the placebo regression (Eq. (5) run on the sample of children living with their biological parents) are insignificant and close to 0 for most outcomes. One exception is the outcome of spending at least 6 months as NEET at age 19, but even in this case, the coefficient estimate is positive and small, pointing toward slightly worse local circumstances in counties with higher capacities. In Table A9, we also estimate the placebo on the subset of children living with their biological families who, based on their observed characteristics, are more comparable to children who live in state care. Specifically, we estimate the propensity of getting into state care conditional on observables in 6th grade and estimate the effect only for children whose predicted propensity is above 2.8%. 2.8% is the median value of the estimated propensity of getting into state care of children who are, in fact, in state care. We also find zero coefficients of foster care capacity on this subsample of children. This further strengthens our confidence that county features outside the child protection system cannot account for the differences in the outcomes of children living in state care.

One natural mechanism through which child protection systems with more potential foster parents lead to better outcomes for children in state care is the fact that in these systems, more children are placed into foster care. If this were the only mechanism, we could measure the effect of foster placement with an IV approach detailed in Appendix C. However, we cannot rule out other mechanisms, as other unobserved features of the local child protection system (e.g., the quality of residential care) might be correlated with foster parent capacity, and as they do not affect the children living with their birth families, they would not show up in our placebo "experiment."

However, even the reduced form estimates yield an important result: keeping county characteristics constant, a child protection system operating with more abundant foster parents leads to better outcomes for children in state care.

7 Robustness checks

7.1 Specification curve analysis

Our results are robust to several different choices made during the analysis. Following the specification curve analysis approach of Simonsohn et al. (2020), we define five reasonable decisions made during the analysis and estimate the coefficient of foster placement across all combinations of these choices.

The first choice is about the sample. Our main analysis only included those who did not change home type during the observation period ("home type does not change" on Fig. 2). A potential problem with this choice is that by excluding children who are in foster care in grade 6 and residential care later, we exclude some problematic children and thus overestimate gains from foster care. Another reasonable choice would be to include all children in state care in 6th grade and measure the effect of 6th grade home type ("just 6th grade home type").

The second choice is about the subsample. Our main approach is to include all children in the sample regardless of their observables in grade 6 ("full sample").

Table 6 Placebo estimates for the effect of foster parent capacity on children living with their own parents

	Secondary education	Mental health medic	Birth	Abortion	NEET for at least 6 months	Outcome index
	(1)	(2)	(3)	(4)	(5)	(6)
Lives in a county with high foster parent capacity	0.003	−0.002	−0.000	0.002	0.010**	−0.003
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)
N	113,180	113,180	56,333	56,333	113,180	113,180
Adj. R squared	0.262	0.006	0.190	0.057	0.097	0.214
Mean outcome in low capacity	0.720	0.037	0.049	0.053	0.158	0.040

Estimates of β in equation $Y_i = \alpha + \beta\, highcapacity_c + C'_{c,gr6}\gamma + X'_{i,gr6}\gamma + u_i$,where high capacity is an indicator of living in a county with an above-median foster parent capacity, using the sample of children living with their biological parents. Foster parent capacity is defined as the number of women with occupation code foster parent in 2015 in the given county over the number of children living in state care in the county in 2015. The following county-level controls are included in all models: employment, unemployment, mean wage, birth rate, and a composite development indicator of the county, and the following individual-level controls: age, number of siblings, county indicators, calendar year indicators; standardized mathematics-, and reading test scores; grades in mathematics, literature, behavior, and effort; indicators for the presence of mild mental disability, autism, physical disability, speech impairment, psychological problems, and behavior or learning problems. The outcome index is calculated by standardizing over the whole sample. White robust standard errors in parentheses, $^*p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$

However, suppose we want to emphasize our argument that children living in the two types of settings are comparable by estimating the coefficient on a subsample of children for whom placement in foster care is theoretically possible. In that case, we might choose a smaller subsample. First, we rerun the models on a subsample of children without special needs or disabilities, thus making it more likely that these children would be fit to live in family-like settings ("no sn"). Second, we refine our sample to satisfy the overlap of the control variables ("overlap"). Specifically, we restrict the sample to those children who, based on their observed features in 6th grade, would have a positive probability of being placed in either residential or foster care. To achieve this, we estimate the following probit model : $P(foster = 1|X'_{i,gr6}) = \phi(X'_{i,gr6}\beta)$, where X includes the same variables as in Eq. 1. We then calculate the 10th and 90th percentile of the propensity score distribution for children in foster care and residential care separately. We keep only observations with propensity scores above the higher of the two 10th percentiles and below the lower of the two 90th percentiles, that is, the overlapping region of the two distributions.

The third choice concerns the age at which we measure the outcomes. There is a trade-off here: if the outcomes are measured at older ages, the sample size decreases

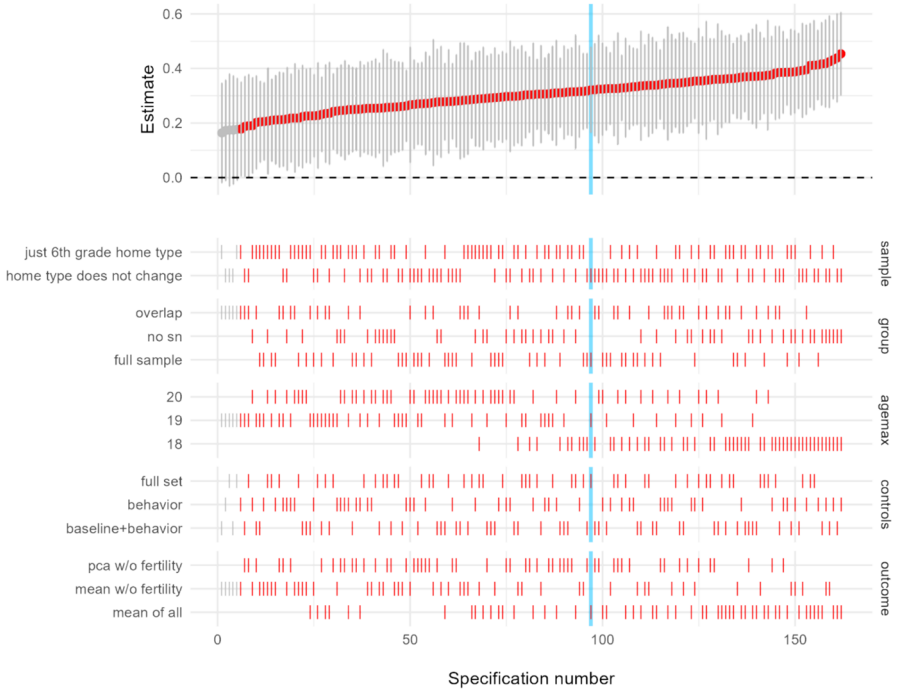


Fig. 2 Specification curve for the index of the outcomes. Note: Coefficient estimates of foster care on the index of outcomes using different specifications. The top panel shows the point estimate (dot) and the 95% confidence interval (grey line). The bottom panel indicates the combination of the five choices that led to the specific estimate. Red dots indicate statistically significant estimates at the 5% level, and grey dots indicate insignificant ones. We highlight our main specification with blue

as the data ends in 2017. However, measuring later could be preferable for some outcomes, especially for NEET status. In our main specification, we measure the outcomes at age 19, and here, we also show the outcomes measured at age 18 and age 20.

The fourth choice concerns our control variables (behavior, behavior + baseline, full set), as described in Section 6.1. While we prefer the full set of controls, the most important determinants of living in foster care are variables measuring behavior; thus, it would be a defendable choice to include only those.

Regarding the index of outcomes, our fifth choice is how to generate the index. As described in Section 4 in our main specification, we calculated the mean of four standardized outcomes ("mean of all"). In the specification curve analysis, we calculate a version that includes only relevant variables for both genders ("mean w/o fertility"). In addition, instead of calculating a simple, standardized mean, we perform principal component analysis to generate the index and re-estimate the regressions using the first principal component as the outcome ("pca w/o fertility"). For comparability, we rescale all three outcome indices so they are centered around 0 and have a standard deviation of 1.

Figure 2 shows the coefficient estimates for the outcome index and 95% confidence intervals resulting from the 162 combinations of the different choices. We highlight our main specification with a light blue background, and red dots indicate significant estimates at the 5% level, while grey dots show insignificant estimates. The curve reveals that the positive coefficient estimates are robust to these choices, and in the vast majority of cases, they are also statistically significant at the 5% level. No other clear pattern emerges except maybe the fact that when the outcome is measured at age 18, the coefficient tends to be larger.

We also present the specification curves for all our binary outcome measures in the appendix, Figures A3-A7. As all of these variables are used in the calculation of the outcome index, we do not use different outcome definitions in this analysis. However, since all the variables are binary, we also show results from estimating a probit model instead of a linear probability model. For the probit estimates, the plots display the average marginal effects. These curves reveal robust results, and the coefficients are always in the same direction as our main estimates. We get statistically significant estimates for most outcomes in most cases. The only exception is mental health medication, where only 39% of the specifications appear significant (the original estimate was also only significant at 10%). However, the effects are negative and large in all these specifications.

The specification curves also reveal some interesting patterns. For secondary education and birth, the gap between children raised in residential care and foster care increases as the children age. At the same time, the gap measured in NEET status and mental health problems decreases as children get older. However, this evidence is tentative as the coefficients are estimated on different samples.

For inference, we follow the approach of Simonsohn et al. (2020) and redefine the outcome variables as the difference between the predicted and the observed outcome under the given model. We then draw 500 random bootstrap samples for all specifications using this nullified outcome and the original right-hand-side variables and re-estimate the given specification under this null on all the

reshuffled samples. In Table A10 in the appendix, we show the median effect size and the share of statistically significant results for all outcomes in the original specification in the first column. In the second column, we calculate p-values for these statistics, which are defined as the share of shuffled samples that yield a test statistic at least as extreme as the one observed in the actual sample. For all of our outcomes, none of the reshuffled samples with a nullified outcome yield a more extreme test statistic than the original curve, showing that it would be extremely unlikely to get the specification curves if the coefficients were actually zero. Overall, the main coefficient estimates on foster care are robust to different specifications.

7.2 Further robustness checks

We present further evidence to show the robustness of the results. We did not include these analyses in our specification curve because of the small sample sizes, the measurement of different concepts compared to our original specification, or other theoretical considerations. However, it is helpful to show these results, as they provide tentative evidence against alternative explanations.

First, our main result is that children in foster care have better outcomes, and we proposed that foster care per se improves their outcomes unless unobserved characteristics played a crucial role (see the $\widetilde{\delta}$ values). One of these critical unobserved variables is the age at which the child was removed from her family. We take age under control by using the sample of children who still lived with their parents in grade 6, and whom we observe as being in state care in grade 8. These children were placed in state care between the 6th and 8th grades. Furthermore, we do not face the proxy control problem in this case: we measured the controls in grade 6th when children were still living with their biological families. Table A11 shows the results. The point estimates are large and in the same direction as our main results, showing better outcomes for children raised in foster care in the 8th grade, with the exception of mental health problems. These results indicate that differences in the age of removal cannot explain the large discrepancies between foster and residential care youth for most of our outcomes. However, due to the small sample size, the estimate is only marginally significant for obtaining secondary education and for the composite index of outcomes, and it is insignificant for other outcomes. Also note that most point estimates are larger than in our main specification, which is consistent with our argument that the late measurement of control variables might bias the main estimates downwards.

Another concern in our setting is that we only observe a fraction of those children who live in state care because of non-response in the survey accompanying the national assessment of the basic competencies. If the differences between non-responding children in residential care and foster care were substantial, our results might not be generalized to the full population of children in state care. To mitigate this concern, we re-estimate our main specification on a sample for whom living location information is missing in grade 6 but available in grade 8, indicating that

they live in state care. Note that this subsample is not part of our primary analysis.[6] We estimate the relationship between foster placement in 8th grade and the outcomes in Table A12. The point estimates, except for abortions, are large and in the same direction and magnitude as our original estimates; however, they are only statistically significant for secondary education and the outcome index due to the limited sample size. These results provide tentative evidence that including non-respondents in our primary analysis would not dramatically change the results.

To further show that the results are not dependent on the choice of specific covariates, we use machine learning to select the control variables. Following the recommendation of Lieli et al. (2022), we use double-debiased machine learning instead of direct machine learning. The coefficient estimates remain large, are in the same direction as our original estimates, and are statistically significant for all outcomes (Table A13).

Lastly, we re-estimate our regressions with the primary explanatory variable, placement in foster care, defined more leniently (Table A14). Recall that we restricted the sample in our main analysis to respondents who consistently answered two survey questions about living arrangements and the presence of biological parents. In this specification, we only demand that they confirm that they live in a foster family or a group home and keep them in the sample even if they gave contradictory information about living with a biological parent. In this sample, we get somewhat larger point estimates than in our original specification, but this may be the result of including children who are not, in fact, in state care. For example, biological children of people who work as foster parents might state that they live in a foster family. Thus, although we have a larger sample here, we prefer the original, stringent definition of living in state care. Nevertheless this robustness check confirms that our main results do not hinge on our chosen definition of foster and residential placement.

Returning to our original model in Table A15, we recalculated standard errors clustering at the county level, and using bootstrap. We found that the method used to calculate the standard errors only minimally affects the confidence intervals. Since the estimated benefits of foster care remain robust across these specifications, we proceed with a cost–benefit analysis.

8 Cost–benefit analysis

We conduct two types of cost–benefit analysis: One is an opportunity cost comparison between residential care and foster care. At our request, the Hungarian SOS Children's Villages, a care network, calculated the average expenditures for children

[6] In terms of observable demographic characteristics, this sample is similar to our main sample in 6th grade, for children raised in family foster care: 52 percent are boys (vs 49 in our main sample) and their average age is 12.8 (vs 12.9 in our main sample). In the case of children raised in residential care, boys are overrepresented compared to our main sample (62 percent vs 49 percent), and the mean age is similar (13.1 vs 13.3).

in state care in 2021.[7] This organization is part of an extensive international network with strict quality assurance standards. Yet, it operates as a small network in Hungary, providing care for 250 children at a higher level than the average quality of care in the country. In addition to state normative support, the organization primarily relies on corporate and private donations. In both types of care, wage costs account for 55–70 percent of the total expenses, with the higher proportion typically found in residential care. The SOS calculations strictly focused on wages for professional staff, excluding costs associated with administration, maintenance, and fundraising. They estimate that a child's residential care cost is EUR 19,000 per year, while foster care costs significantly less at EUR 7,000 per child per year. This results in a substantial annual difference of EUR 12,000 per child. According to SOS's estimates, a typical Hungarian care network spends less on children in state care. By subtracting the costs of additional services provided by SOS, such as various leisure and development programs, the training costs for professional staff, and the value and maintenance costs of their vehicle fleet, we arrive at a realistic comparison of expenditures for a typical Hungarian care network. The revised estimate is EUR 14,000 for residential care and EUR 7,000 for foster care. The difference remains significant. On average, in Hungary, the annual cost of caring for a child in state care is EUR 7,000 lower in foster families compared to residential care. For every thousand children in residential care, this disparity translates to potential annual savings of EUR 7 million.

Another consideration could be to measure the expected long-term consequences of a child in state care raised in different care settings. We can perform another cost–benefit analysis on the improved outcomes, measuring the advantages of foster care over residential care. In this context, the key question is the social benefits of the improved outcomes for young adults raised in foster care. These enhanced outcome measures translate into better life opportunities for individual children. We can explore what these better outcomes mean for society by drawing upon findings from a prior simulation exercise (Kertesi and Kézdi 2006). This analysis demonstrated the long-term budgetary benefits when Roma children, the most disadvantaged ethnic minority in Hungary, complete some secondary education instead of merely finishing primary school. We apply these calculations to children in state care.

We remind our readers that children in foster care are by eight percentage points more likely to have completed some form of secondary education compared to their peers in residential care. Kertesi and Kézdi's study focused on the social benefits of education, highlighting that educated individuals contribute more to the national budget while relying less on transfers. The balance of increased contributions versus decreased transfers represents the potential net budgetary benefits. Seven channels were analyzed: personal income tax from registered full-time employment, social security contributions made by employers and employees on earned income, unemployment benefits, means-tested welfare benefits, earnings from public employment initiatives, value-added and excise taxes on consumption, and costs associated with incarceration. Additionally, the estimates were adjusted to account for the extra costs

[7] https://www.sos-childrensvillages.org/where-we-help/europe/hungary

associated with increased secondary and college education. The analysis used representative surveys and administrative data sources.

According to the benchmark estimate, discounted to age 4, the present value of the future benefits, measured in 2006 HUF and EUR values, was about HUF 19 million (EUR 70,000) relative to the value the government would collect on the representative person in case she had not continued her studies after primary school. The benefits were minor, amounting to HUF 15 million (approximately EUR 55,000) if the young person completed vocational training school. The estimated returns are sensitive to the discount rate, the assumed wage growth, the college completion rate after secondary school, and the race-specific employment and wage differentials, partly due to labor market discrimination. However, even the most conservative estimates suggested the benefits were at least HUF 7–9 million (EUR 30,000) per person. Overwhelmingly, the benefits stem from increased government revenues from personal income tax and employer-employee social security contributions after earned income. Higher value-added and excise tax revenues were also substantial. Savings on unemployment insurance, welfare benefits, and public employment projects were negligible, and savings on incarceration costs were small.

These back-of-the-envelope calculations suggest that foster care is (i) significantly less expensive than its alternative, residential care. Raising children in foster care is a more economical choice, making it possible to reallocate resources from residential care to foster within short-term budget constraints. (ii) Considering the various placements in state care as distinct long-term human capital investments with varying rates of return, selecting the foster type at higher budgetary costs is rational, even from a purely financial perspective. It is important to acknowledge the practical constraints to achieving such a shift. Recruiting, training, and supporting a sufficient number of suitable foster parents is challenging, and expanding the pool through targeted efforts and higher salaries would involve additional costs. However, the expected returns from such investments would likely outweigh the costs, making it in the government's best interest to allocate more resources toward providing higher-quality care to more children in need of foster care.

9 Conclusion

In this study, we compare the outcomes of young adults in Hungary who were raised in foster care during their adolescence with those raised in residential care. We use individual administrative panel data linked to survey information on home type and a large set of indicators measured at age 13. We present evidence that young adults raised in foster care experience significantly better outcomes compared to similar youth raised in residential care, conditional on a large set of control variables, including indicators of behavioral problems. They are substantially more likely to complete secondary education, less likely to use medication for mental health issues, less likely to give birth and have an abortion as teenagers, and spend less time without either employment or enrollment in education.

Following the method of Oster (2019), we argue that unobserved variables, including previous placement history and ethnicity, would need to account for 1.4–6.1 times more for the selection into foster care than observed characteristics

to invalidate the estimates. These are higher than 1, the usual benchmark value of equal selection. We also present evidence that local child protection systems operating with more foster parents lead to better outcomes for children raised in state care.

Prior research has shown the beneficial effects of foster care compared to residential care for children placed in state care before age 3 (Nelson et al. 2014). Existing research on older children suggests that foster care is likely to have a positive impact on youth with behavioral problems in the US for some outcomes (see Lee et al. 2011; Taylor 2021). Our study provides new pieces of evidence for the positive effect of foster care during adolescence on a wide range of adult outcomes in the European context.

Delving into a comprehensive analysis of why being raised in foster care can offer greater benefits compared to residential care is beyond the scope of this analysis. However, one of the most important channels that can explain the significant gains from foster care is the opportunity for the child to form a trusting and caring relationship—helping them to navigate life successfully—with a supportive and loving adult figure in this type of care (Nagaoka et al. 2015; Gypen et al. 2017). Such relationships are less likely to form in group homes even if highly trained professionals run them (UNICEF 2022). In addition, problems specific to living in residential care—stigma, negative peer effects, and low autonomy related to institutional routines—can contribute to worse outcomes.

In English-speaking countries, residential care is only reserved as a last resort for children whose placement into foster families is not possible (del Valle 2014). But in most other countries, including Hungary, many children who would be capable of living in foster families live in residential care. Child welfare organizations have long called for the de-institutionalization of these children (see, e.g., UNICEF 2022). Our study shows that living in a family-like environment during adolescence is not only a normative ideal but can also lead to improved outcomes. Efforts to increase the number of foster parents to place more children in foster care could be important policies in those countries where residential care is still common (for example, Germany, France, the Benelux countries, and the Mediterranean and post-Socialist countries in Europe). In these countries, the exact advantages and disadvantages of foster care might differ from our estimates because of the local details of the child protection system–for example, the quality of both residential and foster care can be substantially different than in Hungary. Still, the fact that we find better outcomes for foster youth regardless of gender, special needs, and the quality of foster care suggests that gains from living in a family-like environment as an adolescent might be quite universal.

Future research in different child protection settings can shed more light on what features of children and foster families make it more likely that children raised in state care become successful adults. To pin down precise causal effects, randomized controlled trials similar to the Bucharest Early Intervention Project could provide high-quality evidence about the effectiveness of different care types for various subgroups of children. Finally, it is important to acknowledge that while foster care has the potential to improve the well-being of children living in state care, even foster youth have much worse outcomes than the general population of children. More research is needed to gain a better understanding of how governments can improve the overall quality of state care to raise successful individuals when their birth families cannot provide for them.

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Data availability The administrative data used in this project is individual-level, sensitive, and cannot be made publicly available. However, it is available through a safe online connection for the international academic community after an agreement with the Databank of the ELTE Centre for Economic and Regional Studies (contact: adatkeres@krtk.elte.hu). For detailed information on requiring access to the data, see CERS Databank's website: https://adatbank.krtk.mta.hu/en. Our computer code (Stata) and instructions for replication are available in the following public repository: https://github.com/barditspanka/children_in_state_care.

Declarations

Competing interests The authors have no competing interests to declare relevant to this article's content.

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