Journal of Biosocial Science (2024), 56: 3, 560–573
doi:10.1017/S0021932023000184

CAMBRIDGE UNIVERSITY PRESS

RESEARCH ARTICLE

The impact of welfare on maternal investment and sibling competition: evidence from Serbian Roma communities

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(Received 8 February 2023; revised 20 June 2023; accepted 31 August 2023; first published online 25 September 2023)

Abstract

Siblings compete for limited parental resources, which can result in a trade-off between family size and child growth outcomes. Welfare incentives may improve parental circumstances in large families by compensating for the additional costs of an extra child and increasing the resources available to a family. The improvements in conditions may influence parents to increase their investment, expecting greater returns from the investment in child survival and development, while in turn increase sibling competition for the investment. This study assessed whether welfare benefits have influenced parental investment trade-offs and competition between siblings among Serbian Roma, a population largely dependent on welfare. Using data from the UNICEF Multiple Indicator Cluster Survey 6, this study assessed the associations between maternal investment, child cash benefits, sibship size, and child anthropometry, as an indicator of health, among 1096 Serbian Roma children aged 0 to 59 months. Living in a small family benefited Roma children, while the incentives increased competition between siblings. Maternal investment was negatively associated with incentives, as the improvements brought about were insufficient to influence a change in maternal perceptions about the local setting uncertainty and thus promote an increase in investment.

Keywords: parental investment; sibling competition; welfare incentives

Introduction

Parental investment may be an important contributing factor to early childhood development, including impact on health outcomes such as growth and nutrition. Parental investment implies any parental expenditure in terms of time, energy, and resources that benefits offspring (Clutton-Brock, 1991). Investment can be anything from providing food, protection, shelter or attention, education, and financial support. However, in most environments, parental resources are limited, and parents face a trade-off in number of children and allocations of investment per child (quantity–quality trade-off) (Lawson and Mace, 2009). Evolutionary life history theory predicts that siblings in large families compete for finite parental resources (quantity–quality trade-off effects) (Kramer et al., 2016; Lawson and Mace, 2008).

Early childhood growth (height and body size) is an important proxy of offspring quality (health and fitness) for a trade-off between offspring number and quality, or between the number and size of offspring, thus children's growth is expected to be negatively associated with family size (Walker et al., 2008; Hagen et al., 2006). Growing up in large families, with many siblings, may be especially harmful for the later borns, as parents tend to invest more in offspring who have a

higher likelihood of contributing to parental fitness, which is, along with sex and health, often older children (Hertwig et al., 2002). The negative effects of competition between offspring (quantity–quality trade-off effects) appears most often under conditions of resource scarcity and high fertility (Gibson and Lawson, 2011; Gillespie et al., 2008).

Among humans, empirical evidence for trade-offs between family size (quantity) and child quality has provided mixed results, where several studies have found a negative family size effect on growth, while others have not (Lawson and Mace, 2008; Hagen et al., 2006); Pelto et al., 1991; Kramer et al., 2016; Strassman, 2011). The effects of trade-off may be modified by the conditions of local environment: poor resources and high environmental risk affect parental conditions and may influence overall parental investment and how biased that investment is (Quinlan, 2007). Under such conditions, there may be limited differential investment between children, as parents may have little control of their children's survival and reproductive chances, and parents should favour low levels of parental investment and higher fertility (Sear, 2011). In turn, when risk factors appear low, parents can increase their investment, expecting greater returns from their efforts in terms of child survival, development, and eventual reproductive success, which may increase sibling competition for the investment (see review in Gibson and Lawson, 2011). On the other hand, a reduction in fertility rates may result from increased levels of parental investment and sibling competition (Winterhalder and Leslie, 2002).

Furthermore, the effects of trade-off may be decreased or masked by sociocultural and economic phenomena (i.e. kin or government support for education, public health improvements and care, or food), by reducing external environmental risks and improving resources and thus decreasing the negative effects of numerous children within families (De Keyser and Van Rossem, 2017; Gibson and Lawson, 2011). In countries where policies supporting the family (e.g. a welfare state) are well established, non-parental investments – the welfare benefits – might aid in children's development and growth (Gibbs et al., 2016; Bras et al., 2010). The welfare incentives, by providing parents access to certain resources such as cash transfers, free healthcare, and education, may also have a strong impact on parental behaviour (Almond et al., 2011; Dahl and Lochner, 2012). Cash transfers in particular may alleviate parental conditions in large families by compensating for the additional costs of an extra child and, at the same time, increase the resources available to family.

Even though welfare incentives, by improving conditions and reducing risks, might affect family dynamics and sibling competition with short- and long-term health impacts on household children, studies investigating associations between parental investment, sibling competition, and offspring outcomes under welfare are lacking (Manley et al., 2012).

This study assessed whether government support, that is, welfare benefits, by decreasing environmental risks and improving resources, have influenced parental investment trade-offs and competition between siblings among Serbian Roma, a population largely dependent on welfare. The associations between maternal investment, child cash benefits, sibship size, and child anthropometry, as an indicator of health, were tested to assess whether receiving welfare (child cash transfers) increased the reliability in investment returns and thus investment per child and increased competition between siblings for resources.

The Roma are the largest, poorest, and youngest ethnic group in Europe. They have been present in Serbia since the middle ages, but their integration in mainstream Serbian society has been poor, and they remain a separate ethnic group. At present, there are more than 140.000 Roma in Serbia, or around 2.1% of the population. Common demographic features, including young age profile, high unemployment, poor educational attainment, and dependency on state welfare, characterise the Roma population in Serbia. Due to their low educational levels and skills, many Roma remain unemployable, relying on a combination of social benefits and informal work for survival (Čvorović and James, 2018). Previous research has found that Roma exhibit moderate levels of maternal investment, varied by birth weight and child wantedness (Čvorović, 2020).

https://doi.org/10.1017/S0021932023000184 Published online by Cambridge University Press

Serbia has a well-developed system of social protection with different forms of assistance available through material benefits and services. According to Serbian Law on Social Welfare, the general child benefits and health service include free healthcare and education, and financial social assistance (cash transfers) available under certain conditions to poor citizens including children, which increases with the number of children in a family. By Serbian Law on Social Welfare, the right to child cash benefits (entitlement to cash transfers) is granted to a parent or direct caretaker of a child for a maximum of four children in the family, from the date of the submitted request until the child has reached 19 years of age (and enrolled in regular schooling) (Vlada Republike Srbije, 2020). The entitlement usually covers the first, second, third, and fourth born in the family, but it may extend to later borns as well, if, due to the age limit, one of the first four children can no longer exercise the right.

In recent decades, the government has introduced numerous affirmative measures aimed at improving the Roma's situation in several areas, including housing, education, and healthcare, and facilitated access to financial social assistance as the most important state measure against poverty and social exclusion. According to available census data, there were 5264 families with 5 or more children, out of which 1719 were Roma, or around 33% (Inicijativa A11, 2021). Over 780 families consisted of one or both illiterate parents, while in 1024 families one or both parents did not have elementary education, over 760 did not have bathrooms, and over 640 did not have toilet facility.

Additionally, through the social protection system, Serbian Roma enjoy the right to reduction in costs for electricity, water, and other utilities, and for children, benefits in education through numerous affirmative measures. These strategies have resulted in a gradual decline in infant and child mortality and an increase in birth weight (UNICEF, 2020).

Roma cultural traditions have encouraged high fertility, and large families have remained the norm among the Roma; thus, a considerable proportion of Roma children grow up with many siblings (Čvorović, 2014). Although data are available on the prevalence and factors associated with stunting (low height for age) among Roma (UNICEF, 2020), nothing is known how welfare incentives might affect maternal investment, sibling competition, and growth pattern in this population.

Data from the UNICEF Multiple Indicator Cluster Survey 6 (MICS 6), a nationally representative sample of Serbian Roma children, were used to assess these issues. Child outcomes included height-for-age (HAZ) and weight-for-age (WAZ) z-scores, as anthropometric measures of growth and nutrition.

Method

Study design

This was a secondary analysis of publicly available data from UNICEF's sixth MICS (2019) for Serbian Roma settlements (available at http://mics.unicef.org/surveys). The survey included estimates on child health indicators at the national level for the Roma communities. Details regarding the surveys methodology can be found elsewhere (UNICEF, 2015, 2020). MICS includes child anthropometric along with elementary information on mothers and households. Children's age, gender, and maternal and household characteristics were reported by Roma mothers.

The sample consisted of 1096 Roma children aged 0 to 59 months. Some data (birth weight and child wantedness) were available only for the children aged 0–24 months; thus, the sample was divided into children aged 0–24 months (N = 420) and 25–59 months (N = 629). Eleven per cent of children were born with low birth weight (less than 2.500 g) (UNICEF, 2020). Child mortality rates remain notably higher among the Roma when compared with the national average. Roma fertility remains high in comparison with the majority: total fertility rate (for one year prior to the survey) for Roma women was 3.5 children per woman vs. 1.3 for Serbia.

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In the three months prior to survey, over 80 % of households received various forms of financial social assistance/welfare.

Child outcomes

HAZ and WAZ scores were available for 1096 Roma children aged 0 to 59 months and used as indicators of child nutritional status and growth. Height is a key indicator of cumulative nutrition and health loads from conception, frequently used as a measure of offspring quality, as it may affect future health and reproduction, with short stature often associated with children's health and mortality, and later-life lower fitness (Kramer et al., 2016).

Improved childhood energetic status can significantly affect children's ability to stave off disease in highly pathogenic environments (McDade et al., 2008). Weight-for-age (WAZ) reflects body mass relative to chronological age, while shortfalls can point to either acute or chronic inadequacies.

Independent variables

Sibship size (the number of maternal siblings residing in the same household (including those older than 60 months) was the key exposure variable. In addition, other variables such as child's age, gender, birth weight, and child wantedness (for children aged 0–24 months), maternal age and investment, literacy skills, and socio-economic position were included in the analyses, to reduce the risk of confounding.

The quantity of mother–child interaction was used as a proxy for direct maternal investment (Čvorović, 2022). Mother–child interaction was reported by the mothers and referred to the types and number of activities a mother engaged in with her child over the three days prior to the survey. A total of six activities were reported: reading books or looking at picture books; telling stories to the child; counting or drawing with the child; singing songs/lullabies; taking the child outside the home, into a yard or park; and playing with the child. The score of these activities ranged from 0 to 6 points. In this sample, internal consistency was $\alpha = 0.67$.

Maternal literacy skills and household access to improved toilet facility were used as an indicator of socio-economic position. Many Roma women are illiterate or functionally illiterate; hence, literacy skills were categorised as basic literacy/can read the whole sentence, and functionally illiterate/can read only part of the sentence. Poor sanitation/open defecation is closely associated with poor socio-economic position, influencing early-life health and deficits in height and weight (Spears, 2020).

Statistical analyses

Descriptive statistics, independent samples t-test, and Chi-square test for independence were used to identify differences among only child and children with siblings across the socio-demographic variables. Independent samples t-test was used to analyse differences in child's age, height, weight, birth weight (up to 24 months of age) and maternal age. Chi-square test for independence was used to detect differences in child's sex, child wantedness (up to 24 months of age), maternal literacy skills, type of toilet, and child cash benefits. One-way ANOVA and post hoc Tukey's HSD tests were used to account for differences in height and weight among only child and children with one, two, three, and four and more siblings.

To determine predictors of maternal investment, a Poisson regression was performed. The dependent variable was maternal investment (continuous), and predictors were receiving welfare/child cash benefits (0 – no, 1 – yes), maternal basic literacy skills (0 – illiterate, 1 – literate) and household access to improved toilet facility (0 – unimproved, 1 – improved) used as a proxy for

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socio-economic position, maternal age (continuous), child's age in months (continuous), sex (0 – girls, 1 – boys) and number of siblings (continuous).

To assess whether welfare incentives (e.g. child cash benefits) have influenced levels of resource competition between siblings in the family (Roma children HAZ and WAZ scores), several multiple hierarchical regressions were conducted, separately for children aged 0–24 months and 25–59 months. Sibship size was set at a cut-off ≤ 3 siblings and ≥ 4 siblings (coded 0–0, 1, 2, and 3 siblings, and 1–4–10 siblings), based on child benefit right entitled to four children in a family. That is, given that the majority of children were recipients of child benefits, which may undermine the effect of sibship size and results, the negative relationship, if any, between sibship size, and height and body size, should be evident in children with four or more siblings. All models were adjusted for maternal and child characteristics. Maternal characteristics included maternal age and investment (continuous), basic literacy skills (0 – illiterate, 1 – literate), receiving child cash benefits (0 – no, 1 – yes), and household access to improved toilet facility (0 – unimproved, 1 – improved). Child characteristics accounted for age in months (continuous), sex (0 – girls, 1 – boys), birth weight (continuous, in kg) and child wantedness (0 – no, 1 – yes) for children aged 0–24 months.

Statistical significance was set at $P = \leq 0.05$, while statistical analyses were conducted in R (version 4.0.2).

Results

Table 1 presents descriptive statistics of 1096 Roma children aged 0–59 months and their mothers. The average child's age was 30 months, and there were more boys (52.4%) than girls (47.6%). Children had mean HAZ and WAZ scores of less than 0 (−0.86, SD = 1.28, and −0.40, SD = 1.15, respectively), while the average number of siblings was 2.12 (range 0–10). The majority of children were recipients of child cash benefits (85%).

The majority of younger children (aged 0–25 months) were breastfed (90%, not shown), and the majority were wanted while birth weight was, on average, 3.06 kg (SD = 0.57). Roma mothers were young at an average of 25.68 years (age range 15–48), with an average of three children (range 1–11, not shown), more than one-fourth were illiterate, and 10 % lived in households without access to improved toilet facility. The majority were recipients of child cash benefits (85%) for more than five years (60%) (not shown).

Roma mothers engaged moderately in activities with their children: the average level of direct investment was 3.33 (SD = 1.61), while 7% (74) of mothers had no investment whatsoever (0 activities with a particular child).

Table 2 shows differences among only child and children with siblings across the socio-demographic variables.

There were 14% (155) of only child in the sample. No difference was found between only child and children with siblings in regard to height, but there was a significant difference between only child and children with siblings in weight: only children were on average heavier (M = −0.14, SD = 1.16) when compared with children with siblings (M = −0.43, SD = 1.14) t(958) = 2.81; $P = 0.01$, $\varepsilon^2 = 0.01$) (not shown). Only children were on average younger (M = 21.09, SD = 14.71) than children with siblings (M = 30.87, SD = 17.30, t(243.88) = −7.47; $P = 0.00$, $\varepsilon^2 = 0.05$). Mothers of only children were on average younger ((M = 22.17, SD = 4.62 vs. M = 26.32, SD = 5.66, t(250.82) = −10.01; $P = 0.00$, $\varepsilon^2 = 0.09$), and fewer received child cash benefits in comparison with mothers with more children (χ^2 (1, 1020) = 6.03, $P = 0.01$, Phi = 0.08). Also, mothers of only child had greater literacy skills (χ^2 (1, 853) = 5.94, $P = 0.02$, Phi = 0.08).

Table 3 shows differences in height and weight among only child and children with one, two, three, and four and more siblings.

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Table 1. Descriptive characteristic of the sample

Characteristics	0–24 months		25–59 months		Total	
	Mean (SD) or %	N	Mean (SD) or %	N	Mean (SD) or %	N
Child						
Sex		420		629		1096
Female	47.6	200	49.6	312	49.6	544
Male	52.4	220	50.4	317	50.4	552
Child wantedness		420				
No	10.7	45				
Yes	89.3	375				
Age	11.70 (7.29)	420	41.58 (10.30)	629	29.61 (17.30)	1049
Height-for-age z-score WHO	−0.72 (1.43)	368	−0.95 (1.16)	557	−0.86 (1.28)	925
Weight-for-age z-score WHO	−0.38 (1.13)	399	−0.41 (1.17)	585	−0.40 (1.15)	984
Number of siblings	1.85 (1.73)	414	2.31 (1.65)	606	2.12 (1.70)	1028
Weight at birth	3.06 (0.57)	400				
Birth order	2.77 (1.73)	414	2.72(1.65)	606	2.74(1.68)	1028
Received assistance through child cash benefits						
No	18.7	78	12.7	80	15.1	158
Yes	81.3	340	87.3	548	84.9	888
Mother						
Age	24.21 (5.32)	414	26.69 (5.77)	606	25.68 (5.71)	1020
Basic literacy		342		503		853
Literate	74.3	254	71.6	360	72.6	619
Illiterate	25.7	88	28.4	143	27.4	234
Maternal investment	3.12 (1.54)	413	3.17 (1.53)	605	3.37 (1.63)	1018
Type of toilet facility		420		629		1096
Unimproved and open facility	9.8	41	8.9	56	9.3	102
Improved sanitation facility	90.2	379	91.1	573	90.7	994

ANOVA showed that both height and weight differed between only child and children with siblings. There was a statistically significant difference in height ($\alpha = 0.05$, $F(4.\ 898) = 3.71$, $P = 0.01$, $\varepsilon^{2\ =\ 0.02)}$, with only child being taller ($M = -0{,}65$, $SD = 1.48$) than those with three ($M = -1.05$; $SD = 1.26$) and four and more ($M = -1.08$; $SD = 1.20$), $p<0.05$) siblings. The difference in height between the others was not statistically significant, $p>0.05$. Similarly, weight also differed ($\alpha = 0.05$, $F(4.\ 955) = 4.14$, $P = 0.00$, $\varepsilon^{2\ =\ 0.02)}$, with only child being heavier ($M = -0.14$, $SD = 1.168$) than those with three ($M = -0.52$; $SD = 1.18$) and four or more (($M = -0.62$; $SD = 1{,}01$) siblings. The difference in weight between the others was not statistically significant, $p>0.05$.

Table 4 shows the results of Poisson's regression analysis

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Table 2. Differences among only children and children with siblings

	Number of siblings			
	No siblings	One or more	N	P^*
Child				
Child sex, n = 1028				0.170**
Female	70 (44.3)	437 (50.2)	507	
Male	88 (55.7)	433 (49.8)	521	
Child ever been breastfed, n = 414				0.259**
No	13 (13.1)	29 (9.2)	42	
Yes	86 (86.9)	286 (90.8)	372	
Age, n = 1020	21.09 (14.71)	30.87 (17.30)		0.000***
Height-for-age z-score WHO, n = 903	−0.65 (1.48)	−0.89 (1.25)	903	0.092***
Weight-for-age z-score WHO, n = 960	−0.14 (1.16)	−0.43 (1.14)	960	0.005***
Weight at birth, n = 400	3.04 (0.58)	3.07 (0.57)	400	0.668***
Mother				
Age, n = 1028	22.17 (4.62)	26.32 (5.66)		0.000***
Basic literacy skills, n = 853				0.015**
Literate	92 (82.1)	527 (71.1)	619	
Illiterate	20 (17.9)	214 (28.9)	234	
Household				
Type of toilet facility, n = 1028				0.602**
Unimproved and open facility	13 (8.2)	83 (9.5)	96	
Improved sanitation facility	145 (91.8)	787 (90.5)	932	
Financial social assistance/child benefits, n = 1020				0.014**
No	64 (41.0)	268 (31.0)	332	
Yes	92 (59.0)	596 (69.0)	688	

*$P = \leq 0.05$.
**Chi-square with Yates' correction for continuity.
***t-test.

Table 3. Differences in height and weight among only children and children with one, two, three, and four and more siblings

	Only child	One sibling	Two siblings	Three siblings	≥ 4 siblings	P^*
Height-for-age z-score WHO, n = 903	−0.65 (1.48)	−0.73 (1.15)	−0.78 (1.32)	−1.05 (1.26)	−1.08 (1.20)	0.005
Weight-for-age z-score WHO, n = 960	−0.14 (1.16)	−0.31 (1.17)	−0.36 (1.13)	−0.52 (1.18)	−0.62 (1.01)	0.002

*$P = \leq 0.05$.

As shown in Table 4, older children were more likely to receive greater maternal investment (OR = 1.02, 95% CI = 1.018-1.023, $P = 0.00$)) as well as those with fewer siblings (OR = 0.94, 95% CI = 0.91-0.97, $P = 0.00$). Receiving child cash benefits reduced the likelihood of maternal

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Table 4. Poisson's regression analysis: predictors of maternal investment

Parameter	Sig.	Exp(B)	95% Wald confidence interval for Exp(B)	
			Lower	Upper
(Intercept)	0.102	1.194	0.965	1.478
Child's sex				
Female	0.083	1.078	0.990	1.174
Male		1		
Child's age (months)	0.000*	1.020	1.018	1.023
No of siblings	0.000*	0.940	0.911	0.971
Maternal age	0.000*	1.185	1.083	1.296
Basic literacy				
Illiterate	0.129	1.007	0.998	1.016
Literate				
Financial social assistance/child benefits				
No	0.012*	0.881	0.798	0.972
Yes		1		
Type of toilet facility				
Unimproved	0.366	1.066	0.928	1.223
Improved		1		

*$P = \leq 0.05$.

investment (OR = 0.88, 95% CI = 0.80-0.97, $P = 0.01$), while older mothers were more likely to invest in their children than their younger counterparts (OR = 1.19, 95% CI = 1.08-1.30, $P = 0.00$).

Table 5 presents the adjusted models between Roma children individual-level HAZ and WAZ scores and number of siblings, dichotomised as ≤ 3 siblings and ≥ 4 siblings.

For children aged 0–24 months, an increase in age of one standard deviation was associated with a decrease in height of 0.13 standard deviations ($\beta = -0.13$; 95%CI, −0.80 to −0.06; $P = 0.02$). An increase in birth weight of one standard deviation was associated with an increase in both height and weight of 0.23 standard deviations ($\beta = 0.23$; 95%CI, 0.17 to 0.50; $P = 0.00$) and 0.35 standard deviations ($\beta = 0.35$; 95%CI, 0.27 to 0.52; $P = 0.00$), respectively. Maternal investment was positively associated with both height ($\beta = 0.20$; 95%CI, −3.36, 2.96; $P = 0.03$) and weight ($\beta = 0.21$; 95%CI, −3.37, 2.95; $P = 0.04$): an increase in investment of one standard deviation was associated with an increase in height of 0.20 standard deviations and 0.21 standard deviations for weight. Having ≥ 4 siblings was associated with a decrease in weight of 0.19 standard deviations ($\beta = -0.19$; 95%CI, −0.34 to −0.07; $P = 0.00$).

For children aged 25–59 months, both child's age and maternal investment were positively associated with height and weight. An increase in age ($\beta = 0.14$; 95%CI, 0.10 to 0.46; $P = 0.00$) and maternal investment ($\beta = 0.20$; 95%CI, −3.37 to 2.96; $P = 0.03$) of 1 standard deviation was associated with an increase in height of 0.14 and 0.20 standard deviations, respectively. An increase in age was associated with an increase in weight of 0.10 standard deviations ($\beta = 0.10$; 95%CI, 0.01 to 0.22; $P = 0.04$), while an increase in maternal investment was associated with an increase of 0.06 standard deviations in weight (($\beta = 0.06$; 95%CI, −3.23, 3.10; $P = 0.00$).

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Table 5. Associations of sibship size ≤ 3 siblings and ≥ 4 siblings and Roma children individual-level height-for-age (HAZ) and weight-for-age (WAZ) z-scores

	Height-for-age z-score WHO		Weight-for-age z-score WHO	
	0–24 months	25–59 months	0–24 months	25–59 months
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Child				
Sex				
Female	1.0 reference category	1.0 reference category	1.0 reference category	1.0 reference category
Male	−0.082 (−0.275, 0.040)	−0.044 (−0.156, 0.055)	−0.052 (−0.175, 0.058)	0.046 (−0.051, 0.158)
Age (months)	−0.130 (−0.801, −0.061)*	0.141 (0.100, 0.461)*	0.085 (−0.047, 0.499)	0.096 (0.008, 0.217)*
Child wantedness				
No	1.0 reference category	1.0 reference category	1.0 reference category	1.0 reference category
Yes	0.111 (−0.002, 0.326)		0.002 (−0.119, 0.123)	
Weight at birth	0.227 (0.168, 0.495)*		0.352 (0.265, 0.521)*	
Child cash benefits	0.060 (−0.070, 0.240)	0.064 (0.004,0.460)*	0,033 (−0.078, 0.151)	0.017 (−0,029, 0.018)*
Number of siblings				
≤ 3 siblings	1.0 reference category	1.0 reference category	1.0 reference category	1.0 reference category
≥ 4 siblings	−0.111 (−0.363, 0.049)	−0.131 (−0.266, −0.100)*	−0.187 (−0.335, −0.070)*	−0.200 (−0.360, −0.104)*
Mother				
Age	0.084 (−0.095, 0.353)	0.137 (0.034, 0.285)	0.108 (−0.035, 0.296)	0.171 (0.076, 0.324)
Investment	0.20 (−3.36, 2.96)*	0.20(−3.37, 2.96)*	0.21(−3.37, 2.95)*	0.06(−3.23, 3.10)*
Basic literacy				
Nepismena	1.0 reference category	1.0 reference category	1.0 reference category	1.0 reference category
Pismena	0.086 (−0.035, 0.286)	0.042 (−0.057, 0.155)	−0.003 (−0.123, 0.115)	0.012 (−0.091, 0.120)
Type of toilet facility				
Unimprove	1.0 reference category	1.0 reference category	1.0 reference category	1.0 reference category
Improve	−0.057 (−0.234, 0.074)	0.005 (−0.099, 0.112)	−0.082 (−0.204, 0.023)	0.022 (−0.079, 0.131)

*$P = \leq 0.05$.

Children who were recipients of child cash benefits were taller and heavier for 0.06 and 0.01 standard deviations than their counterparts ($\beta = 0.06$, 95% CI = 0.00-0.46, $P = 0.05$ and $\beta = 0.01$, 95% CI = 0.02-0.01, $P = 0.00$, respectively), while having ≥ 4 siblings was associated with a decrease in height and weight of 0.13 and 0.20 standard deviations, respectively ($\beta = -0.13$; 95% CI, −0.27 to −0.10; $P = 0.01$, and $\beta = -0.20$; 95% CI, −0.36 to −0.10; $P = 0.01$).

Discussion

This paper used nationally representative data from Serbian Roma communities to assess whether welfare incentives have influenced maternal investment, sibling competition, and children growth outcomes. Receiving welfare, which has improved child outcomes, was associated with decreased levels of maternal investment, as measured in this study. There was competition between younger and older siblings, while living in a small family benefited Roma children. Welfare incentives, received by up to four children in a family, increased competition between siblings, as reflected by the lower height and weight of older children and weight for the younger ones with ≥ 4 siblings.

Unlike in other studies, where the reduction of external risks increased the reliability in investment returns and thus investment per child (Gibson and Lawson, 2011), Roma maternal investment decreased with a receipt of welfare. In contrast to other studies, this finding indicates that the extent to which the state – rather than the parent(s) – bears the cost of rearing children has a negative influence on maternal investment (see Desai, 1995; Del Boca et al., 2014; Arriagada et al., 2020). The Serbian welfare state guarantees the Roma benefits in healthcare, schooling, and social assistance incentives, alleviating hardships to at least a certain extent. However, poverty and environmental uncertainty are strong correlates of low levels of parental investment (Quinlan, 2007). For many Roma mothers, government-provided cash benefits are the only guaranteed source of income, given the Roma low education, skills, and levels of employment (Čvorović and Vojinović, 2020). Child benefits should compensate at least partially for the additional costs of an extra child and increase household spending on inputs. However, given the Roma low socio-economic position, the amounts received, or the improvements brought about may not be perceived as sufficient to cause a shift in investment.

Nevertheless, the relationship between welfare and Roma mothers' parental investment is not straightforward: there was a positive association of child cash benefits with both height and weight for Roma children aged 25–59 months, that is, child outcomes improved with welfare. The most obvious way cash benefits can influence growth is that they enable mothers to use cash to purchase better nutritional food for their children. Given that the MICS design is cross-sectional, and that measures of direct maternal investment did not include how the child cash benefit was spent or feeding practices, the finding may be confounded by an unmeasured variable that correlates with direct maternal investment, such as the usage of cash benefits. Furthermore, parental resources, both economic and non-economic, influence children's well-being (Desai, 1995). For all children, maternal direct investment was positively associated with height and weight. Given that feeding practices that directly influence growth (Grasgruber and Hrazdíra, 2020) were unaccounted for, a positive association between maternal investment and child's height and weight may be explained by reverse causality in that mothers provided more direct investment to more endowed children (taller, heavier) (Čvorović, 2022; Maselko et al., 2019).

Conversely, the relationship of welfare and investment can work both ways: mothers who did not receive welfare for their children had greater investment per child, perhaps as a consequence of trying to alleviate perceived higher environmental risks by increased parenting effort (Quinlan, 2007). It is thus possible that mothers boosted their investment towards offspring in poorer economic conditions, that is, without welfare support. In situations where children are lagging behind (in this case lacking welfare support), mothers might try to increase investment in order to improve children's outcomes, and over the long term, reproductive success (Tracer, 2009).

https://doi.org/10.1017/S0021932023000184 Published online by Cambridge University Press

Furthermore, maternal investment was greater for older mothers, and for older and children with fewer siblings, indicating that the overall investment received, in addition to welfare, also depended on the maternal age, and child's age and number of children. Reproductive effort should increase with age; thus, older mothers, with limited opportunities to bear an additional child, have higher odds of investment in a particular child than younger mothers, with a greater number of reproductive years ahead (Williams, 1966; Uggla and Mace, 2016).

Additionally, older children were taller and heavier than their younger counterparts, a reflection of the maternal favouritism of older children. Parents tend to value older offspring much more than younger ones as the offspring reproductive value tends to increase with higher age. Under poor conditions, the later born children are frequently disadvantaged relative to the earlier born in growth and nutritional status, being at risk for higher morbidity and mortality (Lawson and Mace, 2009). Maternal parity influences the differentials in parental investment across and within species (Walker et al., 2008). Growing up with many siblings (parental trade-off between number of children and investment per offspring) results in poorer parental investment but also economic hardship, as the birth of each additional child limits the time, attention, and other resources parents have to allocate to any one of their children (Lawson and Mace, 2010).

Among Roma children, only children were heavier than children with any number of siblings. Furthermore, only children were taller and heavier than those with three and four or more siblings, implying that growing up in a small family is beneficial for Roma children, at least in regard to their physical growth (Manley et al., 2012; De Keyser and Van Rossem, 2017). For Roma children, sibling competition extended to another limited resource – welfare – a cut-off of having ≤ 3 vs. ≥ 4 siblings, based on child cash benefit entitlement, implied that having ≥ 4 siblings was negatively associated with both height and weight for all children, except in the younger group (0–24 months) for height. Child cash benefits usually covers the first four children in a family, but the flexibility of the system permits extension to children born subsequently. This enables parents/mothers to rotate welfare benefits within children in a family, as long as there are children entitled for the state help, and, in this way, to invest in any of their children as they see fit. In turn, welfare incentives may influence the reproductive behaviour of recipients, in that increases in payments result in increases in births: the incorrect idea that more children would mean more payments, resulting in a crowding-in effect and subsequent reduced parental investment (Halla et al., 2016). MICS does not include data on possible welfare rotations in families, but in more affluent welfare systems, the rate of reproduction of children born into disadvantaged households tracks the generosity of welfare benefits (Dunn et al, 2014; Perkins, 2016). Thus, as the resources available from welfare may cover any four children per family, the physical growth outcomes of Roma children with ≥ 4 siblings may be a by-product of a successful reproductive strategy 'on welfare', which may help to maintain fertility, feed the children albeit unequally, and balance the costs to health and nutrition that mothers would otherwise face.

For the younger group (0–24 months) of children, there was no association of height and weight with child cash benefits, or height with the number of siblings (≥ 4 siblings), while there was a negative association of age with height, and a negative association of weight with the number of siblings (≥ 4 siblings). For many children living in low-income and middle-income countries, declines in mean HAZ with age may be a consequence of a dropping shift of the entire HAZ distribution, implying that children across the HAZ range may experience slower growth in comparison with international norms due to nutritional and infectious conditions (Victora et al., 2010). Roma children have a mean HAZ of less than 0, and the results show a decline in the mean HAZ at early stages and is continuing throughout the early years of life. Having ≥ 4 siblings was associated with a decrease in weight, reflecting sibling competition for resources. In regard to height, younger Roma children bore no negative consequences of having numerous siblings, as the variable ((≥ 4 siblings) had no effect on children's height. This may be explained by the protective effects of breastfeeding: over 90% of children were breastfed. Breastfeeding is perhaps the most direct measure of maternal investment, positively influencing child survival, development, and

https://doi.org/10.1017/S0021932023000184 Published online by Cambridge University Press

health, providing protection against diseases appearing later on (Tracer, 2009). Furthermore, both height and weight of the younger children were positively associated with birth weight. Numerous studies have found birth weight to be one of the key specific correlates of child growth for both height and weight (Aryastami et al., 2017; Ntenda, 2019). Birth weight is one of the most important determinants of later growth status during early life, and it reflects maternal size, reproductive strategy, and environmental constraints (Del Giudice et al., 2015).

In this low-resource setting, welfare incentives were negatively associated with maternal direct investment for all children. The incentives were associated with better child outcomes in terms of height and weight but were insufficient to influence a change in maternal perceptions regarding the local setting uncertainty and promote an increase in investment. Sibling competition was apparent between younger and older children, but also for welfare benefits, which in turn may have helped Roma to maintain relatively high birth rates.

Unlike in other studies, there was neither bias in sex ration nor differentially biased maternal investment to sons and daughters (Bereczkei and Dunbar, 2002). Cues that reflect high status in the given environment should trigger the Trivers–Willard mechanism, but in this study, a probable lack of status differences among Roma mothers influenced the result (Keller et al., 2001). Also, type of toilet facility was insignificant in this study, possible due to unaccounted community/neighbours' sanitation facilities: child health outcomes are affected not just by an individual household's sanitation facilities but also by the rates of open defecation within one's community (Cameron et al., 2022). MICS database include only individual household sanitation facilities, which may have affected the results.

The findings of this study might explain fertility patterns in resource-limited environments and help to improve social policy interventions by identifying the most vulnerable children in a household, that is, the present limit for the entitlement of child cash benefits disproportionally affects the most vulnerable families, leaving those with more than four children without support.

The present study included several limitations, including the cross-sectional survey design, limiting causal inference. Data were available for only short-term measures (height and weight); thus, evidence of possible effects on other fitness outcomes, such as reproductive success, are lacking. Furthermore, height is often used as indicator of health status, dependent on genetics and on environmental conditions during the growth period (Roberts and Warren, 2017), so even though short stature is associated with reduced reproductive success, being small might be disadvantageous in one environment but advantageous in another (Uggla and Mace, 2016). That is, people can be short without fitness implications – the question being how short. Except for children's height and weight, variables were mother-reported and liable to potential biases. Birth weight and child wantedness were available only for the younger group of children. Anthropometric measures were available only for children aged 0–59 months; thus, it was not possible to estimate how sibling competition might have affected older children. A composite score of the measures used to estimate parental direct investment might have resulted in scores that are skewed higher for older children because some of the activities may be more likely to be done with older children. Other potential confounders, such as mother's height and birth spacing, or the amount of alloparenting effort available from close kin were not collected. As sibling interactions depend on life-history stage, future studies should address these limitations but also sibling cooperation affecting lifetime reproductive success (Draper and Hames, 2000; Nitsch et al., 2013).

Despite these limitations, this is the first study using the Serbian Roma national dataset to provide new evidence on the importance of environmental conditions in regard to influencing parental investment and sibling competition.

Financial support. No funding was received for conducting this study.

Competing interests. None.

https://doi.org/10.1017/S0021932023000184 Published online by Cambridge University Press

Ethical approval. The author asserts that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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Cite this article: Čvorović J (2024). The impact of welfare on maternal investment and sibling competition: evidence from Serbian Roma communities. *Journal of Biosocial Science* **56**, 560–573. https://doi.org/10.1017/S0021932023000184