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The Gender Gap in Children's Educational Time Investments in Informal Settlements

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Abstract

We document gender differences in children's time investments in education, labour, and leisure in an understudied population of children living in urban informal settlements. Using within-settlement and within-sibling comparisons, we find that boys spend significantly less time than girls on schooling and homework and more time on leisure activities. We also find that caregivers invest less time in helping their sons with reading and homework than their daughters. One possible explanation is that girls spend more time on domestic work. As a result, as the share of girls in the household increases, primary caregivers spend less time on domestic work and more time on other activities such as teaching children. We find that the gender gaps in time use are more pronounced among children whose parents have lower schooling and more financial constraints.

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1 Introduction

Achieving gender equality and improving educational opportunities for girls continues to be a core objective of low- and middle-income countries (LMIC). However, as gender parity in primary school enrolment continues to improve, a growing issue of concern is the increasing disengagement from education among boys across many countries. In a reversal of the education gender gap, boys now lag behind girls in educational attainment in many high-income countries (Murnane, 2013), and this trend is now emerging in many LMICs (UNESCO, 2022b).

This paper explores one possible explanation for this gap: gendered differences in children's and their caregiver's time investments in education. How much time children spend engaged in educational activities, including schooling, homework and being read to by parents, is a key input for cognitive skill development (Fiorini & Keane, 2014). We focus on a largely understudied setting of informal settlements (sometimes called slums). Specifically, our data come from over 1,400 children living in 24 informal settlements in Indonesia and Fiji. We propose that in informal settlements, time spent in educational activities is especially important because the quality of other inputs entering the children's human capital production function is low.[2]

In both countries, administrative records and survey data show that boys lag behind girls in their educational attainment (OECD, 2018; UNESCO, 2022a). In Fiji, girls complete on average 0.2 more years of schooling than boys (Sachs et al., 2023). While more boys enrol in primary school than girls, boys are less likely to transition from primary to secondary school and perform worse than girls in end-of-school examinations (UNESCO, 2022a). In Indonesia,

[2] Other critical inputs for children's human capital such as investments in healthcare, nutrition, school materials and healthy living environments, are unlikely to be high given the levels of poverty and pathogen contamination prevalent in informal settlements.

the patterns are similar (Statistics Indonesia & National Population and Family Planning Board, 2017). For example, boys' average number of completed years of education start lagging as early as age 9, and the gap becomes larger with age. By age 18, only 60% of boys have attained secondary education versus 69% of girls. This gap is also reflected in standardised test scores; at age 15, girls outperform boys in reading literacy, mathematics and science by 25, 10 and 7 points, respectively. These differences are statistically significant and much larger than the average OECD gap favouring girls (OECD, 2018). There is currently little evidence on the factors contributing to the lower educational attainment of boys in these settings, and we are unaware of any studies that examine children's time spent in educational activities in informal settlements.

Our paper has three main contributions. First, we provide one of the first descriptions of children's time use in a setting of extreme disadvantage. Approximately 350-500 million children live in slums and informal settlements (UNICEF, 2023), where they are often exposed to environmental hazards, criminal activity, and poverty (Ezeh et al., 2017; Lilford et al., 2017). Yet, we know very little about the way they spend their time.

Our second contribution is estimating the gender gap in children's time spent in schooling, homework, labour, watching TV, and playing outdoors, as well as parental time investments in reading to their children and helping them with homework. We estimate within-settlement regressions, implying that we compare neighbouring children, and control for a wide range of child, caregiver and household characteristics. To test the robustness of our findings, we also estimate within-household (i.e., sibling fixed effects) regressions.

Our third contribution is estimating whether these gender differences are magnified in more extreme levels of family disadvantage. While all families living in informal settlements face hardships, there remains variation in the level of disadvantage experienced. We hypothesise that greater scarcity in household resources and lower parental schooling will

likely affect the family's expectations of the returns to education for boys and girls, as well as the need for additional support around the house or in earning income.

Our research shows that children in informal settlements attend school on fewer and shorter days than is the national norm. Further, our estimates of the gender gap in time use show that boys living in informal settlements spend 10% fewer hours/week on educational activities, such as attending school and doing homework, compared with girls in the same neighbourhood. This gap mainly comes from less time spent in school. One potential explanation for this could be a substitution between schooling and labour. However, our estimates show that boys spend 39% (0.7) fewer hours/week in unpaid labour than girls, and spend 35% (3.6 hours) more hours/week playing outdoors. The additional hours of unpaid labour undertaken by girls are driven by caring duties within the household. We find that in line with girls' greater time spent on educational activities, parental time investments in reading to their children and helping them with homework also favours girls. One possible explanation for this is that daughters free up their parent's time by helping out around the house. We show that when the share of girls in the household increases, the primary carer spends less time on domestic duties, such as caring for family members. This potentially affords them additional time to spend on other activities, including educational activities with their daughters.

Our findings also show that these gender gaps are moderated by family disadvantage such that boys whose parents have lower schooling or experience financial difficulties spend even less time in educational activities than girls from similar backgrounds, although these differences by family disadvantage are not statistically significant. These findings are consistent with research from high-income countries showing that disadvantage affects boys and girls differently. For example, studies show that boys born to disadvantaged and single-parent households have lower test scores, more disciplinary problems and a lower likelihood

of completing high school compared to girls from similar backgrounds (Autor et al., 2019; Bertrand & Pan, 2013).

This paper contributes to an active body of literature on the gender gap in educational outcomes and investments in education, mostly from high-income countries (Baker & Milligan, 2016; Buchmann & DiPrete, 2006; Goldin et al., 2006; Lauglo & Liu, 2019; Mencarini et al., 2019) but with a few exceptions in LMICs (Himaz & Aturupane, 2021; Takasaki, 2017; Wongmonta & Glewwe, 2017; Xu et al., 2022). As part of this literature, several alternative hypotheses for the reverse gender gap have been proposed. One hypothesis proposes that schools are designed to reward behaviors that are more commonly associated with females than those associated with males (De Bolle et al., 2015). For example, Attention-deficit/hyperactivity disorder (ADHD) is more commonly diagnosed among boys than girls, largely given the differences in the symptoms they present (American Psychiatric Association, 2022). Hyperactivity and other externalising symptoms more commonly displayed by boys are penalised in schools. A second hypothesis concerns the effects of neighbourhood quality on educational and labour market outcomes. Results suggest that boys' outcomes vary more across areas than girls' outcomes do (Chetty, Hendren, & Katz, 2016; Chetty & Hendren, 2018a, 2018b). Another hypothesis is that there may be sex differences in production functions (e.g. girls often talk and learn new words faster), and this may lead to differences in how parents invest in girls compared with boys (Baker & Milligan, 2016)

We also contribute to the literature studying the gendered patterns of children's time use in LMICs (Edmonds, 2006; Zapata et al., 2011). Time use data of children is scarce in LMICs and most of the existing studies have focused on time allocated to labour. For example, Edmonds (2006) studies sibling differences in child labour in Nepal and finds that girls tend to work more than their brothers and that this extra work increases with the number of younger siblings and the spacing between siblings. In Bolivia, Zapata et al. (2011) analyse the role of

gender and ethnicity in the work-school trade-off among school-aged children and find that girls are twice as likely as boys to be out of school and working. In our sample, girls work more than boys, but also spend more time in school.

The remainder of the paper is as follows. Section 2 provides a description of our data and of children's time use in the 24 informal settlements that make up our sample. Section 3 outlines the empirical strategy and the main results of estimating the gender gap in children's time use. Section 4 focuses on the child gender gap in parents' time use. Section 5 presents results on the gender gap in children's time use by different degrees of family disadvantage. Section 6 concludes.

2 Children's and caregivers' time use in informal settlements

2.1 Time use data

The data we use are based on a biennial longitudinal survey of urban informal settlement residents in Makassar, Indonesia and Suva, Fiji. The surveys were collected as part of a larger research project, the Revitalising Informal Settlements and their Environment Program (RISE), which is trialling sustainable water and sanitation solutions in the informal settlements (French et al., 2021; Leder et al., 2021).

The time use data consist of two surveys in each country collected between November 2018 – January 2019 and February – March 2021 in Indonesia, and between June – August 2019 and February – April 2021 in Fiji. They include detailed information on children's and caregivers' time use in the week prior to the survey, as well as demographic and household characteristics. Interviews were conducted with one respondent per household in each settlement. For households with children, the respondent was the children's primary caregiver, and the surveys collected time use information about multiple children aged 5 to 15. The

resulting sample with time use data includes 557 Indonesian children and 898 Fijian children across the 24 informal settlements in the RISE study.

As Appendix Table 1 shows, the average age of children in the combined waves is 9.6 and, in each country, approximately half (52%) are boys. Most children in the sample attended school according to their caregivers, 89% in Indonesia and 96% in Fiji, with no significant differences between boys and girls. Closely tracking these averages, 85% of Fijian caregivers had completed at least secondary school, whereas in Indonesia, only 53% of caregivers were in this category. This is consistent with the fact that 26% of Fijian caregivers and 9% of Indonesian caregivers are male.

The second time use survey in Indonesia was modified to capture schooling from home. Many Indonesian cities, including Makassar, were under stay-at-home orders to curb the spread of COVID-19 when wave 2 of the survey was rolled out. The peak of the pandemic infection took place later in Fiji, such that it was only in the second half of 2021 that students and teachers were advised to stay at home and attend online classes. These restrictions lasted for six months and were no longer in place when the second time use survey was rolled out (Ministry of Education, 2021). We account for the different schooling environments presented by COVID-19 by first descriptively examining differences in schooling time between waves 1 and 2 and then by including year and country fixed-effects in the regression analyses.

Children's time use information is collected with the question, "*In the past week, on how many days/hours/minutes did your child do the following activities?*". The activities included: a) going to school; b) collecting or buying water; c) watching TV; d) playing outside in the settlement; e) doing homework for school; f) working for wages; g) working for the family business; and h) caring for a household member.[3]

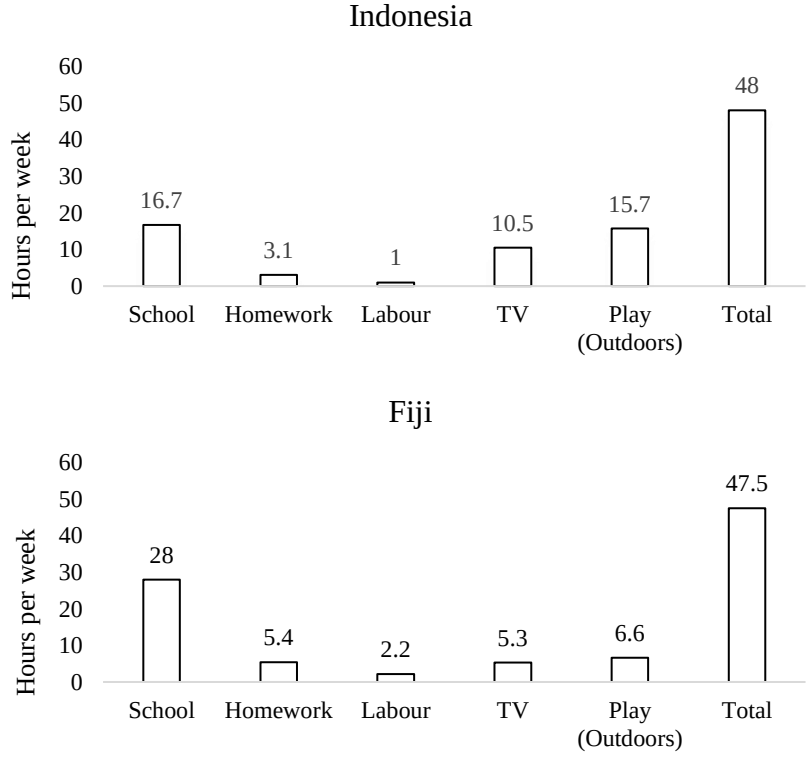
[3] We aggregate hours and minutes and multiply them by the number of days in the past week to construct a variable measuring the total number of hours spent in each activity during the week prior to the survey.

In a separate module, caregivers were asked a similar set of questions, this time referring to their own time allocation towards the following activities: a) reading to their children or helping with their homework; b) caring for sick family members; c) working in the family business; and d) doing paid labour as an employee. As for children's time use, caregivers' responses are recoded to construct measures of the total hours dedicated to these activities in the week preceding the survey.

2.2 A Description of Children's Time Use

Our data account for approximately one-third of a child's weekly time allocation in both countries. In Figure 1, we pool both waves and decompose this time into separate blocks for schooling, homework, labour, TV time and time spent playing outdoors for each country.[4]

Fig. 1 Children's time use in informal settlements by country



Note: The figures above show the average number of hours/week children spent in different activities during the seven days prior to their household survey, as reported by their caregivers.

[4] The corresponding statistics by country and gender can be found in Appendix Figure 1.

The figure shows that Indonesian children spend an average of 16.7 hours/week in school. Meanwhile, the average Fijian child spends approximately 28 hours/week in school, almost twice the value of the Indonesian sample. This gap is present in both the pre- and post-COVID waves (see Appendix Figure 2). Most schools in both countries have a 5-day week, with the school day lasting between 6.5 and 9 hours, depending on the grade. This implies that most children should spend between 33 and 45 hours/week in school. This difference in our sample appears to originate from children attending both fewer and shorter days of school in Indonesia (on average 2.4 days/week and 4.87 hours/day) and shorter days in Fiji (4.9 days/week and 5.7 hours/day). Children from our sample of informal settlements in both countries are thus lagging behind national norms of schooling time, but especially so in Indonesia.

Additionally, we find differences in the average time spent on homework across the Indonesian and Fijian settlements. Fijian children dedicate an average of 5.4 hours/week to homework, while children in the Indonesian settlements only dedicate an average of 3.1 hours/week to homework.[5]

We find no evidence that a substantial portion of children's time is allocated towards labour. According to their caregivers, Indonesian and Fijian children only work between 1 and 2 hours/week, respectively. We cannot, however, rule out social desirability bias. Given that child labour is illegal in both countries, it is possible that our estimates suffer from underreporting. Moreover, since our measure of time dedicated to labour only accounts for time working for wages, working for the family business, collecting or buying water, and caring

[5] For Fiji, this is consistent with the homework policies in place in the schools attended by children in the settlements which stipulate that homework assignments should not exceed 15 minutes/day for year 1-2 students, 30 minutes/day in years 3-4, 45 minutes in year 4, 1 hour/day in years 5-6 and 1.5 hours in years 7-8. However, homework policies vary widely in Indonesia, with cities in some states such as East Java prohibiting homework assignment.

for a relative, it is possible that we are missing other forms of labour, such as selling home-produced items in the street.

Our third category of time use is leisure, which captures time watching television and playing outdoors. Our two measures of leisure make up approximately 37% of the total time we record for our sample of Indonesian children, who spend an average of 10.5 hours/week watching TV and 15.7 hours/week in outdoor play. In comparison, our sample of Fijian children spend less than 12 hours/week in both activities combined, with an average of 5.3 hours/week for TV and 6.6 hours/week for outdoor play. As Appendix Figure 3 shows, it is unlikely that the lower allocation of time to schooling and larger allocation of time to play in Indonesia relative to Fiji is driven by different age distributions in the samples.

3 The Gender Gap in Children's Time Use

Overall, the data suggest that our sample of children living in informal settlements dedicates less time to educational activities than is prescribed by the school schedule. This deficit pre-dates the COVID-19 epidemic but was exacerbated by it. In this section, we explore whether gender plays a role in how children and their caregivers spend their time in these settings. In both countries, administrative records and survey data show that boys are not only less likely to enrol in secondary school, but they also perform worse in school examinations and standardised test scores (OECD, 2018; UNESCO, 2022a). We hypothesise that gendered patterns in children's time allocation and parental investments are likely to contribute to these trends.

3.1 Empirical specification

We employ two types of econometric models to estimate the gender gap in children's time use. First, we estimate regressions with settlement and wave fixed-effects:

$$y_{ist} = \beta_0 + \beta_1 male_i + \alpha_s + \sigma_t + \delta_1 X'_{it} + \varepsilon_{ist} \quad (1),$$

where *i* indexes individuals, *s* the informal settlements and *t* the survey waves. The dependent variable, y_{ist} denotes our four main outcomes, which are the hours in the week prior to the survey spent in: educational activities; working; watching television; and, playing outdoors. $male_i$ takes a value of one if the child is male and zero if female, and β_1 is our main parameter of interest.

Parameters α_s and σ_t capture the settlement and wave fixed effects, respectively. The settlement fixed effects allow us to compare boys and girls within the same small settlement,[6] who are living under similar conditions in terms of settlement size and density, socioeconomic status, ethnic and religious composition, and access to essential services such as healthcare, roads, and schooling; all of which could affect children's time use. For example, qualitative evidence collected by field-workers during the survey roll-out suggests that most children attend the school nearest to their settlement so α_s captures unobserved time constant factors specific to the settlement including the school. The time fixed effects ensure that we only compare children's time use during the same wave of data collection.

X'_i is a vector of child, caregiver and household characteristics and include: the child's age, the caregiver's age and gender, whether the caregiver answering the survey is the child's parent, the caregiver's marital status and their schooling level, the number of children and people in the house, household wealth, survey duration, whether the caregiver had problems answering the survey, and country indicators in the pooled regressions.

We additionally estimate regressions with household fixed-effects:

$$y_{iht} = \beta_0 + \beta_1 male_i + \gamma_h + \sigma_t + \delta_1 X'_{it} + \varepsilon_{iht} \quad (2),$$

[6] The settlements have between 20 - 150 houses each.

which compares boys and girls living in the same household. In most cases, the children being compared are siblings. Only 53% of households have a boy-girl dyad, so our statistical power is significantly reduced compared to the within-settlement specifications. Therefore, our preferred specification is equation (1), and we will only refer to the results from equation (2) as a check for the consistency of the sign in our gender coefficient. In both specifications, standard errors are clustered at the household level.

3.2 Main results

The main results for the coefficient of gender on children's time use are reported in Tables 1 and 2. Panel A shows the pooled results, Panel B shows the results for children in the Indonesian settlements, and Panel C shows the results for children in the Fijian settlements.

Table 1. Gender gap in children's time use (Hours per week)

	(1) Educational Hours	(2) Labour Hours	(3) TV Hours	(4) Play Hours
Panel A - Pooled				
Child's gender = Male	-2.625***	-0.671*	0.308	3.558***
	(0.708)	(0.390)	(0.459)	(0.523)
Panel B - Indonesia				
Child's gender = Male	-2.248***	-0.946***	-0.492	6.877***
	(0.815)	(0.350)	(0.838)	(0.982)
Panel C - Fiji				
Child's gender = Male	-2.863***	-0.485	0.807	1.268**
	(1.038)	(0.612)	(0.537)	(0.532)
p-value (difference)	0.817	0.404	0.156	0.000
Outcome mean (pooled)	27.95	1.72	7.4	10.2
Outcome mean (Indonesia)	19.82	0.98	10.51	15.67
Outcome mean (Fiji)	33.26	2.21	5.31	6.62
Observations	2,014	2,014	2,010	2,011

Notes: All outcomes are measured in hours per week. All models control for the child's age, gender, the respondent's age, gender, parental status, marital status, number of people in the house, number of children in the house, whether the respondent has secondary schooling, survey duration, household asset wealth, whether the respondent had problems answering the survey, as well as settlement and wave fixed effects. The p-values at the bottom correspond to the statistical difference between the Indonesian and Fijian coefficients. Standard errors in parentheses clustered on the household level. * p<0.1; ** p<0.05; *** p<0.01

The estimates in Panel A of Table 1 show that boys spend, on average, 2.6 fewer hours/week in educational activities than girls living in the same settlement.[7] This corresponds to about 9.3% fewer hours/week relative to the mean of about 28 hours. The corresponding estimates for the within-household (siblings) specifications in Appendix Table 2 confirm this intuition such that boys spend 1.7 fewer hours/week in schooling and homework than girls in the same household. The size of the gender gap is remarkably consistent in both countries, with a slightly larger gap among Indonesian children relative to the mean (11.3% versus 8.6%), though this between-country difference is not statistically significant (*p-value* = 0.817). Table 2, which reports the estimates when we disaggregate the education and labour hours categories, shows that the gender gap is driven by both types of educational activities: attending school and doing homework.

Table 2. Education and labour breakdown

	(1) School Hours	(2) Homework Hours	(3) Hours Collecting Water	(4) Hours in Family Business	(5) Caring Hours
Panel A - Pooled					
Child's gender = Male	-1.914***	-0.711**	-0.087	-0.160	-0.424***
	(0.578)	(0.298)	(0.300)	(0.145)	(0.156)
Panel B - Indonesia					
Child's gender = Male	-1.864***	-0.385	-0.034	-0.324	-0.588**
	(0.699)	(0.291)	(0.070)	(0.232)	(0.258)
Panel C - Fiji					
Child's gender = Male	-1.942**	-0.921**	-0.120	-0.056	-0.308
	(0.847)	(0.464)	(0.506)	(0.188)	(0.188)
p-value (difference)	0.490	0.379	0.910	0.328	0.274
Outcome mean (pooled)	21.37	4.50	0.90	0.38	0.45
Outcome mean (Indonesia)	11.45	3.13	0.09	0.49	0.41
Outcome mean (Fiji)	27.87	5.40	1.42	0.31	0.48
Observations	2,014	2,014	2,014	2,014	2,014

Notes: All outcomes are measured in hours per week. All models control for the child's age, gender, the respondent's age, gender, parental status, marital status, number of people in the house, number of children in the house, whether the respondent has secondary schooling, survey duration, household asset wealth, whether the respondent had problems answering the survey, as well as settlement and wave fixed effects. The p-values at the bottom correspond to the statistical difference between the Indonesian and Fijian coefficients. Standard errors in parentheses clustered on household level. * p<0.1; ** p<0.05; *** p<0.01

[7] In Appendix Table 3, we show all the controls included in Table 1. Only age of the child and household wealth are significantly associated with children's time allocation, apart from gender. As household wealth increases, so does children's time spent in educational activities but play hours decrease.

However, while boys' time spent in school is lagging in both countries, the gender gap in time spent doing homework is primarily driven by children in the Fijian settlements.

Given the potential substitution between children's time spent in education and labour, a possible explanation for the educational gap favouring girls is that boys work more. However, this does not appear to be the case. The estimates in column (2) of Table 1 suggest that Indonesian boys spent almost one hour less per week in unpaid labour than Indonesian girls. Compared to the mean, this implies that girls do 97% of the reported labour hours in the Indonesian settlements. While the estimated gender difference in Fiji is not as large and the coefficients are imprecisely estimated, the results are consistent in direction. While girls study more, they are also burdened by spending more time caring for their relatives, collecting water and working for the family business, though the last two are not statistically significant. We are, however, hesitant to draw strong conclusions from this finding as there may be underreporting of paid labour, which is more likely to be undertaken by males. For example, while girls may do more labour in the household (such as chores and caregiving), boys may be more likely to work for wages in farms, factories or streets, which is illegal in both countries.

Next, we explore the gender differences in two types of leisure activities recorded in our surveys: watching TV and playing outdoors. Given the negative mental health impacts associated with screen time (Stiglic & Viner, 2019), it is encouraging not to find evidence of a gender gap in this outcome. However, boys spend between 1.3 (Fiji) and 6.8 (Indonesia) more hours/week than girls playing outdoors. The large difference between the two countries is likely driven, at least in part, by different gender norms dictating the locations that boys and girls can visit (Chandramohan et al., 2023). Overall, the gender gap in play time estimated in Table 1 may initially appear to be favourable for boys, as more physical activity during childhood is associated with positive health and developmental outcomes in later life (Carson et al., 2017). We argue that this is not necessarily the case in informal settlement settings where the risk of

exposure to environmental health hazards is high (Ezeh et al., 2017). For example, among our sample, the soil and waterways in the 24 informal settlements, have *E. coli* concentrations considered by the WHO to indicate raw sewage contamination (French et al., 2021). Altogether, these estimates suggest that boys spend their time in less productive and potentially riskier activities than girls in the same neighbourhood and household.

Furthermore, the lower time allocated to educational activities will likely have negative consequences for children's academic and later life outcomes, especially because there are cumulative effects and complementarities in learning (Cunha & Heckman, 2007). In Table 3, we show the gender gaps by broad age group (5-10 years and 11-15 years), and we see some evidence that the gender gaps for educational and play hours increases with age (although the difference is statistically insignificant for the educational hours). These trends are consistent with a cumulative effect of investments in education.

Table 3. Heterogeneity in the gender gap by age and age of the child

	(1) Educational Hours	(2) Labour Hours	(3) TV Hours	(4) Play Hours
Male x Age 5-10	-2.266**	-0.359	0.745	2.586***
	(0.893)	(0.405)	(0.600)	(0.695)
Male x Age 11-15	-2.992**	-1.349	-0.478	4.692***
	(1.281)	(0.873)	(0.783)	(0.793)
p-value (difference)	0.589	0.348	0.162	0.030
Outcome mean (pooled)	27.95	1.72	7.4	10.2

Notes: All outcomes are measured in hours per week. Columns (1) – (4) are estimated on the pooled sample. The p-values at the bottom correspond to the statistical difference between the two age groups. All regressions control for the child's gender, the respondent's age, gender, parental status, marital status, number of people in the house, number of children in the house, whether the respondent has secondary schooling, survey duration, household asset wealth, whether the respondent had problems answering the survey, as well as settlement and wave fixed effects. Standard errors in parentheses clustered on household level. * p<0.1; ** p<0.05; *** p<0.01

4 The Child Gender Gap in Parental Time Use

Next, we investigate whether a gender gap is also observed in parental investments, in particular the time they spend reading to children or helping them with their homework. It is

not *a priori* clear whether parental time investments ought to align with children's own time investments in education. For example, caregivers may invest more time reading/helping children who are falling behind because they need additional support, or they may invest more time to children in whose education they are more invested in, or who have a natural advantage in learning and where the costs of delivering the support are lower (Baker & Milligan, 2016; Frijters et al., 2013).

Caregivers did not have to report how they split this time if they had multiple children, so we only estimate the gender difference in time spent reading or helping with homework by creating a measure of the share of boys in the household (ranging from 0 to 1). The estimation approach is as follows:

$$y_{pst} = \pi_0 + \pi_1 ShareMales_p + \alpha_{sp} + \sigma_t + \delta_1 X'_{pt} + \varepsilon_{pst} \quad (3),$$

where p indexes parents, s the informal settlements and t the survey waves. The dependent variable, y_{pst} denotes our four parent outcomes: hours spent reading to the child and helping with homework; caring for sick family members; working in the family business; and, doing paid labour as an employee in the week prior to the survey. $ShareMales_i$ is a continuous variable that ranges between 0 and 1; where zero (one) means that the caregiver only has female (male) children. π_1 is our main parameter of interest. Parameters α_{sp} and σ_t capture the settlement-by-share of boys and wave fixed effects, respectively. The former allows us to control for settlement specific gender attitudes, such that the remainder, captured by π_1, is the family-level response (to a larger share of boys) within settlements. X'_{pt} is a vector of caregiver and household characteristics that include asset wealth, age and gender of the respondent, whether the respondent has secondary schooling, their marital status, whether they are the children's parent and country indicators in the pooled regressions.

The pooled results in column (1) of Table 4 show that when there is a higher share of boys in the household, caregivers spend less time reading to children or helping them with

homework. This is mainly driven by households in Fiji, where a one-unit increase in the share (i.e., an increase from 0% to 100% or all girls to all boys) is associated with 1.53 fewer hours of the main caregiver's time investment in educational activities (*p-value* <.01).

Table 4. Relationship between the share of boys in the household and caregivers' time use by country

	Reading & helping with homework (1)	Caring for family members (2)	Working in the family business (3)	Paid work as employee (4)
Panel A - Pooled				
Share of boys	-0.331*	1.811***	0.013	-2.789***
	(0.161)	(0.286)	(0.368)	(0.497)
Panel B - Indonesia				
Share of boys	-0.083	1.146***	0.782	-3.482***
	(0.080)	(0.102)	(0.481)	(0.364)
Panel C - Fiji				
Share of boys	-1.534***	2.703***	-5.880***	-9.238***
	(0.340)	(0.441)	(0.336)	(0.709)
p-value (difference)	0.002	0.007	0.000	0.000
Outcome mean (pooled)	4.21	2.54	6.62	7.04
Outcome mean (Indonesia)	2.61	2.05	7.22	5.85
Outcome mean (Fiji)	5.18	2.83	6.26	7.75
Observations	2,114	2,101	2,116	2,115

Notes: All outcomes are measured in hours per week. All models controls for the share of boys in the household, asset wealth, age and gender of the respondent, whether the respondent has secondary schooling, their marital status, whether they are the child's parent, as well country, wave, and settlement by share of boys fixed effects. Standard errors in parentheses clustered on settlement level. * p<0.1; ** p<0.05; *** p<0.01

In columns (2) to (4), we examine the caregiver's time in paid and unpaid labour as competing priorities for the caregiver's time. We find in column (2) that when there is a higher share of boys in the household, caregivers spend more hours caring for family members. The estimates are significant at the 1% level for both Indonesia and Fiji, though the size of the relationship is larger in Fiji. These findings align with the results in Table 2, which show that girls spend significantly more time caring for family members than boys. Together, the results indicate that having more girls in the household alleviates caring duties from the main caregiver, potentially freeing up time for the caregiver to spend with girls on their schoolwork. This occurs while boys play outside the house, which is culturally more acceptable.

In columns (3) and (4), we also find that when there is a higher share of boys in the household, the primary caregiver spends substantially less time doing paid labour in both Indonesia and Fiji. In Fiji, they also spend less time working in a family business. These results align with the common substitution between caring duties and paid employment that is often borne by primary caregivers globally. Thus, we provide early evidence to suggest that in informal settlements, the ability of caregivers to undertake paid labour differs by child gender, which may be partly due to the time girls spend on domestic work.

5 The Child Gender Gap and Higher Family Disadvantage

A recent UNESCO report focusing on the reverse gender education gap in Fiji finds parents' often expected sons to be providers and take over their father's business (often farms), while daughters were expected to leave home to marry and eventually return to care for their elderly parents (UNESCO, 2022a). A family with these expectations may conclude that there are higher returns to investing in girls' education, since schooling is valuable in the marriage and job markets, leading to the above results. Given these expectations are more common among disadvantaged, less educated families, we would anticipate larger gender gaps when family disadvantage is greater.

To test this hypothesis, we separately estimate equation (1) for children in more and less disadvantaged families. It is important to be mindful that all households in the sample experience economic disadvantage, and thus, this analysis examines more extreme disadvantage compared with less extreme disadvantage. Family disadvantage is captured in two ways: schooling level of the caregiver and self-assessed financial stress. The former measures a more stable form of disadvantage, whereas the latter measures current circumstances. Approximately 27% of children in the combined sample have caregivers who

have either no schooling or only primary schooling. Almost 60% of children in our sample live in households experiencing financial stress, 54% in Indonesia and 63% in Fiji.[8]

Importantly, Appendix Table 4 shows that child gender is independent of family disadvantage. That is, boys and girls are not differentially likely to grow up in households that are wealthier, have an employed household head, have literate or highly schooled caregivers, or have a caregiver who is married. Similarly, in Appendix Table 5, we show that households with these characteristics are not differentially likely to have a larger share of boys.

Table 5 shows the estimated coefficients for this exercise. In Panel A, we disaggregate the gender gap by the caregiver's secondary schooling levels.

Table 5. Heterogeneity in the gender gap by indicators of higher family disadvantage

	(1) Educational Hours	(2) Labour Hours	(3) TV Hours	(4) Play Hours
Panel A - Caregiver's Schooling				
Male x Primary or Less	-3.569***	-1.432**	-0.714	6.434***
	(1.196)	(0.658)	(0.844)	(1.073)
Male x Secondary or Higher	-2.115**	-0.299	0.779	2.360***
	(0.859)	(0.466)	(0.547)	(0.571)
p-value (difference)	0.166	0.081	0.124	0.001
Panel B – Financial Stress				
Male x Difficulty making ends meet	-3.510***	-1.713***	0.694	3.211***
	(0.959)	(0.486)	(0.511)	(0.648)
Male x Easily make ends meet	-2.722**	0.467	-0.284	3.867***
	(1.148)	(0.682)	(0.770)	(0.869)
p-value (difference)	0.702	0.012	0.291	0.358

Notes: All outcomes are measured in hours per week. All models control for the child's age, gender, the respondent's age, gender, parental status, marital status, number of people in the house, number of children in the house, survey duration, household asset wealth, whether the respondent had problems answering the survey, as well as settlement and wave fixed effects. The p-values at the bottom of each panel correspond to the statistical difference between the SES groups. Standard errors in parentheses clustered on household level. * p<0.1; ** p<0.05; *** p<0.01

[8] Financial stress is created from the survey question: Thinking of your household's total monthly or weekly income, is your household able to make ends meet, that is pay your usual expenses? Responses ranged from 1 – with great difficulty to 6 – very easily. Households that answered 1 – with great difficulty, 2 – with difficulty and 3 – with some difficulty, were coded as experiencing financial stress (1). Household with that answered 4 – fairly easily, 5 – easily and 6 – very easily, were coded as zeros (no financial stress).

We find that while the gap in educational and play hours is still present across both groups, it is substantially larger for children whose caregivers have not completed secondary school. The difference by parental education is highly significant for play hours, but not statistically significant for educational hours. In Panel B, we find consistent results emphasising that boys' educational time is deprioritised when faced with high levels of scarcity. Though the difference in educational time by financial stress levels is large in magnitude, it is not statistically significant. Overall, these results are broadly in line with the findings by Autor et al. (2019), Bertrand & Pan (2013), and Chetty & Hendren (2018a), suggesting that poorer child-rearing environments are particularly harmful for boys.

6 Discussion

Gender imbalances harm economic development and growth, which is why gender equality, and the empowerment of women and girls continue to be central to the global development agenda (IMF, 2020). Regarding educational outcomes, this gap is not only closing, but statistics show significant reversals across a broad cross-section of countries.

We explore one potential contributor to this emerging educational gender gap in these understudied settings. Using unique survey data on how children in informal settlements spend their time, we examine the gender differences in educational time investments made by children and their caregivers. Our results show that a) children in informal settlements spent fewer and shorter days in school compared to the norm, and b) that boys living in these settings also spend almost 10% fewer hours/week in educational activities than girls. They are also significantly more exposed to contaminants because of the time they spend playing outdoors in the settlements.

Although girls invest more time in educational activities, they also devote more time to caring duties in the household. This leaves girls with less time for other activities essential for

human capital growth, such as leisure and further investment in their education. But at the same time, this appears to reduce the time their caregivers need to spend on caring duties, partly explaining the greater caregiver investment in educational activities provided to girls, namely in helping with their homework and reading to them. Like Autor et al. (2019) and Bertrand & Pan (2013), we find that the lower investment in education for boys is much greater as household socioeconomic disadvantage increases, although our estimates are imprecisely measured. This suggests some degree of intergenerational transmission of disadvantage in informal settlements for boys.

These gaps could have both direct and indirect consequences. Studies show that males' labour market outcomes are susceptible to disadvantaged childhood environments (Chetty, Hendren, Lin, et al., 2016). Furthermore, the indirect social costs could be substantial. Boys and men falling behind in school could be more vulnerable to falling prey to crime (Huttunen et al., 2023; Lochner & Moretti, 2004), have more drug use disorders (Fothergill et al., 2008), have less trust in government, lower political participation (Hakhverdian & Mayne, 2012; Mayer, 2011), and have less progressive values and behaviours (Pew Research Center, 2016). These externalities are not observable in our data, so more research is needed to determine whether they materialise.

Getting boys back on track could be achieved by increasing parents' awareness of the potential negative externalities for how their children spend their time. Of all the inputs that can contribute to children's human capital production function, the time investments of children and their caregivers in educational activities is not only highly productive, but also malleable in the short term. In contrast, inputs such as parental education, school infrastructure and teacher quality may not be as easy to adjust, particularly in highly disadvantaged settings such as the one studied in this paper.

Declarations

Conflicts of Interests: The authors have no relevant financial or non-financial interests to disclose.

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Ethics Approval: This study is approved by participating universities and local IRBs, including: Monash University Human Research Ethics Committee (Melbourne, Australia; project ID 35903), Ministry of Research, Technology and Higher Education Ethics Committee of Medical Research at the Faculty of Medicine, Universitas Hasanuddin (Makassar, Indonesia; protocol UH18020110), and Fiji National University College Human Health Research Ethics Committee (CHREC ID 137.19). This trial is registered with the Australian and New Zealand Clinical Trials Registry (ACTRN12618000633280; https://www.anzctr.org.au/).

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Appendix Figures

Fig. A1 Time use in the settlements by country and gender of the child

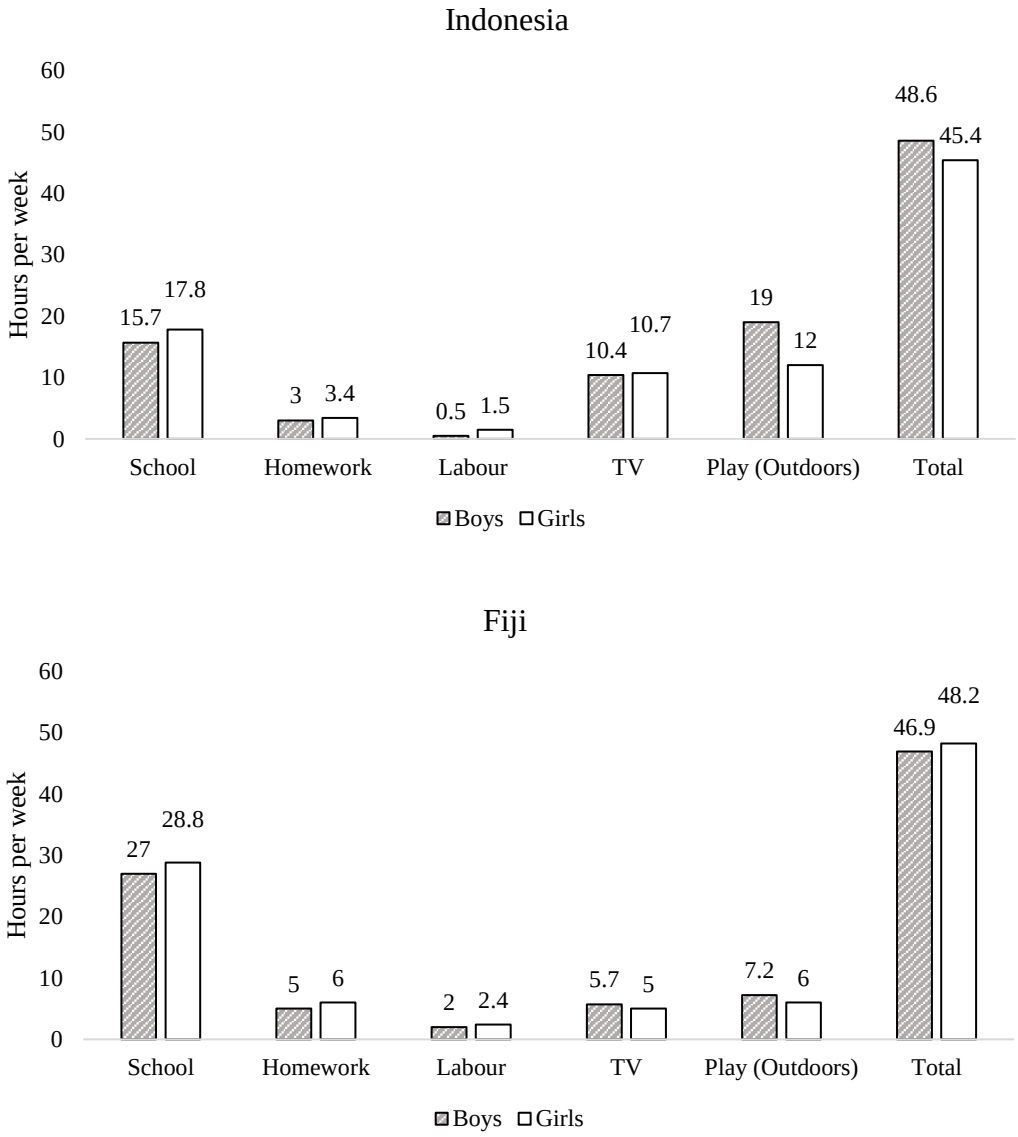


Fig. A2 Time use in the settlements by country and wave

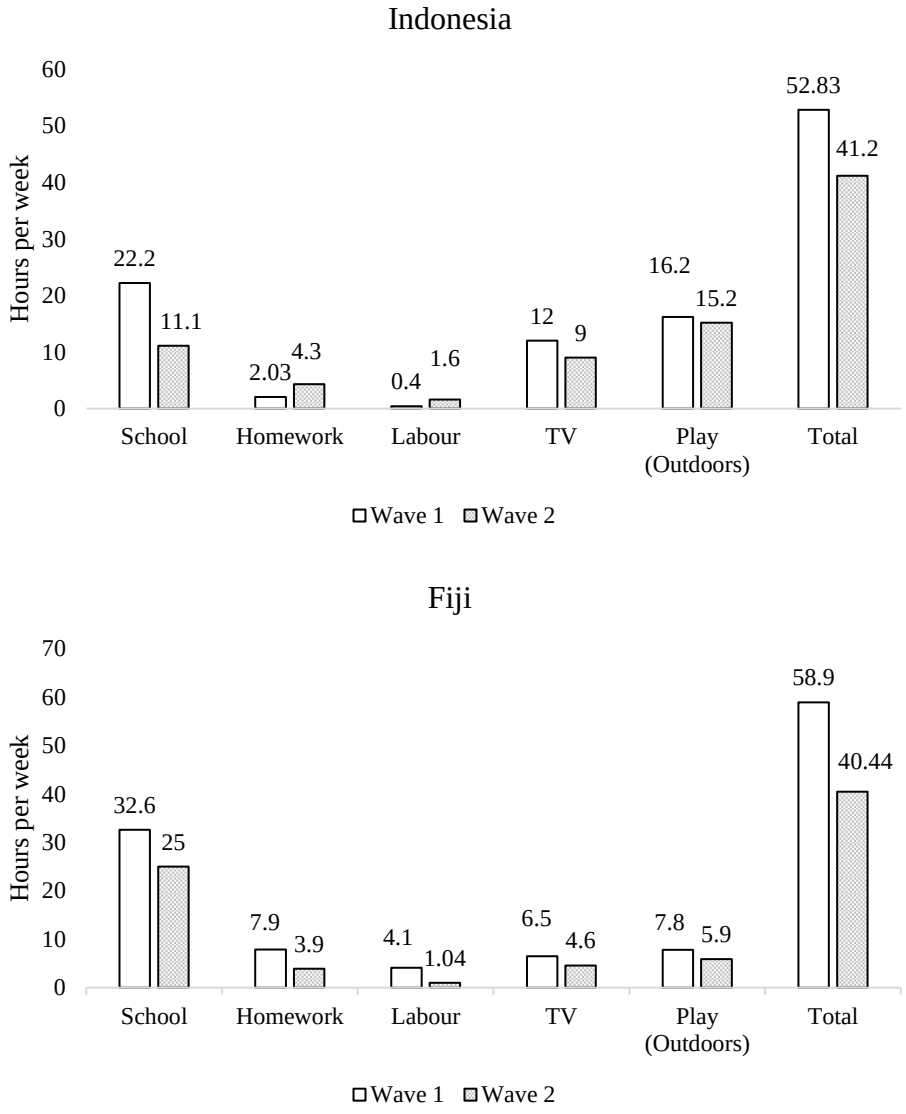
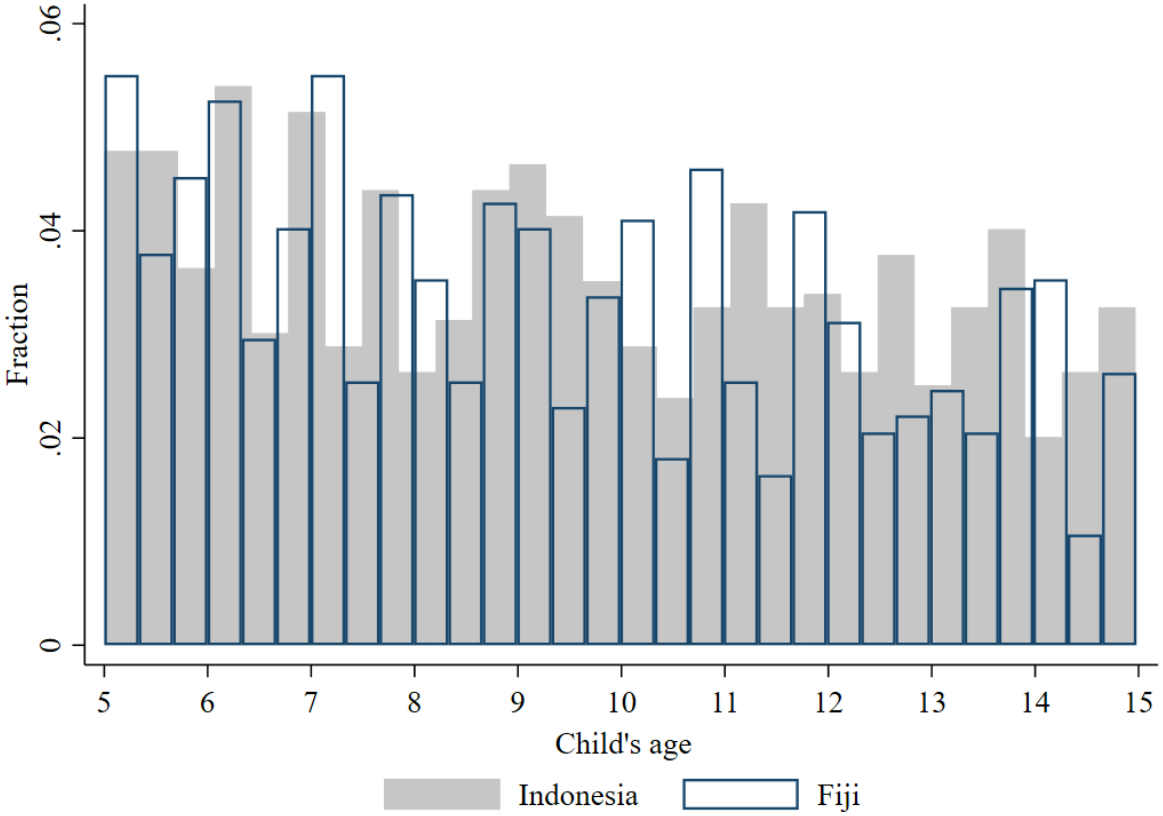


Fig. A3 Age distribution by country



Appendix Tables

Table A1. Characteristics of children in the sample

	(1) Mean	(2) S.D.	(3) Min	(4) Max
Panel A - Pooled Sample				
Child's age	9.60	2.88	5	15
Child's gender = Male	0.52	0.50	0	1
Attending school	0.92	0.27	0	1
Caregiver's gender = Male	0.19	0.39	0	1
Caregiver secondary schooling	0.73	0.45	0	1
Caregiver's age	40.84	11.59	16	83
Number of siblings	1.77	1.66	0	9
Panel B – Indonesia				
Child's age	9.67	2.87	5	15
Child's gender = Male	0.52	0.5	0	1
Attending school	0.89	0.31	0	1
Caregiver's gender	0.09	0.28	0	1
Caregiver secondary schooling	0.53	0.5	0	1
Caregiver's age	39.05	9.1	16.7	81
Number of siblings	1.15	1.06	0	7
Panel C - Fiji				
Child's age	9.54	2.88	5	15
Child's gender = Male	0.52	0.50	0	1
Attending school	0.96	0.19	0	1
Caregiver's gender	0.26	0.44	0	1
Caregiver secondary schooling	0.85	0.36	0	1
Caregiver's age	42.2	13.02	16	83
Number of siblings	2.18	1.85	0	9

Notes: The values reported above pool data from 2 waves in Indonesia and 2 waves in Fiji.

Table A2. Gender gap in children's time use - Household Fixed Effects

	(1) Educational Hours	(2) Labour Hours	(3) TV Hours	(4) Play Hours
Child's gender = Male	-1.798	-0.483	0.566	2.823***
	(1.112)	(0.529)	(0.677)	(0.936)
Outcome mean (pooled)	27.95	1.72	7.4	10.2
Observations	2,014	2,014	2,010	2,011

Notes: All outcomes are measured in hours per week. All models control for the child's age, gender, the respondent's age, gender, parental status, marital status, number of people in the house, number of children in the house, whether the respondent has secondary schooling, survey duration, household asset wealth, whether the respondent had problems answering the survey, as well as wave and household fixed effects. Standard errors in parentheses clustered on household level. * p<0.1; ** p<0.05; *** p<0.01

Table A3. Table 1 with controls - Pooled sample

	(1) Educational Hours	(2) Labour Hours	(3) TV Hours	(4) Play Hours
Age of the child	1.619***	0.354***	-0.098	-0.450***
	(0.128)	(0.078)	(0.086)	(0.087)
Child's gender = Male	-2.625***	-0.671*	0.308	3.558***
	(0.708)	(0.390)	(0.459)	(0.523)
Household wealth (z-score)	1.418***	0.400	0.498*	-1.297***
	(0.440)	(0.260)	(0.261)	(0.275)
Caregiver's age	0.008	0.004	-0.016	0.013
	(0.047)	(0.021)	(0.024)	(0.026)
Caregiver's gender = male	-0.833	-0.745	0.019	-0.894
	(1.268)	(0.539)	(0.625)	(0.573)
Caregiver has secondary schooling +	-0.407	-0.356	-0.249	-0.941
	(0.957)	(0.559)	(0.652)	(0.730)
Caregiver is married	0.520	0.912	0.192	0.622
	(1.353)	(0.645)	(0.716)	(0.680)
Caregiver is the parent	0.190	-0.265	-0.078	0.367
	(1.261)	(0.706)	(0.692)	(0.756)
Number of people in the house	0.039	0.120	0.300*	0.272
	(0.273)	(0.140)	(0.161)	(0.167)
Number of children in the house	-0.535	-0.108	-0.374	0.258
	(0.587)	(0.248)	(0.262)	(0.308)
Wave 2 - Fiji	-12.108***	-3.054***	-1.505**	-1.861***
	(1.361)	(0.793)	(0.623)	(0.670)
Wave 2 - Indonesia	-10.777***	1.113**	-3.014***	-0.014
	(1.273)	(0.452)	(1.053)	(1.116)
Outcome mean (pooled)	27.95	1.72	7.4	10.2
Observations	2,014	2,014	2,010	2,011

Notes: All outcomes are measured in hours per week. All models control for the child's age, gender, the respondent's age, gender, parental status, marital status, number of people in the house, number of children in the house, whether the respondent has secondary schooling, survey duration, household asset wealth, whether the respondent had problems answering the survey, as well as settlement and wave fixed effects. Standard errors in parentheses clustered on household level. * p<0.1; ** p<0.05; *** p<0.01

Table A4. Balance in children's gender across SES indicators

	Household Wealth Score	Caregiver can read and write	Caregiver has secondary schooling	Household head is employed	Caregiver is married
	(1)	(2)	(3)	(4)	(5)
Panel A - Pooled					
Child's gender = Male	0.037	-0.004	-0.009	-0.018	0.008
	(0.034)	(0.009)	(0.015)	(0.017)	(0.010)
Panel B - Indonesia					
Child's gender = Male	0.030	-0.026*	-0.012	-0.004	0.017
	(0.063)	(0.016)	(0.032)	(0.029)	(0.013)
Panel C - Fiji					
Child's gender = Male	0.042	0.011	-0.007	-0.027	0.001
	(0.039)	(0.010)	(0.013)	(0.021)	(0.014)

Notes: Regressions include settlement fixed effects. Standard errors in parenthesis are clustered at the household level. * p<0.1; ** p<0.05; *** p<0.01.

Table A5. Balance in share of male children under 15 years old across SES indicators

	Household Wealth Score	Caregiver can read and write	Caregiver has secondary schooling	Household head is employed	Caregiver is married
	(1)	(2)	(3)	(4)	(5)
Panel A - Pooled					
Share of males	0.112	-0.006	-0.006	-0.057	0.016
	(0.078)	(0.021)	(0.035)	(0.041)	(0.025)
Panel B - Indonesia					
Share of males	0.080	-0.034	0.013	-0.017	0.018
	(0.119)	(0.030)	(0.061)	(0.055)	(0.027)
Panel C - Fiji					
Share of males	0.142	0.021	-0.023	-0.096	0.013
	(0.102)	(0.028)	(0.038)	(0.061)	(0.042)

Notes: Regressions include settlement fixed effects. Standard errors in parenthesis are clustered at the household level. * p<0.1; ** p<0.05; *** p<0.01.