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The long-run impacts of paid maternity leave on height and educational attainment

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This study investigates the extent to which paid maternity leave affects educational attainment and adult height in 29 developing countries between 1990 and 2019. The identification hinges upon the variation in the educational achievement and health outcomes of individuals residing in the same place but exposed to different lengths of paid maternity leave at birth due to policy reforms. The analysis uncovers the long-lasting favorable effects of paid maternity leave as an additional week of leave duration could result in an increase of around 0.007 years in educational attainment and 0.056 cm in adult height. The study calls for the enforcement and extension of paid maternity leave.

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Introduction

Paid maternity leave is a policy aimed at addressing the challenges faced by working women who become pregnant such as job loss, and suspended earnings, among others. The global standard about paid maternity leave created by the International Labour Organization (ILO) requires a minimum 12-week duration and recommends a 14-week duration (ILO, 1998). In response, different countries, in different years, initiated paid maternity leave and extended its duration. As stated by the World Bank (2018), almost every nation in the world has paid maternity leave laws although the duration, who pays for it, and the degree of employment protection might differ.

Prior works have documented that paid maternity leave may yield beneficial effects on both mothers and children. Specifically, paid maternity leave is shown to improve a wide range of maternal health including mental health, blood pressure, BMI, etc. (Butikofer et al., 2021). Women in pre-birth jobs who are covered by paid maternity leave have a faster return to work after delivery compared to women without leave coverage (Berger and Waldfogel, 2004). Paid maternity leave can also generate favorable effects on child development. For example, infants whose mothers are exposed to longer paid maternity leave are less likely to be hospitalized and die (Hajizadeh et al., 2015; Jou et al., 2017). Besides, paid maternity leave could lead to improvements in children's educational outcomes such as higher test scores and a lower probability of school dropping out (Baum, 2003; Carneiro et al., 2010). While much focus has been placed on the short- and medium-run effects of paid maternity leave, there is scant evidence on the long-run impacts of the policy.

This paper investigates the extent to which paid maternity leave affects long-run human capital accumulation, i.e., educational attainment and adult height, in 29 developing countries over nearly three decades. We make three contributions. First, we concentrate on the less obvious effects of paid maternity leave, whereas most previous research examines the more visible effects on child development in the short and medium run. Second, by evaluating how paid maternity leave can influence adult outcomes, this study provides additional evidence on the long-lasting impacts of early-life circumstances. Finally, rather than working on a single country, our sample spans 29 countries during the 1990–2019 period. Such large geographical and temporal coverage allows us to consider the estimated results as externally valid.

To estimate the impacts of interest, the Demographic and Health Survey (DHS) and the Women, Business and the Law 2021 file released by the World Bank are utilized. In terms of identification, our empirical model exploits the variation in the educational achievement and health outcomes of those living in the same area but exposed to different lengths of paid maternity leave at birth due to policy reforms. We uncover the long-lasting favorable effects of paid maternity leave as an additional week of paid maternity leave may lead to an increase of around 0.007 years in educational attainment and 0.056 cm in adult height. The results pass various robustness tests where alternate health measures and model specifications are employed.

The literature suggests multiple potential pathways to the positive impacts of paid maternity leave. First, by raising the amount of time the mother spends with her child, paid maternity leave might produce better childhood outcomes along the dimensions of health, behavior, and cognitive development, which could ultimately lead to higher educational attainment and taller stature in adulthood (Currie and Thomas, 2001; Case et al., 2005; Rabiner et al., 2016). Second, paid maternity leave decreases the probability of the child receiving non-parental care which has been shown to have detrimental impacts on child development and thus adult outcomes (Loeb et al., 2007; Baker et al., 2008). Finally, paid maternity leave gives the mother the financial

resources to afford various health inputs for her child. Given the vestigial effects of good health in early life on later-life outcomes, paid maternity leave may lead to higher educational attainment and taller stature (Hoynes et al., 2016).

In addition to enhancing maternal well-being and child development as shown in prior studies, our paper provides compelling evidence for the long-run beneficial returns of paid maternity leave to educational attainment and height in adulthood. To the extent that educational attainment and stature might be translated to the second generation, the potential benefits of policies aimed to improve the well-being of women such as paid maternity leave could have been previously underestimated. Therefore, our study calls for the enforcement and extension of paid maternity leave as one path to sustainable development.

Literature review

This paper evaluates the impacts of paid maternity leave on long-run human capital accumulation, measured by educational attainment and adult height. Adult stature is an important measure of human capital because it is the result of cumulative net nutrition and indicates the equilibrium between nutritional intake and losses across time (Perkins et al., 2016). Height is also associated with a variety of important outcomes such as cognitive functions (Case and Paxson, 2008; Lundborg et al., 2014a) and health outcomes (Paajanen et al., 2010; Nelson et al., 2015). Specifically, Case and Paxson (2008) and Lundborg et al. (2014a) show that adult height is positively correlated with memory and numeracy. Paajanen et al. (2010) and Nelson et al. (2015) point to a reduced risk of coronary heart disease and respiratory as well as cardiovascular diseases among taller adults compared to shorter adults. Therefore, adult height can be regarded as a measure of population cumulative health and development (Perkins et al., 2016).

Regarding educational attainment as an important measure of human capital, it is documented that education reduces mortality (Kaplan et al., 2014; Le and Nguyen, 2019; Case and Deaton, 2021) and raises the health outcomes for the second generation (Lundborg et al., 2014b; Nguyen and Le, 2022a). In monetary terms, the more educated people tend to have higher labor earnings than the low-educated ones (Ashenfelter and Rouse, 1998). Besides, individuals who attain higher years of education are more likely to participate in the financial market as measured by investment income and equities ownership and they are less likely to declare bankruptcy and experience foreclosure (Cole et al., 2014).

Our work builds on two lines of research. The first line of research examines the effects of maternity leave on child development and maternal outcomes. There is evidence for the link between leave policies and improvements in child health in high-income countries. Specifically, Jou et al. (2017) find that American women who took paid maternity leave are less likely to have their infants hospitalized. Also in the US, Rossin (2011)'s findings indicate that unpaid maternal leave provided through the Family and Medical Leave Act of 1993 decreases neonatal, post-neonatal, and infant mortality. The inverse relationship between paid maternity leave and infant mortality is also uncovered in European countries and OECD countries (Ruhm, 2000; Tanaka, 2005). The evidence in developing countries is, to some extent, quite scant. For example, Hajizadeh et al. (2015) show that paid maternity leave could raise the vaccination rate for children. According to Nandi et al (2016), each additional month of paid maternity was associated with a 13% relative reduction in infant death in low and middle-income countries.

In addition to the health effects, maternity leave can also lead to improvements in children’s educational outcomes. Particularly, children whose mothers are exposed to longer leave tend to have higher test scores and a lower probability of dropping out of school (Baum, 2003; Carneiro et al., 2010). With regard to maternal outcomes, it is documented that paid maternity leave positively affects mother’s labor market outcomes including job continuity, labor market attachment, as well as wages (Brugiavini et al., 2013; Rossin-Slater et al., 2013; Dahl et al., 2016). There is also evidence of the favorable effects of longer leave on mother’s post-partum mental health along with long-term mental health as they are less likely to experience depressive symptoms (Chatterji and Markowitz, 2012; Avendano et al., 2015). We contribute to this line of studies by exploring the long-run effects of paid maternity leave on human capital accumulation, i.e., educational attainment and adult height.

The second line of research our study can be connected to investigates the impacts of early-life circumstances on long-term outcomes. Nutritional intake during both the in-utero and the postnatal periods is critically linked to adult height (Silventoinen, 2003). Grasgruber et al. (2014) demonstrate that early-nutrition levels, especially the consumption of high-quality proteins, can explain most of the differences in adult height. Incidences of major diseases during childhood and the prenatal period can also depress educational attainment and also adult stature as infections might take away nutrients and inflammatory diseases might thwart the growth of long bones (Almond, 2006; Batty et al., 2009; Herzog et al., 2014; Ogasawara and Inoue, 2018).

Socioeconomic conditions including family income, parental education, and parental occupation are all important determinants of adult outcomes since such factors represent the degree of exposure to risks, access to resources, and maternal health behaviors of the mother (Silventoinen, 2003; Batty et al., 2009). Experiencing poverty in early life might deteriorate cognitive development, worsen health conditions, and lower earnings (Alderman et al., 2006; Duncan et al., 2010). Weather events can be another factor that can have long-run impacts as early-life exposure to rainfall leads to higher years of education completed and taller stature in adulthood (Maccini and Yang, 2009; Le and Nguyen, 2022).

In addition, government policies could act as positive treatments which might lead to favorable adult outcomes. Particularly, participation in preschool programs is positively linked to years of education, high school completion rate, and college attainment rate (Rossin-Slater and Wust, 2020). Better family economic resources through the food stamp program during early childhood result in improved socioeconomic outcomes for women (Hoynes et al., 2016). Cohodes et al. (2016) find that an increase in Medicaid eligibility during childhood decreases the high school dropout rate, raises college enrollment, and raises college completion. We add to this line of research by examining a different type of early-life condition, the paid maternity leave policy, on educational attainment and adult height.

Data

The Demographic and Health Survey (DHS) is the primary source of data in this study. Our analyses utilize the Household Members data file of the DHS that collects information on individual background characteristics (age, gender, marital status, etc.) and educational attainment as well as health outcomes. Educational attainment measured in single years and height measured in centimeters are the main outcomes in our main analysis. In the robustness analysis, we also utilize other measures such as whether the individual completed high school and height-for-age Z-score.

We obtain information on maternity leave from the Women, Business, and the Law 2021 file released by the World Bank (2021). This document belongs to a series of studies that measure laws and regulations influencing women’s socioeconomic opportunities in 190 countries. The Women, Business and the Law 2021 file provides detailed information on maternity leave such as its availability in each country, whether it is paid or not, whether the leave is fully administered by the government and the length of the leave. By definition, maternity leave refers to a period of absence from work granted to a mother before and after the birth of her child. Although not all birthing people identify themselves as women or mothers and maternity leave may not be an appropriate term for their leave, the term “maternity leave” is best used to reflect the labels used by governments. Information on the implementation year of the law governing maternity leave is also present. With the birth year of the individual available from the DHS, we can determine the length of paid maternity leave he/she was exposed to in his/her year of birth. For example, Bolivia raised the length of paid maternity leave from 60 to 90 days in 1977. Therefore, Bolivian individuals born in January 1977 and after had their mothers experience roughly 12.9 weeks of paid leave in their birth year. However, Bolivian individuals born before 1977 had their mothers experience only ~8.6 weeks of paid leave in their birth year.

Here, we impose two restrictions on our sample. First, since we are interested in the long-run effects of paid maternity leave on education and height, we only consider individuals who are above the age of 18. This value is chosen because it is considered the age of legal adulthood in most countries. Besides, the age of 18 also marks the end of school age (including high school), and most people do not grow taller after 18. Second, we only analyze nations where maternity leave benefits are completely administered by the government, including public funding, government-mandated private insurance, mandatory social insurance programs, or where employers compensate employees for any leave benefits provided directly to them. In the final case, the government requires the employer to pay for employee’s maternity leave and then reimburses the employer (World Bank, 2021). The purpose of this restriction is to avoid optional paid maternity leave, i.e. the paid maternity leave is endogenous to individual choices.

Our estimation sample includes almost one million individuals in 29 countries surveyed during the 1990–2019 period. Table A1 in the Appendix contains a list of nations. Descriptive statistics for the variables utilized in the study are reported in Table 1. On average, the individuals in our sample completed 8.038 educational years, and 24.9% of them finished high school. The average height is 157.2 cm, and the average height-for-age Z-score is -1.086 standard deviations. The negative value of the height-for-age Z-score is expected since the sample consists of mostly

Table 1 Summary statistics.

	Mean (1)	SD (2)	N (3)
Education (in single years)	8.038	5.072	1,232,975
High School Graduate	0.249	0.433	1,232,975
Height (in centimeters)	157.2	7.911	326,617
Height-for-age Z-score	-1.086	1.274	325,881
Paid Maternity Leave (in weeks)	11.54	3.580	1,232,975
Age	27.12	6.282	1,232,975
Being Male	0.476	0.499	1,232,970
Being Married	0.334	0.472	1,232,975
Residing in Rural Areas	0.441	0.496	1,232,975
Being Household Head	0.212	0.408	1,232,975

developing countries where people are usually shorter compared to the median of the reference population that also covers those from richer countries.

Our main explanatory variable Paid Maternity Leave is the duration of paid maternity leave (in weeks) in the individual's year of birth. According to Table 1, the average duration of paid maternity leave at birth is 11.54 weeks. On average, the individuals are 27.12 years old at the time of being surveyed. Around 47.6% of them are male, 33.4% are currently married, 44.1% reside in rural areas, and 21.2% are household heads.

Empirical methodology

We estimate the long-run effects of paid maternity leave on education and height outcomes using the following regression equation,

$$Y_{ijts} = \beta_0 + \beta_1 PML_{ijts} + \delta_j + \theta_t + \lambda_s + X'_{ijts} \Omega + \epsilon_{ijts} \quad (1)$$

The subscripts correspond to individual *i*, residential cluster *j*, year of birth *t*, and year of survey *s*. The variable *Y_{ijts}* represents the outcomes of interest including educational attainment in single years and height in centimeters. The variable *PML_{ijts}* (Paid Maternity Leave) presents the duration (in weeks) of paid maternity leave at birth of the individual. We respectively denote by δ_j , θ_t , and λ_s the fixed effects for the residential cluster, birth year, survey year.

The covariate *X'ijts* includes individual attributes such as gender, marital status, age, squared-age, whether the individual resides in rural areas and is the household head. Finally, the variable ϵ_{ijts} is the error term. Sampling weights are applied, and standard errors are clustered at the residential cluster level throughout the analysis.

We are particularly interested in the coefficient β_1 which captures the long-run impacts of paid maternity leave on education and height outcomes. In particular, the coefficient β_1 presents the quantified impacts of an additional week of paid maternity leave at birth on the education and health outcomes of individuals in adulthood. In this empirical setting, we take advantage of the variation in the education and health outcomes of individuals living in the same place but subject to different lengths of paid maternity leave at birth due to policy reforms. The identifying assumption is that the timing of policy reforms to extend leave length is uncorrelated with residential cluster-specific factors at birth that could affect individual education and health outcomes in adulthood.

Results

Main results. We report the estimated long-run impacts of paid maternity leave on education and health outcomes in adulthood in Tables 2 and 3. In these tables, Column 1 displays the estimates where only Paid Maternity Leave is accounted for. Next, we additionally control for individual attributes in Column 2 (i.e. gender, marital status, age, squared-age, whether the individual resides in rural areas and is the household head, and birth year as well as survey year fixed effects). Column 3 further incorporates into the regressions the country fixed effects. Finally, Column 4 presents our preferred specification where we replace the country fixed effects with residential cluster fixed effects. Here residential clusters refer to small neighborhoods that individuals live in.

Education. The long-run impacts of paid maternity leave on educational attainment are displayed in Table 2. Column 1 shows that an additional week of paid maternity leave is positively linked to an increase of ~0.095 educational years. Nevertheless, the estimate in Column 1 only presents a correlation between paid maternity leave and education because many factors

Table 2 The impacts of paid maternity leave on education.

	Y = Education (in single years)			
	(1)	(2)	(3)	(4)
Paid Maternity Leave (in weeks)	0.095*** (0.001)	0.067*** (0.001)	0.016*** (0.002)	0.007*** (0.001)
Observations	1,232,970	1,232,970	1,232,970	1,231,830
Residential Cluster FE	.	.	.	✓
Country FE	.	.	✓	.
Characteristics	.	✓	✓	✓

Characteristics include gender, marital status, age, squared-age, whether the individual resides in rural areas and is the household head, year of birth fixed effects, and year of survey fixed effects. Country FE and Residential Clusters FE refer to the country and residential cluster fixed effects, respectively.
*p < 0.1, **p < 0.05, ***p < 0.01.

Table 3 The impacts of paid maternity leave on height.

	Y = Height (in centimeters)			
	(1)	(2)	(3)	(4)
Paid maternity leave (in weeks)	0.079*** (0.003)	0.043*** (0.003)	0.044*** (0.004)	0.056*** (0.004)
Observations	326,617	326,616	326,616	325,459
Residential Cluster FE	.	.	.	✓
Country FE	.	.	✓	.
Characteristics	.	✓	✓	✓

Characteristics include gender, marital status, age, squared-age, whether the individual resides in rural areas and is the household head, year of birth fixed effects, and year of survey fixed effects. Country FE and Residential Clusters FE refer to country and residential cluster fixed effects, respectively.
*p < 0.1, **p < 0.05, ***p < 0.01.

simultaneously influencing paid leave and educational attainment are not accounted for. For instance, younger individuals might be exposed to longer paid maternity leave due to the growing importance of maternity leave in the development agenda of many countries in recent years. Younger individuals may also be more likely to complete more years of education thanks to advanced educational technology. Therefore, we proceed to control for individual characteristics in Column 2. Once individual characteristics are conditioned, the estimate decreases compared to Column 1. Column 2 shows that raising paid maternity leave by one week can increase the number of educational years completed by 0.067 years.

Nevertheless, the specification in Column 2 still cannot address unobserved factors jointly associated with the duration of paid maternity leave and educational attainment. For example, higher-income countries might tend to have longer paid leave. Individuals from these countries could have higher educational attainment. To account for differences in the institution, and culture, among others, at the aggregate level, we introduce country-fixed effects to our regression. Doing so further decreases the estimated impact of paid maternity leave on educational attainment. Specifically, Column 3 shows that an additional week of paid maternity leave is associated with an ~0.016-year increase in educational attainment (compared to the 0.07-year increase in Column 2).

While the specification in Column 3 can account for the across-country differences that could jointly determine the duration of paid maternity leave and educational attainment, it is still possible that different locations of a country might hold different approaches to the policy. For example, some locations may make it easier for women to experience the full duration of the leave by offering added

Table 4 The impacts of paid maternity leave—Robustness 1.

	5-Year window		2-Year window	
	Education (in single years)	Height (cm)	Education (in single years)	Height (cm)
	(1)	(2)	(3)	(4)
Paid maternity leave (in weeks)	0.010*** (0.002)	0.031*** (0.006)	0.008*** (0.002)	0.029*** (0.008)
Observations	382,479	95,653	175,869	40,623
Residential Cluster FE	✓	✓	✓	✓
Characteristics	✓	✓	✓	✓

Characteristics include gender, marital status, age, squared-age, whether the individual resides in rural areas and is the household head, year of birth fixed effects, and year of survey fixed effects. Country FE and Residential Clusters FE refer to the country and residential cluster fixed effects, respectively.
 * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

financial support, whereas others do not. Women in some locations might tend to utilize the full duration of the leave while those in others might want to get to work as soon as possible due to location-specific economic or cultural factors. To account for such a possibility, we make the within-residential cluster comparison of individuals in the length of paid maternity leave (Column 4). With the inclusion of the residential cluster fixed effects, we still detect a positive association between paid maternity leave and educational attainment but the magnitude of the impact shrinks considerably. Particularly, raising the duration of paid maternity leave by one week can lead to an increase in educational attainment by roughly 0.007 years.

Height. The estimated impacts of paid maternity leave on adult stature are reported in Table 3. Our simplest specification in Column 1 suggests that a one-week increase in paid maternity leave raises individual height in adulthood by ~0.079 cm. Without adequate controls, this specification only captures the simple correlation between paid maternity leave and adult height. In Column 2, we include individual characteristics as additional regressors. The point estimate is still statistically significant but the magnitude declines by roughly 50% from 0.079 to 0.043.

In Column 3, unobserved factors jointly correlated with paid maternity leave and individual height at the country level are accounted for. For example, some progressive countries might have longer paid leave for mothers. At the same time, individuals in such countries may tend to be taller. Such circumstances can be tackled by the inclusion of country-fixed effects. Column 3 shows that an additional week of paid maternity leave is associated with a 0.044 cm increase in future stature. Finally, our preferred specification in Column 4 replaces the country fixed effects with the residential fixed effects to account for possible unobserved heterogeneity across locations within a country. We find that an individual tends to be 0.056 cm taller in adulthood in response to a one-week increase in the duration of paid maternity leave in his/her year of birth.

Additional analysis. Here, we develop various model alternatives and outcome measures to evaluate the robustness of our results. In the first robustness exercise, we restrict our sample to individuals born within a specific window (5 and 2 years) prior to and after the paid maternity leave policy was implemented in each country. For instance, the length of paid maternity leave in Bolivia was extended from 60 to 90 days in 1977. Therefore, we first focus on individuals born between 1972 and 1981 (5 years before and after the extension in 1977) and then on individuals born between 1975 and 1978 (2 years before and after the extension in 1977), separately.

Recall that the policy raised the length of paid maternity leave for mothers of individuals born after a certain year while mothers of those who just missed the age cut-off of the policy were subject to

the shorter duration of the leave. Therefore, individuals were subject to different lengths of paid maternity leave because they were born a few years apart. The comparison of individuals born within 5 and 2 years before and after the implementation of the paid maternity leave policies can rule out the possibility of potential societal changes which might muddle the relationships of interest. A shorter window allows us to exploit the sharp policy change, which could minimize the potential confounding impact of underlying trends or other policy changes, thus providing more credibility to the identification. However, the drawback of this approach is the substantial loss of observations making the estimates less efficient.

Evident from Table 4, utilizing the 5-year window and the 2-year window leaves our conclusion unchanged. Specifically, using the 5-year window, we find that an additional week of leave duration raises educational attainment by 0.010 years and increases adult height by 0.031 cm (columns 1 and 2). With the 2-year window, our results show that a one-week increase in paid maternity leave is associated with a 0.008-year increase in educational attainment and a 0.029 cm increase in adult height (columns 3 and 4). All estimates are statistically significant. In brief, restricting our sample to individuals born within a specific window prior to and after the implementation of the paid maternity leave policy does not change our conclusion.

In a second robustness exercise, we estimate our preferred specification without sampling weights since several works argue that weighing can affect the efficiency of the estimates (Gelman, 2007; Winship and Radbill, 1994). The estimates from unweighted regressions are reported in columns 1 and 2 of Table 5. We find that an additional week of leave duration can lead to increases of 0.007 years in education and 0.050 cm in height. Our main results are insensitive to the removal of sampling weights.

In the third robustness exercise, we employ different measures of the educational outcome and adult height. Particularly, the probability of finishing high school and Z-score measures are utilized in place of education in single years and height in centimeters. Specifically, High School Graduate is an indicator variable taking the value of one if the individual completed high school and zero otherwise. Height-for-age Z-score captures the number of standard deviations that individual height is lower or higher the median of the international reference population accounting for sex and age. As shown in Columns 3 and 4 of Table 5, we still detect positive effects of paid maternity leave. Specifically, an additional week of leave duration could raise the probability of individuals completing high school by 0.4 percentage points and increase individual height-for-age Z-score by 0.01 standard deviations.

In the fourth exercise, we add the country-specific quadratic trend in our main regression to account for potentially differential trends in educational attainment and height across countries. As shown in Columns 1 and 2 of Table 6, the inclusion of quadratic trends leaves our estimates statistically significant.

Table 5 The impacts of paid maternity leave—robustness 2.

	Unweighted regression		Other measures	
	Education (in single years) (1)	Height (in centimeters) (2)	High School Graduate (3)	Height-for-age (Z-score) (4)
Paid maternity leave (in weeks)	0.007*** (0.001)	0.050***(0.004)	0.004*** (0.000)	0.010*** (0.001)
Observations	1,231,830	325,459	1,231,830	324,718
Residential Cluster FE	✓	✓	✓	✓
Characteristics	✓	✓	✓	✓

Characteristics include gender, marital status, age, squared age, whether the individual resides in rural areas and is the household head, year of birth fixed effects, and year of survey fixed effects. Country FE and Residential Clusters FE refer to the country and residential cluster (neighborhoods that individuals live in) fixed effects, respectively.
p* < 0.1, *p* < 0.05, ****p* < 0.01.

Table 6 The impacts of paid maternity leave—robustness 3.

	Quadratic trends		Higher age cutoff	
	Education (in single years) (1)	Height (cm) (2)	Education (in single years) (3)	Height (cm) (4)
Paid maternity leave (in weeks)	0.007*** (0.001)	0.056*** (0.004)	0.008*** (0.000)	0.051*** (0.005)
Observations	1,231,830	325,459	872,135	246,228
Residential Cluster FE	✓	✓	✓	✓
Characteristics	✓	✓	✓	✓

Characteristics include gender, marital status, age, squared age, whether the individual resides in rural areas and is the household head, year of birth fixed effects, and year of survey fixed effects. Country FE and Residential Clusters FE refer to the country and residential cluster (neighborhoods that individuals live in) fixed effects, respectively.
p* < 0.1, *p* < 0.05, ****p* < 0.01.

We still find that raising the duration of paid maternity leave by one week can lead to an increase in educational attainment by roughly 0.007 years and an increase in adult height by 0.056 centimeters. The insensitivity of our estimates to the inclusion of the country-specific quadratic trend suggests that our estimated long-term impacts of paid maternity leave are unlikely to be confounded by underlying trends or other policy changes.

In the final robustness check, we raise the age cutoff for the individuals included in our sample. Recall that in the main regression, we restrict our sample to individuals who are above the age of 18 because this is considered the age of legal adulthood in most countries and the age of 18 also marks the end of school age (including high school). Now we expand our sample to include individuals aged 22 and above to capture exposure to university or individuals who needs longer than 18 years to finish schooling. As shown in Columns 3 and 4 of Table 6, we still detect positive long-term effects of paid maternity leave on educational attainment and adult height. Specifically, individuals tend to complete 0.008 more years of schooling and to be 0.051 cm taller in response to a one-week increase in the duration of paid maternity leave in their year of birth.

Discussion and conclusion

This paper contributes to the literature by evaluating the long-run effects of paid maternity leave on human capital in 29 developing countries. The data are drawn from the Demographic and Health Survey (DHS) and the Women, Business and the Law 2021 file released by the World Bank. In terms of identification, our empirical model exploits the variation in the education and health outcomes of individuals living in the same area but exposed to different lengths of paid maternity leave at birth due to policy reforms. Our findings present compelling evidence for the beneficial effects of paid maternity leave in the long run. Specifically, an additional week of leave duration could lead to an increase of around 0.007 years in educational attainment and 0.056

centimeters in adult height. The results are insensitive to different health measures and model specifications.

To put the magnitude of our estimated impacts into perspective, given the difference between the average height in the tallest and shortest countries (the Netherlands versus Timor Leste) is around 20 centimeters, the magnitude of our estimated impacts would be around 2.8% of such a difference. Furthermore, our estimated effects of paid maternity leave on educational attainment and adult height are close to the impacts of higher rainfall in early life and the impacts of smaller class size (Maccini and Yang, 2009; Fredriksson et al., 2013; Le and Nguyen, 2022). Specifically, a one percent increase in rainfall during the year of birth leads to a 0.01-year increase in completed schooling and a 0.03-centimeter increase in adult height (Maccini and Yang, 2009). Also, a one percentage point increase in rainfall in the first 1000 days raises educational attainment by 0.01 years (Le and Nguyen, 2022). Besides, Fredriksson et al. (2013) show that as class size decreases by one, future educational attainment increases by 0.05 years.

Our findings on the positive long-lasting impacts of paid maternity leave are consistent with studies showing the importance of early-life circumstances to long-term outcomes. Specifically, early-life exposure to negative shocks such as poverty and disease could leave irreversible consequences on cognitive development, health, and productivity in adulthood (Alderman et al., 2006; Almond, 2006; Duncan et al., 2010; Ogasawara and Inoue, 2018). In another vein, the results of our study are also in line with those highlighting the link between prenatal conditions and after-birth outcomes (Le and Nguyen, 2020, 2021). Our findings further complement those on the short-run and medium-run effects of maternity leave on child development (Hajizadeh et al., 2015; Jou et al., 2017).

There could be several mechanisms through which paid maternity leave could produce beneficial impacts on long-run human capital. First, paid maternity leave raises the amount of time the mother spends with her child, which might result in more breastfeeding and immunization, as well as fewer behavioral

problems (Berger et al., 2005). Besides, there is also evidence that being taken care of by the mother in the early stage of life can also be meaningful to academic achievement during middle childhood (Han et al., 2001; Baum, 2003). In other words, by allowing mothers to spend more time with their children, paid maternity leave might produce better childhood outcomes along the dimensions of health, behavior, and cognitive development, which could ultimately lead to higher educational attainment and taller stature in adulthood (Currie and Thomas, 2001; Case et al., 2005; Rabiner et al., 2016; Nguyen and Le, 2022b).

Second, paid maternity leave reduces the probability of non-parental care for the child, which has been shown to have detrimental impacts on child development (Loeb et al., 2007; Baker et al., 2008). For instance, a study by Loeb et al. (2007) shows that non-parental care can adversely affect cognitive and behavioral outcomes of children. Baker et al. (2008) document that being placed in non-parental care too early might reduce children's vocabulary scores at age five, elevate the risk of emotional disorders, and deteriorate overall health at ages two and three. To the extent that these harmful consequences on child development in early years may have long-lasting irreversible impacts on adult outcomes, paid maternity leave could lead to higher long-term human capital accumulation by making non-parental care less likely.

Last but not least, paid maternity leave gives the mother the financial resources to care for her child. In other words, by providing statutory maternity pay, paid maternity leave can remove the financial constraint the mother could face when she is off from work, which allows her to afford various health inputs for the child. Given the vestigial effects of good health in early life on later-life outcomes, paid maternity leave may lead to higher educational attainment and taller stature (Hoynes et al., 2016).

While the short-run effects of paid maternity leave on child development are well documented, insufficient attention has been given to the long-run effects. Our study emphasizes the long-lasting beneficial impacts of paid maternity leave on human capital, i.e., educational attainment and height in adulthood. To the extent that educational attainment and stature might be translated to the second generation, the potential benefits of policies aimed to improve the well-being of women such as paid maternity leave could have been previously underestimated. Our study calls for the enforcement and extension of paid maternity leave as one path to sustainable development.

Data availability

The data supporting the findings of this study are available upon request from the corresponding author.

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Author contributions

All the authors contributed equally to this work.

Competing interests

The authors declare no competing interests.

Ethical approval

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Informed consent

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