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The impact of introducing free & compulsory pre-primary education policy on mothers' labor outcomes

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ABSTRACT

Pre-primary education improves child health and development. By reducing caregiving constraints, access to pre-primary school may also facilitate the ability of parents to work. This is particularly true for women who disproportionately carry the care workload globally. However, few studies have explicitly assessed the potential for a national, free pre-primary policy to shift women's paid employment in low and lower-middle income countries, and none from Africa. This study employs a natural experiment to estimate the effect of introducing free and compulsory pre-primary school on paid maternal employment. We use nationally representative economic survey data from seven African countries, focusing on the 2008 introduction of tuition-free and compulsory pre-primary school in Ghana. Using two-way fixed effects modelling, we find that the introduction of tuition-free and compulsory pre-primary education significantly increased the likelihood of being in paid employment for mothers of young children (OR 1.53); this translates into a 4.0 percentage point increase in paid employment. Thus, our study found positive impacts of providing free and compulsory pre-primary school on paid employment in Ghana compared to six African countries with similar parental leave policies that did not introduce free pre-primary school. Together with prior evidence that pre-primary school benefits children's development, this makes a strong case for greater investment in national pre-primary school.

1. Introduction

There is ample evidence that pre-primary education improves child development (Milovantseva et al., 2018; UNESCO, 2021). While the national provision of free pre-primary education has the potential to benefit children directly, it also requires significant financial investment. For many low- and middle-income countries, resources are already limited and there are numerous competing priorities. Policies that contribute to economic productivity and sustained growth may help balance the upfront costs. When weighing alternatives, it would thus be helpful to understand whether offering free pre-primary education can generate significant economic returns for families and countries.

Conceptually, access to pre-primary education has the potential to advance parents' ability to work, with disproportionate impacts on women. However, few studies have taken a rigorous approach to estimating the impacts of such investments on economic outcomes for families. A 2021 review found 478 published experimental or quasi-experimental evaluations of early childhood development interventions in low- and middle-income countries (LMICs); only 4 % examined maternal labor force participation as an outcome (Evans et al., 2021). Only one – focused on access to daycare – was from Africa. As described below, there are even fewer studies globally that examine national policies that provide early childhood care through free, national provision of pre-primary school. This study employs a natural experiment to estimate the effect of introducing free and compulsory pre-primary school on paid maternal employment in sub-Saharan Africa.

2. Background

Many young children never reach their developmental potential; children growing up in poverty and/or in a LMIC are particularly at risk (Black et al., 2017). There is abundant evidence that the first 5 years are crucial to meeting the needs of young children. Early interventions during this period can reap meaningful change for children's outcomes.

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Thus, there is a push for countries to provide access to quality early childhood development, including pre-primary education (UNESCO, 2021). According to UNESCO, pre-primary education typically refers to schooling at age 3, 4, or 5 that readies children for primary school (UNESCO, 2021). Research on pre-primary education shows that it improves child development, primary school test scores, and graduation rates (Milovantseva et al., 2018; UNESCO, 2021) and that these gains occur across high-, middle- and low-income countries. As of 2023, however, only 108 of 194 UNESCO member countries were legally providing even one year of free pre-primary education, and these were mostly upper-middle and high-income countries. Only 65 were providing free *and* compulsory pre-primary education. In Africa, only 16 of 48 member states had a legal provision for free pre-primary education, and even fewer made it compulsory (WORLD Policy Center, 2024).

The national provision of free pre-primary school may eliminate caregiving constraints, and thus allow more parents to enter or remain in the labor force. For parents, there is an inherent trade-off between caregiving and employment. This is particularly true for mothers, who are overwhelmingly the primary caregiver. Caregiving and household responsibilities are seen as 'women's work' in many settings. As a result of these persistent and inequitable gender norms, women globally spend over three times as many hours doing unpaid household work (UN Women, 2020), including supervising, feeding and bathing young children. The International Labour Organization (ILO) cites the unequal distribution of caregiving and other household work as a key impediment to women's paid employment, noting that mothers of children 0–5 have the lowest rates of paid employment (Addati et al., 2018). In contrast to what the ILO deems the "motherhood employment penalty," fathers of young children actually have the highest paid employment rates. Thus, access to alternative childcare or early education (encompassing everything from family caregiving to formal center-based or school-based services) is essential to increase female paid employment. While there have been calls to establish comprehensive policies that empower women to engage in the workforce by providing childcare (Addati et al., 2018; Aliga et al., 2023), the proposed solutions often focus on local initiatives rather than national investments (Aliga et al., 2023). Given the gender imbalance in caregiving, national pre-primary policies may promote women's economic participation and increase equity.

A wider literature shows that better access to formal childcare – whether through subsidies or free provision – increases maternal employment. In reviews of research from high-income countries (Del Boca, 2015) and from LMICs (Halim et al., 2023; Harper et al., 2017), access to formal, center-based childcare is associated with improvements in maternal employment in almost all identified studies. For example, in Argentina, the construction of new pre-primary schools in the 1990s increased access, with a knock-on effect for maternal employment (Berlinski and Galiani, 2007). Likewise in Brazil, Paes De Barros et al. (2013) found that providing public, center-based childcare for low-income families increased mothers' labor force participation from 36 % to 46 %. There are fewer studies in sub-Saharan Africa. However, a randomized trial in Kenya found that providing vouchers to registered daycare centers was associated with an almost 9 percentage points increase in paid employment, particularly among married mothers (Clark et al., 2019). A randomized trial in the Democratic Republic of the Congo similarly found that mothers' engagement in commercial agricultural and monthly income increased when they had access to a free daycare center for children age 2–6 years (Donald et al., 2023). In a meta-analyses bringing together evidence across all LMICs (though heavily weighted towards Latin America), the authors calculate that a 30 % increase in formal center-based care use is associated with a 6 % bump in maternal employment (Harper et al., 2017). However, this evidence is not specific to public provision of free pre-primary school; rather the studies include a variety of approaches to increase childcare (e.g., vouchers, public expansion of daycare centers) and a wide range of targeted child ages.

National legislation that guarantees access to free pre-primary school represents the strongest approach to meeting the educational needs of young children (and simultaneously the childcare needs of their parents) at the scale required. For these policies to be effective at improving quality maternal paid employment, research suggests they likely need to guarantee a full day of pre-primary school. For instance, a study of public pre-primary school expansion in Indonesia found that it increased the number of mothers employed, but that this was largely in the area of unpaid family work; this may have been because the short duration of the expansion (only 3 hours per day) did not enable mothers to access higher quality employment (Halim et al., 2022).

Only a few other studies have explicitly assessed the potential for a free pre-primary policy to shift women's employment. Mexico phased in compulsory, universal preschool between 2004 and 2008. Exploiting the geographic variation in implementation, De la Cruz Toledo (2015) showed a corresponding rise in employment for mothers of 3- to 4-year olds. Similarly, Brazil made pre-primary school compulsory in 2009, lowering the age of school entry from 6 to 4 years old. As a result, a regression discontinuity analysis (structured around the enrolment cut-off date) found that mothers whose children had access to pre-primary school reported a greater number of hours working; they were also more likely to be in formal employment that guaranteed workers' rights and protections (Ryu, 2020). In Argentina, another regression discontinuity analysis similarly found that implementing universal pre-school at age 5 had a positive knock-on effect on maternal employment (Berlinski et al., 2011).

To our knowledge, no causal inference studies have assessed the impact of a policy guaranteeing free pre-primary school on women's employment in a low or lower-middle income country globally, nor have such studies been fielded anywhere in Africa. And it is not clear that the above findings will generalize to this region. While the above demonstrates the potential for national provision of pre-primary school to impact mother's employment, impact may depend on context. In their broader review of daycare and women's employment in LMICs, Harper et al. (2017) found substantial between-study heterogeneity. This suggests that there may be important country differences that affect impact. Free pre-primary school alone may not be enough to shift employment outcomes in countries where there is high fertility or there is pronounced gender discrimination in employment. Another contextual effect modifier may be the prevailing childcare arrangements. For example, in countries where women traditionally rely on alternative caregivers, such as grandparents or older siblings, pre-primary policies may not substantially influence maternal employment (though it may have benefits for the alternative caregivers).

Moreover, based on the nature of the labor market, the provision of free pre-primary school could have different impacts on unpaid and paid employment. For example a study in urban Ghana found no association between the number of children at home and women's labor force participation as a whole. However, the null finding masked two underlying forces. First, they found that some women left the labor market, or switched to self-employment, to balance caregiving as the number of children increased. Second, mothers who remained in formal employment worked more hours as fertility rose, presumably to provide economically for their children (Heath, 2017). Importantly, the engagement in paid work was facilitated by the presence of alternative caregivers in the household (e.g., older siblings or grandparents). The authors suggest a lack of available alternative caregivers may prevent some women who otherwise want to from increasing their hours of work, a gap that can be closed by tuition-free pre-primary and other childcare policies.

Sub-Saharan Africa is the region with the highest female labor force participation. However, this includes work in agricultural or other unpaid labor, and women have far fewer opportunities for paid employment than men. This results in sub-Saharan Africa having the highest gender gap in paid employment (Waterhouse et al., 2022). Partly, this may be because access to organized childcare is relatively rare, of

Table 1
Policy details during the available observation periods for each study country.

	Free Pre-primary School Changes		Paid Maternity Leave Changes		Survey Years
Treatment Country					
Ghana	✔ 2008	Free and compulsory pre-primary starts at age 4 and is available for 2 years	✔ 2004	Increased from 6 to 12 weeks	2005–06 HIES 2012 HIES 2016 HIES
Comparison Countries					
Botswana			✔ 2011	Increased from 3 to 6 weeks	2002 HIES 2012–13 AIS
Cameroon				Stayed at 14 weeks	2001 ECAM 2007 ECAM 2014 ECAM
DRC				Stayed at 14 weeks	2004–05 LFS 2012 LFS
Nigeria	(2013)			Stayed at 6 weeks	2003 LSMS 2009 LSMS
Sierra Leone			✔ 2002	Increased from 0 to 12 weeks	2003 SLIHS 2011 SLIHS 2014 LFS
Uganda			✔ 2006	Increased from 4.3 to 10.9	2005 LSMS 2010 LSMS 2019 LSMS

Notes: AIS - AIDS Impact Survey; ECAM - Quatrième Enquête Camerounaise Auprès des Ménages; ENTAM -; HIES - Household Income, Expenditure and Consumption Survey; LFS - Labor Force Survey; LSMS - Living Standard Measurement Study Survey; SLIHS - Sierra Leone Integrated Household Survey.
Nigeria introduced a free pre-primary school policy in 2013; however it is retained as a comparison country as we do not use data post-policy.

questionable quality, and often unaffordable (Horwood et al., 2021; Murungi, 2013). For women in the labor force, the predominate child-care strategy is a reliance on family and friends (49 %), followed by simultaneously caregiving while they work (39 %) (Waterhouse et al., 2022). Recent studies, however, suggest fewer and fewer mothers are living with extended family that can help with caregiving (Waterhouse et al., 2022), an impediment to paid work. Thus, there is a growing need – and demand - for more formal solutions across Africa (Clark et al., 2019). Government provision of free pre-primary school may thus boost mother's engagement in paid employment specifically. In this study, we critically examine the policy potential using a natural experiment in sub-Saharan Africa.

3. Methods

This study uses a natural experiment to estimate the effect of introducing free and compulsory pre-primary education on mothers' employment. Natural experiments are a robust method for understanding the impact of national-level laws and policies, which cannot be examined in randomized control trials. In this case, we have a country (Ghana) that has implemented a new policy. We have data on women in Ghana both before and after the implementation of the new pre-primary policy, and thus can observe whether employment outcomes changed. We also have data from women in comparison countries, none of whom were exposed to a free pre-primary policy. Women from the comparison countries provide information on secular trends. By leveraging twenty years of data across multiple countries, we can thus evaluate whether the new free pre-primary policy improved employment outcomes among mothers of pre-primary aged children. Below, we provide detailed methodology.

3.1. Data

We merge two main types of data: country-level policy data and individual-level economic data. The policy data were constructed by researchers at the WORLD Policy Analysis Center at the University of California Los Angeles. Data on national policies, including pre-primary education and maternity leave, were coded from primary-source legislation; this was supplemented with UN reports and country reports submitted to international bodies and monitory committees. Detail on the methodology is available elsewhere (Raub et al., 2022). For each year from 1990 forward, WORLD recorded whether there was a guarantee of tuition-free pre-primary school included in the country's constitutional rights, laws or policies. The coding is specific to tuition; it does not reflect any additional costs such as uniforms, books, or supplies. Coding also captures whether pre-primary school was compulsory, the starting age, and the total number of years of pre-primary available. Similarly, WORLD recorded whether there was a guarantee of maternity leave and the extent of such for each country in each year from 1990 forward.

The individual-level data came from nationally representative economic surveys that have been harmonized to capture employment information. The economic surveys employ a common approach, but differ slightly in their methodology and implementation. The Living Standard Measurement Study Survey (LSMS), for example, is a household survey supported by the World Bank and fielded in LMICs by national statistics offices. The specific questionnaires vary by country and year but revolve around a core set of modules on household demographics, employment, income, and education. The Household Income, Expenditure and Consumption Surveys (HIES) are also designed by national statistics offices, and have common domains related to employment. The Labor Force Surveys (LFS) are a collection of national surveys used for official employment reports. While surveys differ on the exact wording of employment questions, they generally follow the standard definitions and general guidelines provided by the ILO. As noted in Table 1, the final individual-level data used comes from surveys between 2002 and 2019.

Table 1 details the countries and economic surveys that are included in analyses. Countries were retained if they had 1) complete pre-primary school policy data (in rare cases, the policy was indeterminant); 2) multiple rounds of individual-level economic data enabling us to assess changes over time; and 3) economic questions and response categories sufficient to code the primary employment outcomes. There were 6 countries that had a policy change during the study period. Only four countries had sufficient data before and after the policy change to estimate a change. Of those four countries, only one introduced full day pre-primary school during the observation period, which is likely needed to have a meaningful impact on women's employment because prior studies have shown that the length of the school day impacts mother's ability to work (Halim et al., 2022). Ghana introduced free and

compulsory pre-primary school in 2008, implemented as part of its compulsory universal basic education package. Ghana offers pre-primary school (kindergarten) covering the full school day. Children attend for two years, starting when they turn four (Ghana Ministry of Education, 2018). In Ghana and in all comparison countries, children are expected to start primary school at age 6.

3.2. Variables

Policy variable: The main exposure variable is a guarantee of tuition-free and compulsory pre-primary school, coded 1 if available in the survey year and 0 otherwise.

Outcomes variables: There are two labor outcomes capturing whether the individual was employed at the time of the survey and whether this was likely to be paid employment.

Employment: We considered individuals to be employed if they engaged in activities for pay or profit, or were producing goods or services for home use or sale, for at least an hour in the reporting period. Individuals who were not working in the reference period because of a temporary absence (e.g., parental leave, compensatory time) were still considered employed. We then created a binary variable indicating whether a woman was employed in the reference period (coded 1); those who were unemployed or not in the labor force were coded 0. Generally, surveys collected information on employment during a short reference period (mostly in the past 7 day, though occasionally 30 days or 1 year).

Paid employment: We created a second binary outcome variable indicating whether an individual worked for pay as opposed to being unemployed, an unpaid worker, or not in the labor force. In the economic surveys, there was typically a separate question on whether the respondent received payment for their job, including both in-kind and cash payments. In addition, those who reported that they were an employer were considered working for payment.

Covariates: We included several covariates. At the individual level, we captured the mother's age (a continuous variable), education (coded categorically as no formal education, at least some primary, at least some secondary or higher), and marital status (a binary variable indicating whether she was married or cohabitating, and coded 0 otherwise). At the household level, we captured whether there was a female household head, the household size (a count of the total number of residents), the total number of children in the household, and the age of the youngest child in the household. Finally, we incorporate several covariates at the country level. First, we control for the national legislated duration of paid maternity leave, available from 1995 forward. For each individual we create a continuous variable representing the number of adjusted full-time weeks of maternity leave available, indexed to the year of their youngest child's birth. Adjusted full-time weeks refer to the number of weeks multiplied by the wage replacement rate (e.g., if a policy allows for four weeks of leave at 50%, this is coded as two adjusted full-time weeks of maternity leave). There is existing evidence that paid maternity leave benefits women's employment (Broadway et al., 2020; Heymann et al., 2017). We also control for the percent of the population that lives in an urban area and the unemployment rate in the year of the survey; these latter two variables were extracted from the World Bank's collection of macroeconomic indicators (The World Bank, 2022).

3.3. Analytic sample

We restrict all analyses to mothers of reproductive age (15 – 49) who are either household heads or partners of the household head. Data limitations do not allow us to accurately identify co-residing mothers. For the main analyses, we restrict the sample to women where the youngest child is aged 4–6 years, the eligible age range for pre-primary school in Ghana (N = 22,338). We specifically exclude mothers who have additional children under age 4, given that their ability to work would be constrained by caregiving for children too young to access pre-primary school. This is supported by studies in Argentina and in Brazil that found public pre-primary enrolment had employment benefits only for mothers who did not have additional younger children or relatives in the home (Berlinski et al., 2011; Ryu, 2020).

3.4. Analytic approach

We use two-way fixed effects (TWFE) modelling to estimate the impact of free and compulsory pre-primary education on mothers' employment outcomes. Given that the employment outcomes are binary, we estimated effects using the following logistic regression model:

$$y_{itc} = \beta_0 + \beta_1 Policy_{tc} + \beta_2 X_{itc} + \beta_3 Z_{itc} + Year_t + Country_c + e_{itc}$$

Where y_{itc} is the outcome for a woman i interviewed in year t living in country c. $Policy_{tc}$ is the primary treatment variable indicating whether a woman in country c was exposed to a free and compulsory pre-primary policy in the year of the survey t. β_1 is the difference-in-difference estimate for the effect of the policy. X_{itc} is a set of control variables at the woman and household-levels; Z_{itc} is a set of time-varying country-level controls. $Year_t$ represents the survey year fixed effects to adjust for secular time trends common across all countries. Due to the limited number of surveys in any given year, surveys are grouped in 5-year blocks. $Country_c$ captures the country-fixed effects, which adjust for time-invariant differences. Finally, e_{itc} is the error term. Standard errors are clustered at the country level.

The main analyses focus on the analytic sample of mothers whose youngest child is aged 4–6 years, and thus would be eligible for pre-primary schooling under Ghana's new policy. We ran two sets of models: the first contains only the relevant policy variables; the latter has additional individual, household, and country-level control variables. For the full models, we also calculated the average marginal effect of introducing the free pre-primary school policy.

Legacy treatment group: As a check, we ran the main analyses on a population of mothers with older children that would not currently be eligible for pre-primary school. Some of these children, however, may have been previously exposed to free pre-primary school. While these mothers might still experience some residual or "legacy" benefit from earlier access to pre-primary education, we expected the policy's impact

Table 2
Analytic sample of mothers by country, exposure status, and eligibility group.

	Eligible Group: Mothers whose youngest child is 4–6 years old		**Legacy Group:** Mothers whose youngest child is 7–17 years old	
Survey	**Pre-Policy (N)**	**Post-Policy (N)**	**Pre-Policy (N)**	**Post-Policy (N)**
Treatment Country				
Ghana 2005–06	753	.	999	.
Ghana 2012	.	1438	.	1939
Ghana 2016	.	1226	.	1640
Comparison Countries				
Botswana 2002	405	.	869	.
Botswana 2012–13	238	.	454	.
Cameroon 2001	959	.	1441	.
Cameroon 2007	869	.	1298	.
Cameroon 2014	847	.	1026	.
DRC 2005–06	1261	.	1514	.
DRC 2012	1864	.	2244	.
Nigeria 2003	2088	.	2612	.
Nigeria 2009	7608	.	9512	.
Sierra Leone 2003	457	.	593	.
Sierra Leone 2011	982	.	1292	.
Sierra Leone 2014	533	.	713	.
Uganda 2005	267	.	338	.
Uganda 2010	214	.	333	.
Uganda 2019	329	.	396	.
Total	19,674	2664	25,634	3579
	22,338		29,213	

to be weaker compared to its effect on mothers of younger children currently eligible for pre-primary school. We tested this assumption by running the above models focusing on mothers whose youngest child is aged 7–17 years at the time of the survey (N = 29,213). Table 2 shows the analytic sample by mothers' country, exposure status and eligibility group.

Subgroup analyses: Finally, we ran a series of subgroup analyses to examine whether the pre-primary school policy had differential effects by education and residential status. We again used TWFE modelling adjusting for the covariates referenced earlier. In the first model, we include the main effects and interaction terms for education level, and then calculate the odds ratio for pre-primary policy exposure at each educational level. To illustrate, we also calculate the average predicted probability of the outcome for different combinations of policy exposure and education level, adjusting for the other variables in the model. In the second model, we take this same approach to examine differences in policy impact by rural and urban residence.

4. Results

Table 3 shows the proportion of mothers of pre-primary aged children who are employed generally and in paid employment specifically, by country and exposure status. Table 4 presents the results of the TWFE regression models. The first set of models focus on our main sample: women whose youngest child is aged 4–6 years and thus pre-primary school age. In models that include only policy variables, women exposed to a free and compulsory pre-primary school policy had statistically significantly higher odds of being in paid employment (OR 1.21) and employed (OR 1.31). When individual, household, and country-level covariates were added to the model, the impact on paid employment strengthened (OR 1.53), translating into a 3.5 percentage point increase in paid employment (moving from a predicted probability of 10 % to 14 %). The effect of pre-primary school policy on employment overall (including paid and unpaid) was no longer significant, despite the magnitude of the coefficient increasing (OR 2.84) and the average marginal effect being a 19.0 percentage point increase in employment (moving from a predicted probability of 67 % to 84 %).

We also examined the policy impact among mothers whose youngest child was 7–17 years old at the time of the survey. We hypothesized that these women would experience little to no current employment benefit from the pre-primary school policy, as their children had already aged into primary and secondary school. As shown in Table 4, the free pre-primary school policy demonstrated no significant associations with employment (paid or otherwise) in either the unadjusted or fully adjusted models. All other covariates perform similarly between the primary analytic group of eligible mothers and the legacy group.

Finally, we tested whether the policy had stronger impacts among marginalized subgroups. The results suggest that mothers who had no education were most likely to benefit from the introduction of free pre-primary (OR 4.00 for employment and OR 2.51 for paid employment; see Table 5). This represents a bump in the predicted probability of being employed, for example, from 60 % to 84 % (see Table 6). The pattern is less clear with respect to residence. While the policy demonstrated a larger impact on employment among urban women only, the interaction term itself was not statistically significant. On the other hand, the interaction term was significant in the model for paid employment and suggests that rural women benefited more from the introduction of pre-primary education (OR 1.99).

Table 3
Summary statistics for eligible mothers, by country and exposure status.

	Proportion Employed♦		Proportion in Paid Employment♦♦	
Survey	**Pre-Policy**	**Post-Policy**	**Pre-Policy**	**Post-Policy**
Treatment Country				
Ghana 2005–06	87.25	.	11.16	.
Ghana 2012	.	92.28	.	14.10
Ghana 2016	.	78.63	.	9.79
Comparison Countries				
Botswana 2002	65.93	.	53.09	.
Botswana 2012–13	65.55	.	53.78	.
Cameroon 2001	69.34	.	13.97	.
Cameroon 2007	85.16	.	15.70	.
Cameroon 2014	83.71	.	15.45	.
DRC 2005–06	79.62	.	6.83	.
DRC 2012	76.39	.	6.02	.
Nigeria 2003	43.63	.	6.20	.
Nigeria 2009	55.63	.	9.36	.
Sierra Leone 2003	78.77	.	3.21	.
Sierra Leone 2011	76.78	.	4.10	.
Sierra Leone 2014	75.05	.	5.96	.
Uganda 2005	90.26	.	14.23	.
Uganda 2010	86.45	.	7.43	.
Uganda 2019	91.19	.	12.16	.
Total	66.10	86.00	10.46	12.11
	68.48		10.66	

♦as opposed to unemployed or not in the labor force
♦♦as opposed to unpaid, unemployed or not in the labor force

5. Discussion

We used a natural experiment to estimate the impact of a free and compulsory pre-primary school policy on mother's paid work. To our knowledge, this was the first study to examine the impact of such in a low or lower middle-income country, and the first to estimate impact in sub-Saharan Africa. We find that the introduction of a new policy in Ghana significantly increased paid employment by 4.0 percentage points – a substantial increase given that less than 11 % of the overall sample reported any paid employment. This suggests that national policies that help mothers balance caregiving and work may have a positive impact on paid employment. Moreover, we found benefits in paid employment accrued primarily to those women who are typically the most marginalized: those with the least education and those living in rural areas. Situated within what is already known about the importance of female employment, this is likely to have knock-on effects for gender equity in decision making, for child health and development, and for overall economic growth (Heath et al., 2024).

Globally, women are less likely to be in the labor force and earn less compared to men. Moreover, women's labor force participation has remained stagnant for three decades. Critically, policies that indirectly increase women's economic productivity could bolster national economic growth, potentially paying for themselves in the long-run. This is the first study of how free pre-primary education affects maternal employment in sub-Saharan Africa. The finding that pre-primary education improves women's engagement in paid employment is in line with those from Mexico, Brazil, and Argentina (Berlinski et al., 2011; De la Cruz Toledo, 2015; Ryu, 2020). We expand on the knowledge base by showing that the policy stimulated economic participation most among those women whose economic potential is currently underutilized, and would thus likely represent a net gain for vulnerable families and for national economies.

The need to provide care for young children can be a particular constraint on formal, paid employment and the protections that accompany such. The informal sector may offer more opportunities for women to both work and care for their children. Such vulnerable employment is more common in sub-Saharan Africa than any other region, and there is a large gender gap (Lo Bue et al., 2022). Parenthood widens this gap. Lo Bue et al. (2022) found that having a young child is a strong predictor of vulnerable employment (as opposed to being paid or an employer) for both women and men. However, since fathers experienced a much smaller parenthood penalty, the result was widening gender inequity. In Ghana specifically, a prior study showed that women with young children were less likely to be engaged in paid employment; men's employment was unaffected by the presence of young children

Table 4
Two-way fixed effects logistic regression modelling employment outcomes in both eligible mothers and a legacy group.

	Eligible Group: Mothers whose youngest child is 4–6 years old				**Legacy Group:** Mothers whose youngest child is 7–17 years old			
	Employed♦ OR (SE)		**Paid Employment**♦♦ OR (SE)		**Employed**♦ OR (SE)		**Paid Employment**♦♦ OR (SE)	
Policy variables								
Free pre-primary school	**1.311*****	2.840	**1.209****	**1.526***	1.147	1.327	1.044	1.061
	(0.078)	(2.271)	(0.097)	(0.364)	(0.135)	(0.592)	(0.099)	(0.143)
Maternity leave	0.958***	0.887	1.016**	0.990	0.989	0.997	0.981**	0.997
(full-time equivalent months)	(0.014)	(0.066)	(0.007)	(0.031)	(0.015)	(0.015)	(0.008)	(0.008)
Mothers' characteristics								
Women's age		1.043***		1.025***		1.036***		1.018*
		(0.005)		(0.010)		(0.002)		(0.010)
Primary education		1.971**		1.447***		1.910***		1.595***
		(0.527)		(0.094)		(0.466)		(0.162)
Secondary education		1.713		5.712***		1.561		6.514***
		(0.764)		(0.925)		(0.622)		(1.276)
Married or cohabitating		0.918		0.742***		0.832***		0.825***
		(0.114)		(0.086)		(0.052)		(0.057)
Household characteristics								
Female head		1.712***		1.540***		1.373***		1.266**
		(0.143)		(0.120)		(0.120)		(0.129)
Household size		0.917***		1.032***		0.918***		1.005
		(0.016)		(0.013)		(0.019)		(0.018)
Number of children		1.072***		0.912***		1.093***		0.974
		(0.022)		(0.019)		(0.025)		(0.018)
Age of the youngest child		1.024		1.035		0.990		0.990
		(0.020)		(0.052)		(0.010)		(0.014)
Country characteristics								
Urban population		0.826		0.952		0.944		0.964
(% of total population)		(0.122)		(0.061)		(0.162)		(0.087)
Unemployment		0.965		1.074***		1.086		1.247***
(% of total labor force)		(0.032)		(0.025)		(0.225)		(0.103)
Observations	22,338	21,867	22,111	21,653	22,005	21,623	21,832	21,456

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
♦ as opposed to unemployed or not in the labor force
♦♦ as opposed to unpaid, unemployed or not in the labor force

Table 5
Odds ratios from fully-adjusted two-way fixed effects logistic regression modelling the impact of free-primary school on employment outcomes in eligible mothers, by subgroup.

	Eligible Group: Mothers whose youngest child is 4–6 years old	
Policy variable: Free pre-primary school	**Employed**♦ OR	**Paid Employment**♦♦ OR
Model 1: education		
no education	**4.00***	**2.51*****
primary	1.96	**2.28*****
secondary	2.26	1.24
Model 2: residence		
urban	**3.67***	1.10
rural	2.35	**1.99****

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
♦as opposed to unemployed or not in the labor force
♦♦as opposed to unpaid, unemployed or not in the labor force

Table 6
Marginal probabilities from fully-adjusted two-way fixed effects logistic regression modelling the impact of free-primary school on employment outcomes in eligible mothers group, by subgroup.

	Eligible Group: Mothers whose youngest child is 4–6 years old	
Policy variable: Free pre-primary school	**Employed**♦	**Paid Employment**♦♦
Model 1: education		
No Policy: no education	60	4
Policy: no education	84	10
No Policy: primary	74	6
Policy: primary	84	12
No Policy: secondary	71	20
Policy: secondary	84	24
Model 2: residence		
No Policy: urban women	64	12
Policy: urban women	85	13
No Policy: rural women	69	8
Policy: rural women	83	14

♦ as opposed to unemployed or not in the labor force
♦♦as opposed to unpaid, unemployed or not in the labor force

(Heath, 2017)

Our study did not examine fathers, but did indicate that the key benefit of pre-primary school for mothers was to shift employment from unpaid, vulnerable work to paid work. In our study, the association with employment overall was not significant in the adjusted model. This is broadly consistent with prior research on fertility. While researchers have found somewhat mixed effects on labor force participation, they have found clearer evidence that having young children decreases mothers' engagement in paid work (e.g., Addati et al., 2018). For example, a study across 58 LMICs, including 30 countries in sub-Saharan Africa, found an overall inverse association between having children at home and women's employment (Bongaarts et al., 2019). However, the magnitude of impact was greatest for modern (defined as professional/technical, managerial, and clerical sectors) employment. Notably, there was no association between the number of children and women's traditional employment (defined as agricultural employment), highlighting the importance of a nuanced investigation by employment

type.

Globally, social norms support women's employment: 70 % of women and 66 % of men say that they prefer that women work at paid jobs (ILO and Gallup, 2017). The above studies suggest that women's employment is curtailed by caregiving. Providing affordable, safe alternatives is key. In Ghana, we found positive impacts of providing free and compulsory pre-primary school on paid employment, consistent with evaluations from other LMICs that used different study designs. Yet there has been slow progress in expanding access: enrolment in pre-primary school almost doubled from 2000 to 2020, but still only 61 % of children 3–6 were in school. This means there were 175 million pre-primary aged children who were not in school. In low-income countries, the achievement gap is particularly glaring: only 17 % of children 3–6 were participating in pre-primary education (UNESCO and UNICEF, 2024). Other researchers have shown that these gaps have potential consequences for children's social and cognitive development; as we show, the lack of pre-primary school access also adversely impacts their mother's economic security.

There are limitations to this study. First, selection into policy exposure is based on country of residence not random assignment; we address this partially by using a difference-in-difference design with longitudinal data that controls for time invariant country characteristics and secular trends in the region. Second, we cannot assess the parallel trends assumption due to only having only one observed time point pre-policy in each country. Thus, we cannot empirically test if maternal employment was following a similar trajectory in Ghana as compared to the comparison countries prior to the introduction of free pre-primary education. However, we are able to compare difference-in-difference coefficients of mothers of older children, and do not observe a policy impact, suggesting that trends in employment for mothers overall in Ghana are not driving the finding. Third, there is only one treatment country, and the findings could be confounded by its changing political, economic or social context. In addition to testing a hypothesized attenuated impact among the legacy group, we control for another policy likely to impact the paid employment of young mothers: paid maternity leave. Ideally, we would hold exposure to maternity leave steady by analyzing only countries with no change. In a practical sense, this is not possible: within a number of countries, including Ghana, the duration of maternity leave available increased across the study period. We see significant impacts of free pre-primary school while controlling for paid maternity leave. In light of reported heterogeneity around the effectiveness of daycare and maternal employment across countries (Harper et al., 2017), however, we caution that our findings are specific to the implementation of free pre-primary school in Ghana. We hope that as more countries adopt free pre-primary policies and further cross-national comparison becomes feasible, future research will examine the impact of free pre-primary on maternal employment in multi-country studies.

This study provides the first causal evidence of the benefit of providing free and compulsory pre-primary school on women's paid employment in a low or lower-middle income country globally, as well as the first to examine policy impact in any African country. As more countries consider expanding access to pre-primary school, the impact of policy change on women's employment is an important factor to consider, alongside the known benefits to children's health and development, when weighing the cost of expanding access to education against the short- and long-term benefits of this investment.

CRediT authorship contribution statement

Jody Heymann: Writing – review & editing, Supervision, Funding acquisition, Conceptualization. **Bijetri Bose:** Writing – review & editing, Methodology. **Pragya Bhuwania:** Writing – review & editing, Methodology. **Alfredo Martin:** Writing – review & editing, Methodology, Data curation. **Amy Raub:** Writing – review & editing, Supervision, Project administration, Funding acquisition, Conceptualization. **Rachel Kidman:** Writing – original draft, Methodology, Formal analysis, Conceptualization.

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Competing interests

The author(s) declare none.

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