Child care and female labor force participation in developing countries - Quasi-experimental results from Togo*

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Original version: March 2009

July 17, 2009

Abstract: Child care in developing countries is mainly provided by female family members. Consequently, increasing the public provision of child care may potentially enhance female labor force participation. This paper estimates the causal effect of reducing the relative number of children in a household that are to be cared for on female labor supply. An instrumental variable is used that exploits the age composition of young children in households given that primary schools may serve as daycare institutions in many countries. For the population of a typical togolese community it is shown that the relative number of preschool age children in a household who are enrolled increases with the average age of these children. Instrumental variable estimations indicate that women are significantly more likely to work when there are fewer children to care for at home.

JEL-classification: J22, J13
Keywords: Child Care, Preschools, Female Labor Supply, Developing Countries, Togo

*Preliminary version. Comments welcome

1 Introduction

This paper investigates whether increasing enrollment of preschool age children positively affects female labor supply in the context of a developing country. While this research question has been studied extensively by economists using data from industrial countries, there exists almost no evidence from the developing world. The issue is of high relevance for policy makers, though, since both the public provision of child care in developing countries currently is at a low level and creating new opportunities for women in these countries to participate in economic activities may significantly reduce poverty.

The identification strategy in this paper will employ an instrumental variables approach using togolese household data. The average age of preschool age children in a household serves as an instrument for the number of these children who are enrolled in school (while controlling for the total number of children of that age group in a household). The instrumental variable is motivated by the fact that in many African societies the legal school entry age is not strictly enforced. Instead, when preschools are absent, *primary* schools provide child care services: children as young as five, four or even three years are admitted to first grade, where they stay until they are mature enough to move on to the next grade. It is argued in this paper that under these circumstances enrolling a preschool age child will be easier the closer the child is to the regular primary school entry age. Consequently, when the average age of preschool age children in a household rises, the relative number of these children who are enrolled should rise as well. This relationship is confirmed for the togolese data for households in a community which do not have access to a preschool.

In the cultural context of West Africa, as in most parts of the world, women are the principal providers of care for children who are not sent to school, which may include not only mothers but all female household members (a phenomenon also observed in Kenya, see Lokshin et al. (2000); the estimation results presented below rely on observations for all women in the respective households, not only mothers of preschool age children). Consequently, not having to care for a child of preschool age will reduce the costs of working for these women. To give some examples for these costs, when young children are to be cared for, work can only be offered at the expense of reduced productivity[1], the purchase of private child care, or the strain of relations within the extended family if other relatives take over child care responsibilities. I therefore expect that enrollment of preschool age children increases the labor supply of women in the same household. If the labor supply response to exogenous increases in enrollment of preschool children is positive on average, it can be expected that expanding preschool provision will increase overall female labor supply. Increasing female labor supply may be a particularly effective means to reduce poverty in developing countries (Lokshin et al., 2000).

For developing countries, the relationship between child care and female labor supply has not been

[1] Women in the studied communities report that they often take their youngest children with them while they work in agriculture, cookshops, sales stalls or in the household.

investigated empirically so far (Lokshin et al. (2000), which shows a positive relation between early childhood development programs and female employment in Kenya, is, to the best of my knowledge, the only exception). A few studies investigate the relationship for emerging economies (see Connelly et al. (1996) for the case of Brazil, Berlinski and Galiani (2007) for the case of Argentina, and Wong and Levine (1992) for a study using data from Mexico).

In industrial countries, on the other hand, a strong link between child care and mothers' labor supply is generally accepted and has manifested itself in numerous research papers. Unfortunately, among them, there are only very few experimental or quasi-experimental studies.[2] Instead of relying on variation in observed household expenditures or area-level averages of prices or expenditures for child care to identify the response in female labor supply, a few studies have tried to exploit natural experiments. An example of a study that uses a natural experiment is Berger and Black (1992) who use women on the waiting list as a comparison group for recipients of child care subsidies and find positive employment effects. Several studies take advantage of expansions of preschool provision or child care subsidy programs. Baker et al. (2008) exploit the expansion of subsidized provision of child care in a Canadian province, and they find a positive effect of child care use on maternal labor supply for married mothers. Cascio (2009) studies the impact of the introduction of preschool subsidies in the U.S. during the 1960s and 1970s. She finds that kindergarten attendance has an effect only on single mothers whose youngest child is five years old. Schlosser (2005) studies the impact on labor supply of the gradual implementation of compulsory preschool laws in Arab towns in Israel. She finds that preschool provision increases maternal labor supply. Finally, Berlinski and Galiani (2007) find a positive impact of a large-scale construction program of preschools in Argentina.

This study may contribute to the existing literature in two ways. First, it adds new evidence to the extremely scarce literature on the issue of the effect of enrollment of preschool children on female labor supply in developing countries. The second contribution of this paper is a methodological one. While I do not exploit a natural experiment in this paper, I circumvent endogeneity problems by estimating the impact of enrollling additional children of preschool age on the labor supply of women in the same household by using instrumental variables. The approach is closely related to the one used by Gelbach (2002) who uses quarter of birth of five-year-old children as an instrument for their enrollment. Assuming full take-up of public preschool places, Gelbach's and my estimates also identify the effect of subsidizing child care on female employment.

I present instrumental variable estimates that make use of data from a survey of 956 households that I conducted with a local team in southern Togo in October 2008 where the whole population of two communities was surveyed. Given their economic activities, infrastructure, and their ethnic and

[2] Numerous studies use US- or Canadian data to simulate child care price elasticities of female labor supply on the basis of parameter estimates of structural models (see Michalopoulos et al. (1992), for instance), and they typically find a negative elasticity although there exists a large range of estimates, and the results are ambiguous for single mothers. Ribar (1992) and Anderson and Levine (1999) include surveys of that literature and related studies from the US; see Michalopoulos and Robins (2002) as an example for a study using Canadian data

religious composition, the communities can be viewed as somewhat representative for small towns in rural areas of West Africa. Observations from the first, larger community, which does not have access to a preschool, is used for the instrumental variable analysis. The second community, which lies in the catchment area of a preschool, is used for a comparison in order to back up the results. I find that the likelihood of a woman to work increases significantly when fewer of the children of preschool age in the household are to be cared for at home.

The rest of this paper is structured as follows: Section 2 describes my dataset and the studied communities, section 3 explains the identification strategy, results are presented in section 4, and section 5 concludes.

2 Data and sample

The data used for the estimations below are the result of a household survey that I conducted with a local team in two neighboring rural communities in southern Togo in October 2008. The survey's questionnaire covered socio-demographic characteristics of all household members, their education, labor supply, agricultural activities, health status, and time use. In both communities, the whole population was surveyed[3] resulting in a dataset with 956 households with 3848 individuals. Most of the analysis below is done with data from only one of the two communities, community A. The two communities differ in that community A (which is much larger than community B) does not have a preschool while in community B there is a catholic preschool available to the population. The geographic distance between the two communities is about 8 kilometers, precluding the possibility that children commute from A to B in order to attend preschool there, since there is no public transport available. The absence of a preschool in community A opens the possibility to use the age distribution of 3-5-year-olds in a household as an instrument for the number of children of that age group who are enrolled in school for households in community A as described in section 3. An additional identification strategy will be based on a comparison of communities A and B.

The two communities are in the Badou-region of southern Togo, a rural area close to the Ghanaian border. Community A is the main town of a small geographic area (a so called "canton"), and its market and secondary schools are of local importance. It receives many secondary school students from all over the "canton" who either commute, are fostered-in[4] (a phenomenon quite common in West Africa, see Serra (2009), Glewwe and Jacoby (1994)) or rent rooms in the community. Almost all households farm (79.0 percent of all women in the sample live in households who have cultivated at least one field within the last 12 months). Many do so on a subsistence level, some produce cocoa

[3] Households without children below 17 only answered to a reduced questionnaire, reporting socio-demographic characteristics.

[4] 16.0 percent of all children in the dataset under 15 with at least one living parent report not to be living in the same household with either parent

and a few produce coffee for export[5]. While the climate is very humid, the mountainous landscape as well as the soil type do not permit the cultivation of large plantations. The data were collected during the first weeks of the new school year, which also marks the beginning of the cocoa harvesting season. Other economic activities found are services and a few crafts, industry does not exist. The infrastructure is poor (no lights, no running water, and only main roads are paved). The Badou-region lies in the sphere of the Ewe, a people scattered over southern Togo and south-eastern Ghana. The most important ethnicity in the community is Akposso (33.5 percent of the sample), who have been influenced strongly by the Ewe. Furthermore, the community has experienced considerable immigration from other parts of Togo and neighboring countries, leading to a mix of ethnicity[6] as well as religion, with Christian churches dominating[7]. Given its economic activities, infrastructure, and its ethnic and religious composition, the communities can be viewed as somewhat representative for small towns in rural areas of southern West Africa.

The sample used for the main analysis below includes all 352 women above the age of 16 living in households with at least one child of three to five years of age in community A who do not have a missing value for any of the variables used in the analysis. The respective samples for the comparison between community A and B use 264[8] observations from community A and 36 observations from community B. Based on these samples, table 7 in the appendix reports descriptive statistics for the variables used for the analysis in section 4.

Out of the 352 women in community A who are considered for the estimations below 84.7 percent work. Among them, the most predominant primary activity is in agriculture, with 40.6 percent working in that sector. Most of the remaining women either sell alimentary goods (27.2 percent), work in other petty trade (15.8 percent) or as tailors (10.7 percent). Only four women report to be salaried employees. Thus, the working women typically contribute to or run their own small family enterprise. Accordingly, it is unlikely that there is little room for increasing female labor force participation. Furthermore, all these activities may allow a woman to simultaneously supervise a preschool age child, which is, however, likely to reduce her productivity.

3 Identification strategy

I am interested in estimating the causal effect of whether children of preschool age are to be cared for at home or not on the labor supply of female members of the same household. The relationship of

[5] 56.5 percent of all women in the sample live in households who have cultivated any cocoa during the last 12 months, 9.4 percent live in households who have cultivated any coffee.

[6] Other mentionable ethnic groups in the community Ewe (22.4 percent), Kabye (13.6), and Kotokoli (12.8). The latter two ethnic groups originally settled in northern Togo.

[7] 48.7 percent of the sample are catholic, 24.4 percent belong to protestant, pentecostal and other Christian churches, 25.0 percent are muslim.

[8] Note that community B does not include a Muslim community. For the sake of comparability, muslim women where therefore dropped from the community A population for any calculations that involve a comparison between the two communities, which is why, for these estimations, 264 observations are used instead of all 352.

interest could be represented by the following equation:

$$ls_i = \beta_0 + \beta_1 enr_i + \beta \mathbf{x}_i + u_i \tag{1}$$

where ls_i depicts the labor supply of woman i and enr_i gives the number of children of preschool age in i's household who are enrolled in (pre-)school. $\mathbf{x}$ is a set of control variables including the number of children of preschool age in the household. The parameter of interest is β_1.

If equation 1 was estimated with OLS, however, the estimate of β_1 would generally be biased. Labor supply and school enrollment decisions of members of the same household are likely to be made simultaneously. Women who are in charge of the care for a child may decide to work and consequently convince the household to send the child to school. Thus, if a positive correlation between preschool child enrollment and female labor supply is observed, the direction of causality is not clear. The direction of the bias of β_1 cannot be determined unambiguously if it is assumed that both an increase in labor supply causes higher enrollment rates and higher enrollment rates induce an increase in labor supply.[9]

3.1 Exploiting variation in the accessability of schooling by age for three to five-year-olds

In order to solve the endogeneity problem in equation 1 a valid instrumental variable for enr_i is needed. A natural candidate would be an exogenous source of variation in the accessability of preschool education if there is a direct link between accessability and enrollment. For the sample of women from community A, I use the average age of children of 3 to 5 years of age in the household as an instrument for the number of these children who are enrolled (while controlling for the total number of children of that age group in the household). In section 4.1 I show that there exits a strong relationship between the instrumental variable and the enrollment of preschool age children. The use of this instrument is motivated by a particularity in the way public primary schooling is organized in Togo: the legal school entry age is not strictly enforced. Apparently, many parents do demand daycare for children of preschool age, and under this pressure (and given the lack of preschools in community A as in most rural communities) primary schools started accepting children as young as 5, 4 or even 3 years of age, where the likelihood of being accepted increases with age. Typically, it is not expected that these

[9] A structural model of both decisions could be given by the following two equations:

$$\begin{aligned} ls_i &= \beta_0 + \beta_1 enr_i + \beta \mathbf{x}_i + u_i \\ enr_i &= \gamma_0 + \gamma_1 ls_i + \gamma \mathbf{x}_i + \epsilon_i \end{aligned} \tag{2}$$

enr_i will generally be correlated with u_i. Assuming that u_i and ϵ_i are uncorrelated, the sign of the simultaneity bias in OLS estimates depends on the sign of the covariance of enr_i and the error term in the first equation, which is

$$\frac{\gamma_1 \sigma^2_{u_i}}{1 - \gamma_1 \beta_1} \tag{3}$$

Since both β_1 and γ_1 are expected to be positive, the sign of the bias cannot be deduced unambiguously.

young children are able to follow the curriculum. Instead, as a pure daycare service, these children share the classroom with first graders, and they repeat first grade until they are considered mature enough to pass on.

In that context I argue that sending a child to school "too early" is easier the closer the child is to the regular enrollment age of six years. If the child is too young, it is more likely to revolt against being sent to school. Moreover, primary schools who generously offer this type of daycare services have limited capacities for it, and they give preference to older children among those who are too young. In other words, it will be costlier to send a three-year-old child to school than a four-year-old, and it will be least costly to send a five-year-old to school.

Table 1 reflects this intuition by showing for community A that the share of a cohort of children who are enrolled rises monotonically with age within the age group of 3-5-year-olds. Thus, the age structure of 3-5-year-olds in a household provides a source of variation in the number of these children who are enrolled (conditional on the total number of preschool age children in the household). A significant number of women in the studied community lives in households with more than one child in the relevant age group (19.3 percent of the women in the sample used for estimations in section 4). In order to make use of the information on the age of all of these children, the estimations below use the average age of five-year-olds in a household as an instrumental variable for the number of these children who are enrolled (while controlling for the absolute number of children in that age group in a household). In section 4.1 it is shown that, conditional on the number of 3-5-year-olds in a household and a number of control variables, increasing the average age of these children by one year increases the number of children enrolled by 0.23. F-tests of excluding the instrumental variable from the first stage regression indicate that the relationship is strongly statistically significant.

In order to substantiate the validity of the underlying exclusion restriction, it is illustrative to look at the reduced-form effect of the instrumental variable z_i on female labor supply:

$$ls_i = \pi_0 + \pi_1 z_i + \pi \mathbf{x}_i + \xi_i \tag{4}$$

If z_i, the average age of 3-5-year-olds in a woman's household actually is a valid instrumental

Table 1: Percent of children enrolled by age

Age of child	Observations	Percent enrolled
3	92	10.87
4	113	46.02
5	124	65.32
6	93	83.87
7	93	88.17
8	108	94.44
9	80	90.00

Sample: all children in community A.

variable for enrolment, then π_1 should pick up the effect of enrolment on labor supply. The exclusion restriction for the instrumental variable estimations below implies that its association with enrolment is the only reason for the instrumental variable to have an impact on labor supply.

Could there be other reasons for the instrumental variable to affect labor supply? Assume for the following paragraphs (for ease of discussion) that labor supply is estimated only for women in households with exactly one child in the 3-5-year bracket (which is actually the case for 80.7 percent of the observations used for the instrumental variable estimates below). Then the instrumental variable is equal to the age of that child in years.

Leibowitz et al. (1992) have built a simple model of how the age of a young child may affect the labor supply of women (in the context of their study, the mothers of the children). Their model is explicitly designed for explaining when it is optimal for young mothers to return to the labor market within the first years of their child's life, and their reasoning refers to children who are younger than three. Still, their model provides a useful framework for thinking about age-effects of three to five-year-old children as well. The model predicts that a woman's probability of (re-)entering the labor force rises with increasing age of the child, and that result is driven by two assumptions. Firstly, the costs of child care are assumed to decline with the age of the child. This is exactly the point made in this paper in order to motivate the use of the instrumental variable: in the studied community it is costlier to send a 3-year-old to school than a 5-year old. Secondly, the mother's reservation wage is assumed to decline with the age of the child. Leibowitz et al. (1992) do not discuss exactly why this should be the case, but one can come up with a few suggestions: Women may have different perceptions (probably determined by cultural contexts, in part) about what is most appropriate for young children depending on the age of the children. Furthermore, when the child grows older, providing care for it could generally become an easier task, decreasing the value of a woman's time in home production.

The instrumental variable estimates presented below implicitly assume that these latter effects, which determine a woman's reservation wage, are not present in the context of the studied togolese communities. In fact, previous literature suggests that women's reservation wages generally are independent of the exact age of preschool age children (3 to 5 years). First of all, most studies that investigate the impact of young children on female labor supply do not estimate equation 4, that is, they do not exploit the variation in the age of children within the three to five year bracket, focussing instead on age-effects of children younger than three. With respect to children older than two years they merely control for the presence of children in specific age groups, where the most commonly used partition for preschool children is the one into 0-2-year-old children and 3-5-year-old children (see, for instance, Duleep and Sanders (1994); others like Lehrer (1992) treat preschool children as one single age group.)[10]. Consequently, these studies implicitly assume that both the cost or availability

[10]Another strand of literature evaluates the impact of children on parents' labor supply in an even more general fashion (see, for instance, ?). These studies rather focus on taking into account the simultaneity of labor supply and fertility decisions by exploiting exogenous variation in family size.

of out-of-home child care and a woman's (mother's) reservation wage are constant while a child is in the 3-5-year-bracket.

Regarding the female reservation wage, the assumption of constancy is quite reasonable. While mothers will indeed worry about which type of care is most appropriate for their children, there appears to be consensus among researchers that for children above the age of two, out-of-home care where the child interacts with other children is generally more appropriate than being cared for at home completely (see Leibowitz et al. (1988) and the psychological literature cited therein). Thus, mothers need not worry about negative impacts on their 3-5-year-old children when letting others care for them, regardless of the children's exact age. The appropriateness of a specific child care arrangement may, however, be in part determined by what is socially accepted. In the region studied here, there is a long tradition of women contributing a substantial part to the households' work while being responsible for raising the children as well. Thus, they have always been under the pressure to seek child care arrangements other than caring for them personally full-time even when children were still very young. Consequently, letting others care for very young children is generally socially accepted.

When the child grows older, providing care for it could generally become an easier task, decreasing the value of a woman's time in home production. This is a plausible assumption for the first two or three years of a child's life, where the minimum effort needed to care for the child actually decreases with the child's age, because, at some point, the child is able to eat by itself, no longer wears diapers, etc. It is not clear, however, why a 3-year-old should differ from a 5-year-old in that respect, and I am not aware of any economic literature that elaborates on this point.

A potential reason for variation in women's reservation wage with the exact age of three to five-year-old children in the West African context may be the common practice of fostering-out children. If the probability that a preschool age child is fostered-out rises with its age, then those households with relatively old three to five-year-olds which remain in the dataset may be a non-random sample. If, in addition, households that foster-out also tend to have female members with strong labor force attachment, the selectivity would lead to a bias. However, the direction of the bias would be downwards, such that the instrumental variable estimates of the effect of enrollment should provide a lower bound of the true effect. In addition, all estimations will include a dummy variable indicating whether there are women below the age of 25 in the household who have children who do not live in the same household. This should control for whether a household is prone to foster-out relatively young children in general[11]

Finally, another reason for the exclusion restriction not to be valid (at least theoretically) might

[11] The togolese dataset does not include further information on children of women in a household who do not live in the same household, so their age is not known. That information is supposed to be collected retrospectively when the interview for the second wave of the data are conducted. Furthermore, children not living in the household may also include deceased children.

be that fertility behavior of the preceding years is in part determined endogenously by labor supply decisions in the survey year in a manner that affects the average-age-variable. That would require that, for instance, women with preschool age children in 2008 and generally strong labor force attachment decided years ago that they want to supply labor in the survey year and, in turn, adjusted the timing of births in their household such that in 2008 there are only relatively old preschoolers present. While this source of bias is possible in principle it obviously depends on rather unrealistic assumptions about household behavior.

Very few studies have controlled for the age of young children more carefully than by dividing preschool children into two age groups. In these cases the justification for doing so is always purely arguing in favor of the variability of child care costs or availability with the child's age, and thus, as in this present study, depending on a particular institutional setting (see Leibowitz et al. (1988) who find no significant differences in the impact of 3-5-year-old children on mothers' labor supply with respect to the exact age of the children). None of these studies claim that a woman's reservation wage varies with the age of a child when the child is 3 to 5 years old.

I use data from the studied community in order to estimate the reduced form effect of the instrumental variable on female labor force participation (equation 4). Results are displayed in table 2. The coefficients in the first column resulted from estimating equation 4 with the sample from community A that will be used for the instrumental variable estimations presented in section 4, that is, with observations on women who live in households with at least one child aged three to five years. In addition to the explanatory variables for which coefficients are displayed in table 2 the estimated model includes further covariates that coincide with the ones of specification 4 in tables 3 through 6 in section 4 (coefficients not reported). As expected, the average age of preschool age children in the household significantly and positively affects female labor force participation.

In order to shed some light on what might be the actual source of this age-effect, it is useful to compare these estimates with the ones obtained for community B which has access to preschool. In case the average-age-variable is insignificant there, it would suggest that the variation in the costs or accessability of school in community A (i.e. the accessability being a function of a child's age) really is the source of the age-effect there: while the two communities obviously differ in the fact that in community A the costs of enrollment for preschoolers varies with their age and in community B it does not, there is no reason to believe that women in the two communities differ systematically in whether their reservation wage depends on the exact age of preschool age children or not.

Unfortunately, it is not practicable to replicate the estimation underlying the coefficients in the first column of table 2 for community B in order to proceed with a direct comparison. The equivalent sample in community B (women living in households with at least one child aged three to five years) comprises only 36 observations out of which only two are women who do not work. In order to circumvent this lack in degrees of freedom and in variation in the dependent variable, two steps are taken. First, the

number of control variables is reduced, resulting in the coefficients displayed for community A in the second column of table 2. This reduces the sice of the average-age-coefficient but it is still estimated to be significantly positive. Then, observations on women in households with children of any age (below 17) are added to the sample. Here, it is no longer meaningful to simply control for the average age of three to five-year-old children, instead, this variable is interacted with an indicator of whether the woman lives in a household with three to five-year-old children, and, in addition, that indicator is controlled for as well. The coefficient of the interaction term has the same interpretation as the coefficient of the average-age-variable in the models of the first two columns. Again, for community A (as displayed in the third column), the estimated effect of the average-age-variable is reduced in size but remains statistically significant (at the 10-percent level). For community B however, as shown in the fourth column, the coefficient for the interaction term is smaller and statistically insignificant, with the estimated standard error being more than twice as large as the coefficient. Thus, the reduced form estimates suggest that the average age of preschool age children affects female labor force participation only if, due to a certain institutional setting, enrollment costs vary with the age of preschool children. This lends credibility to the exclusion restriction for the instrumental variable estimations below.

Note that the literature cited in the preceding paragraphs often focuses on the effect of the youngest child on its mother's labor force participation. The reasoning is that with respect to the need of care, a mother's youngest child will always be the most relevant to look at. Accordingly, children of preschool age are expected to have relatively little effect on mother's labor supply when there are even younger children present. That makes particular sense in societies where nuclear families are prevalent where one of two adults (typically the mother) specializes in home production. In that context, the link from a particular child's need of care to an adults labor supply behavior is very clear. In the West African context, though, child care responsibilities are not as clear, which is why the sample used for this study not only includes the mothers of preschool age children but all women living in the same household. It is imaginable that a woman out of several women in the same household may be more responsible to take care of one child than another one, which makes the effect of the age of the youngest child less clear. Still, it is reasonable to expect that overall female labor force participation is less strongly affected by the enrolment status of preschoolers if there are even younger children present. Thus, the estimations in this study include a dummy variable indicating whether the youngest child in a household is younger the three years old. That is the case for 48.3 percent of the households in the sample.

3.2 Using place of residence as an instrumental variable

As an alternative instrument I propose an indicator for whether a woman lives in community B or not when looking at the pooled observations from both communities. As described in section 2, community

Table 2: Reduced form estimates - Mean age of 3-5-year-olds and female labor force participation

	Community A			Community B
	(1)	(2)	(3)	(4)
Average age of 3-5-year-olds in HH	.083	.062		
	(.030)***	(.028)**		
(average age)*(HH has 3-5-year-old children)			.050	.040
			(.028)*	(.079)
HH has 3-5-year-old children			-.178	-.203
			(.128)	(.341)
Number of 3-5-year-olds in HH	-.041	-.022	-.024	.021
	(.037)	(.035)	(.035)	(.134)
HH has 0-year-old children	.172	-.051	-.034	.012
	(.097)*	(.054)	(.038)	(.122)
HH has 1-year-old children	.172	-.077	-.036	-.086
	(.114)	(.055)	(.038)	(.111)
HH has 2-year-old children	.167	-.042	.004	.038
	(.101)*	(.047)	(.036)	(.107)
HH has 6-year-old children	.079	.088	.022	.149
	(.064)	(.058)	(.039)	(.130)
HH has 7-year-old children	.184	.134	.098	.074
	(.052)***	(.050)***	(.037)***	(.099)
Number of 8-9-year-olds in HH	.007	.003	-.0004	.017
	(.038)	(.036)	(.026)	(.067)
Number of 10-11-year-olds in HH	.004	.003	.023	-.0004
	(.036)	(.034)	(.025)	(.113)
Number of 12-16-year-olds in HH	.015	.031	.030	.007
	(.023)	(.022)	(.016)*	(.066)
Age of woman in years	.018	.020	.016	.024
	(.007)***	(.006)***	(.004)***	(.008)***
(age woman)^2	-.0003	-.0003	-.0002	-.0003
	(.00007)***	(.00006)***	(.00004)***	(.00008)***
Number of observations	352	352	733	81

Dependent variable: indicator of whether a woman works. Standard errors are reported in parentheses. A definition of the respective sample is given in the text. The specifications underlying coefficient estimates in columns 1 and 2 include control variables in addition to the ones for which coefficients are displayed (see text).

B already has access to a public preschool. Thus, regardless of the exact age of a preschool age child, it should generally be easier in community B to send 3-5-year-old children to school than in the community without access to a preschool.[12] In fact, this is reflected by the large fraction of children in the relevant age group in community B who are enrolled in preschool: 27 out of 31 preschool age children in community B are enrolled. Thus, residing in one community or the other provides another source of variation in the explanatory variable of interest. The IV-estimations can be modified by including observations from community B and using the dummy variable of whether a woman resides in that community as the instrumental variable instead of the average-age-variable.

Whether this source of variation is actually exogenous can be disputed, of course, since the choice of the place of residence certainly is not randomly determined. In order for the instrumental variable to be valid, the residence indicator should at least be uncorrelated with unobserved characteristics of women in either community. While this cannot be tested, comparing the populations from the two

[12]Note again that the distance between the two communities is too large for preschool age children to commute from one community to another

communities with respect to observed characteristics may, however, indicate whether they are similar in general or not. Table 7 in the appendix compares means of all variables used in the analysis for the two communities separately.[13] The rightmost column reports p-values corresponding to the t-test of whether the difference between the means of a variable in the two communities differs significantly from zero. Overall, the populations from the two communities appear reasonably similar with respect to the covariates, there are a few noticeable differences, however. As noted already there is a very large difference in the number of a household's preschool age children enrolled in school. In addition, there are a few significant differences in socio-demographic characteristics. Regarding the age structure of children in households, there are relatively fewer older children in community B. Women in that community are older on average, and they tend to be divorced more often, and they have fewer religious communities to choose from. There are no tailors in the sample households of community B, which may be due to the fact that community A hosts a larger weekly market which permits easier access of women in that community to a market for non-agricultural goods. Clearly, adults in sample households of community B are worse educated, which can be, to a large extent, explained by the absence of secondary schools in that community, while there is a secondary school in community A. At the time of the survey, community B was not covered by cellular phone networks (while community A was), and, unsurprisingly, fewer people own a mobile phone there. Finally, none of the sample households in the smaller community receive transfers from within Togo, probably also reflecting the low educational level of adults from that community, which may preclude that the migrate within the country in order to obtain a well paid job and remit money to their home community.

Women from community B, for instance, seem to be somewhat older on average than the ones in community A. With respect to the endogenous explanatory variable (number of preschool age children enrolled), however, the difference is again striking: Relative to the number of 3-5-year-olds in the average household, the number of preschool age children who are enrolled is much larger in community B than in A.

4 Results

The causal effect of preschool enrollment on the labor supply of women in households with young children is estimated using an instrumental variables approach. The mean age of three to five-year-olds in a household is used as an instrumental variable for the number of these children who are enrolled, holding constant the absolute number of children in that age group in a household. In addition, the age composition of all other children in a household is controlled for in detail. The sample consists of all women above the age of 16 living in households with at least one child of three to five years of age. The dependent variable is an indicator of whether the woman currently works

[13] As noted above, muslim women will be dropped from the community A population for instrumental variables estimations involving observations from both communities.

or not.[14] In addition, results are presented that make use of an alternative instrumental variable, an indicator of whether the woman lives in community B or not.

For each approach and sample four different specifications are estimated. Table 3 in section 4.1 indicates the groups of covariates that are included in each specification. Definitions of the respective variables are given in the Appendix. Note in particular that the age composition of children in a household is controlled for very accurately. Besides the number of 3-5-year-olds, all regressions include 14 dummy variables indicating whether there are children of a particular cohort living in a household (that is, year by year for 0-2-year-olds and 6-16-year-olds).

4.1 First stage regression: mean age of 3-5-year-olds and enrollment

The first row of table 3 reports OLS-estimates of the association between the number of 3-5-year-olds in a household that are enrolled in school and the instrumental variable, controlling for the absolute number of children in that age group in a household. As expected, conditional on the number of preschool age children in a household, the number of these children enrolled in school significantly increases when these children are relatively old. Furthermore, the coefficient of the instrumental variable is relatively insensitive to the inclusion of additional control variables. The tables for the second stage results in section 4.2 will display the F-test of excluding the instrumental variable in the first stage regression for all specifications and various samples. The results of these tests consistently suggest that the first stage relationship between the average-age-variable and the endogenous explanatory variable is strong enough to identify the effect of enrollment on female labor supply. The second row in table 3 shows the coefficient for the number of preschool age children. It suggests that, for the average woman, an additional 3-5-year-old child in her household would have a chance of a little more than a third to be sent to school, ceteris paribus.

To illustrate, consider a typical household with exactly one child of preschool age. Holding everything else constant, the child has a 23 percentage points higher probability of being enrolled when it is four years old than when it is three years old, and it is 45 percentage points more likely to be enrolled when it is five years old than two years earlier. Imagine that a second child in the household enters the relevant age bracket (that is, it turns three years old) when the first child turns five years old. In this particular case, the average-age-variable remains unchanged compared to one year earlier (when there was only one four-year-old child). The coefficient for the the number of three to five-year-olds implies that now the number of children enrolled rises by 0.37. Assuming that the enrollment status of the older child does not change, this implies that, in this particular example, the probability of enrollment of the three-year-old is equal to 37 percent.

Columns one and two of table 8 in the Appendix display coefficient estimates and standard errors

[14] This variable equals one if the respondent does paid work, works in a free-lance occupation, runs an agricultural or non-agricultural enterprize, works in agriculture or as family aid, or when she supplies several of these types of work.

Table 3: First stage - Mean age of 3-5-year-olds and enrollment

	Specification			
	(1)	(2)	(3)	(4)
Average age of 3-5-year-olds in HH	.251	.255	.225	.225
	(.041)***	(.041)***	(.044)***	(.044)***
number of 3-5-year-olds in HH	.358	.368	.371	.371
	(.074)***	(.073)***	(.073)***	(.074)***
Age structure of remaining children in HH	✓	✓	✓	✓
Age and age^2 of woman	✓	✓	✓	✓
Woman pregnant	✓	✓	✓	✓
Family status of woman	✓	✓	✓	✓
Education of woman	✓	✓	✓	✓
Religion of woman	✓	✓	✓	✓
Women<26 who have children outside HH	✓	✓	✓	✓
Occupation of other adults in HH		✓	✓	✓
Education of other adults in HH		✓	✓	✓
Number of other adult females in HH		✓	✓	✓
Size of dwelling			✓	✓
S'one in HH owns stereo/mobile/house/land			✓	✓
Surface of agricultural land used			✓	✓
Cash transfers to the household				✓

Dependent variable: number of 3-5-year-olds in a household who are enrolled in school. Robust standard errors are reported in parentheses. A definition of the sample is given in the text. The number of observations is equal to 352.

respectively for the remaining explanatory variables in the first stage regression when using specification 4. It is not the aim of this paper to investigate the determinants of the enrollment of preschool children, so only a few striking results are discussed here. Looking at the effects of the indicators for the presence of different child age groups in the household it turns out that the influence of the overall age structure on preschool age child enrollment does not exhibit a clear pattern. One might have expected that the presence of older children in the household generally reduces enrollment as these children may serve as a substitute for institutionalized child care. Furthermore, the education of the woman does not appear to matter for enrollment. This may indicate that the women in the sample, on average, do not have the final say on enrollment decisions such that their preferences do not completely manifest themselves in the enrollment decisions made by the household (assuming that more educated women prefer high enrollment). Supporting this view, the education of other adult household members clearly does matter for enrollment (this variable is largely driven by the variation in the education of adult males between households). The higher the educational level of other adults in the household, the more preschool age children are enrolled, ceteris paribus. Finally, it is not clear whether richer or wealthier households are more likely to enroll preschool age children. While house ownership as an indicator for wealth clearly is associated with more enrollment, other variables measuring the ownership of luxury goods and land or the earnings potential are not estimated to have a statistically significant effect. Overall, the estimated coefficients appear plausible, and the first stage regressions actually explain observed enrollment quite well (as measured by R^2 which is .38 for specification 4).

4.2 Instrumental variable estimation of the effect of enrollment on labor supply

The first panel of table 4 presents instrumental variable estimates of the effect of enrollment of preschool age children on the labor supply of women in the same household using the complete sample and comparing them to OLS-estimates. Here, only the impact of enrollment is discussed. Table 8 in the appendix includes coefficients of for the other determinants of female labor force participation[15]. As can be seen from the estimates in the first panel of table 4, preschool child enrollment significantly increases female labor supply. According to the coefficient estimate using the richest set of control variables (specification 4, columns 7 and 8), the likelihood that a women works is 37 percentage points higher when the number of preschool age children that are enrolled increases by one (holding constant the total number of 3-5-year-olds in the household). Specifications 3 and 4 generally produce slightly larger standard errors of the IV-coefficients than the first two specifications, but they also result in larger coefficient estimates, and overall, the statistical significance is higher. Furthermore, the IV-estimate is always larger than the respective coefficient from OLS-estimation, implying that the latter exhibit a negative simultaneity bias.

Note that the sample used for the estimations includes both the mothers of the preschool age children in the community if they live in the same household, as well as all other women. One could argue that the mothers' behavior is more strongly affected by the children's enrollment status than that of the remaining women. Accordingly, since the younger women in the sample are more likely to be the mothers of the respective preschool age children, the enrollment effect might be more pronounced for younger women. On the other hand, it could be argued that some of youngest women in the sample are still in school[16] and thus no impact on their labor supply would be expected.[17]. Both concerns motivate to investigate whether the enrollment effect varies with the age of the woman. To start with, as shown in the remaining panels of table 4, it is investigated how sensitive the estimates are to the exclusion of younger women. In fact, almost none of the women older than 18 still go to school. So excluding 17- and 18-year-olds from the sample as was done for the estimates in the second

[15] To summarize a few findings: It turns out that increasing the number of preschool age children in a household, whether they are enrolled or not, significantly reduces labor supply. The same holds true for the presence of *pre*-preschool age children in the household. When children turn six to seven years, however, they are very likely to be enrolled in school, as seen in table 1 in section 3. Accordingly, having household members in that age group is, on average, positively associated with female labor supply. Strikingly, the different levels of schooling of the women (with no schooling being the baseline category; the categories are exclusive) is irrelevant for labor supply or even exhibits a marginally significant negative effect in the case of women who completed a few years of primary school. Furthermore, the coefficient estimates consistently imply that the presence of better educated adults other than the woman significantly reduces her likelihood of working. Finally, no clear pattern regarding the effect of wealth or earnings potential of the household is observed. Overall it appears that female labor supply in community A is driven to a large extent by the opportunity costs of her time which are a function of the presence of young children in the household. Furthermore, the potential returns to education for women in the community are probably low such that own schooling is not as relevant for the labor supply decision. Males, on the other hand, probably have higher returns to education such that high schooling also implies high earnings potentials for them. If they succeed in realizing these returns, than social norms may induce them not to let the women in their household work as soon as they can afford to do so

[16] As pointed out in section 2, the original sample includes all women older than 16.

[17] It will be a separate issue to investigate the impact of the enrollment of preschool age children on the enrollment of older children and adolescents in the same household

Table 4: Sensitivity of IV-estimates to the exclusion of younger women

Coefficient for the number of 3-5-year-olds in school	Specification							
	(1)		(2)		(3)		(4)	
	IV	OLS	IV	OLS	IV	OLS	IV	OLS
All women (n=352)	.277 (.11)**	.066 (.035)*	.282 (.109)***	.098 (.035)***	.380 (.129)***	.113 (.037)***	.374 (.13)***	.112 (.037)***
F-test of IV	38.2		38.5		26.3		25.7	
Women>18 (n=332)	.263 (.118)**	.066 (.036)*	.259 (.114)**	.094 (.037)**	.347 (.133)***	.11 (.038)***	.343 (.133)***	.110 (.038)***
F-test of IV	32.3		33.6		22.4		22.2	
Women>20 (n=301)	.151 (.112)	.047 (.037)	.145 (.116)	.078 (.038)**	.236 (.129)*	.098 (.039)**	.236 (.129)*	.097 (.039)**
F-test of IV	25.0		22.9		15.9		15.8	
Women>25 (n=235)	.074 (.112)	.035 (.04)	.071 (.114)	.074 (.041)*	.119 (.123)	.100 (.044)**	.125 (.121)	.098 (.045)**
F-test of IV	20.6		21.8		17.1		17.6	
Women>30 (n=159)	-.047 (.136)	.019 (.048)	-.028 (.131)	.059 (.054)	.004 (.177)	.064 (.063)	.006 (.176)	.065 (.064)
F-test of IV	16.3		19.1		11.4		11.2	

Dependent variable: indicator of whether the individual works. Instrumental variable: average age of 3-5-year-olds and enrollment. Robust standard errors are reported in parentheses. A definition of the sample is given in the text. "F-test of IV" gives the value of the F-statistic of the exclusion of the instrumental variable in the first stage.

panel of table 4 should provide insight into whether school enrollment of women in the sample affects the results. It turns out that the coefficient estimates are a little bit smaller and slightly less precisely estimated than with the full sample, suggesting that, if the youngest women in the sample differ in their response to enrollment of preschool age children, they do in the sense that their response is actually larger than for the remaining women. Thus, school enrollment of women in the sample does not appear to affect the results. Furthermore, when more and more young cohorts are excluded from the sample, the coefficient estimates appear to approach zero. This might indicate that the strong enrollment effects found for the whole sample are to a large extent driven by young women.

The potential for a differential effect of the enrollment variable with respect to the age of the women is further investigated in table 5 where the sensitivity of the estimates to the exclusion of older women is shown. Strikingly, the enrollment-coefficient as well as its statistical significance increase when older women are excluded from the sample step by step. There is an apparent jump in coefficient size as soon as women older than 39 are excluded. Results from the lowest panel where only women below 30 were included must be interpreted with caution as they potentially suffer from a weak-instrument-problem. Nevertheless the results suggest that the large and significant overall effect of enrollment of preschool age children on female labor supply actually is driven by relatively young women who are more likely to be mothers of young children than older women. However, to investigate the issue further, estimations would have to be made with a sample of mothers of three to five-year-olds alone, which is not possible due to small sample size.

As an alternative identification strategy I make use of the fact that the community investigated so fare (community A) does not have access to a preschool while I have also obtained data on house-

Table 5: Sensitivity of IV-estimates to the exclusion of older women

Coefficient for the number of 3-5-year-olds in school	Specification (1) IV	(1) OLS	(2) IV	(2) OLS	(3) IV	(3) OLS	(4) IV	(4) OLS
All women (n=352)	.277 (.11)**	.066 (.035)*	.282 (.109)***	.098 (.035)***	.380 (.129)***	.113 (.037)***	.374 (.13)***	.112 (.037)***
F-test of IV	38.2		38.5		26.3		25.7	
Women<60 (n=327)	.284 (.107)***	.087 (.035)**	.295 (.105)***	.122 (.036)***	.373 (.125)***	.134 (.036)***	.362 (.124)***	.134 (.037)***
F-test of IV	38.5		37.7		25.7		25.5	
Women<50 (n=300)	.283 (.109)***	.088 (.035)**	.301 (.109)***	.120 (.037)***	.377 (.124)***	.126 (.038)***	.363 (.123)***	.126 (.038)***
F-test of IV	36.2		32.5		24.9		24.5	
Women<40 (n=257)	.402 (.131)***	.100 (.043)**	.398 (.123)***	.123 (.045)***	.480 (.138)***	.132 (.045)***	.470 (.136)***	.132 (.045)***
F-test of IV	32.4		30.3		25.3		24.9	
Women<30 (n=174)	.491 (.162)***	.142 (.058)**	.506 (.16)***	.156 (.055)***	.578 (.202)***	.152 (.055)***	.558 (.206)***	.148 (.056)***
F-test of IV	25.8		17.9		11.0		10.0	

Dependent variable: indicator of whether the individual works. Instrumental variable: average age of 3-5-year-olds and enrollment. Robust standard errors are reported in parentheses. A definition of the sample is given in the text. "F-test of IV" gives the value of the F-statistic of the exclusion of the instrumental variable in the first stage.

holds from another community in the region (community B) that does have access to a preschool. As described in section 3, the analysis can be repeated by pooling (non-muslim[18]) observations from community A with observations from community B and using a place of residence indicator as instrumental variable. The validity of this identification strategy requires the place of residence indicator to be uncorrelated with unobserved characteristics of women in either community, which remains to be a strong assumption . However, these estimations valuable since they may (or may not) increase confidence in the preceding estimates.

Table 6 presents coefficient estimates for the impact of the number of preschool age children enrolled on female labor supply when using the community-B-dummy as instrumental variable. As with the original IV-strategy, the first stage relationship between the instrument and the endogenous explanatory variable is fairly strong . The estimates for the second stage coefficient confirm a statistically significant positive impact of enrollment on female labor supply, at least when the sample is restricted to women below 50. However, when covariates are added to the most modest specification, the effect is reduced in comparison to the estimates from above where only observations from community A were used. This finding could be the result of two different effects or a mixture of both. First, it could be that the instrumental variable used here (place of residence) is not exogenous (conditional on the a vector of covariates) and thus the estimated coefficient is biased and differs from the one obtained with the average age variable as instrument (which, presumably, captures the true causal effect of enrollment on female labor force participation). Second, the different results could indicate

[18]Note again that for these estimations, muslim women are excluded from the community-A-sample for the sake of comparability since community B does not include a muslim community.

Table 6: Estimates using place of residence as instrumental variable

Coefficient for the number of 3-5-year-olds in school	Specification							
	(1)		(2)		(3)		(4)	
	IV	OLS	IV	OLS	IV	OLS	IV	OLS
All women (n=300)	.279	.11	.091	.129	.093	.136	.076	.134
	(.114)**	(.036)***	(.09)	(.035)***	(.087)	(.036)***	(.085)	(.036)***
F-test of IV	19.739		22.862		26.173		25.735	
Women<50 (n=255)	.276	.122	.11	.141	.141	.143	.133	.143
	(.09)***	(.037)***	(.072)	(.036)***	(.08)*	(.036)***	(.079)*	(.037)***
F-test of IV	21.691		23.255		24.336		23.992	
Women<40 (n=220)	.308	.14	.136	.16	.17	.166	.161	.165
	(.102)***	(.044)***	(.081)*	(.044)***	(.092)*	(.045)***	(.091)*	(.045)***
F-test of IV	22.33		25.899		25.371		24.959	

Dependent variable: indicator of whether the individual works. Instrumental variable: indicator of whether the individual lives in community B or not. Robust standard errors are reported in parentheses. A definition of the sample is given in the text. "F-test of IV" gives the value of the F-statistic of the exclusion of the instrumental variable in the first stage. Control variables are the same as for the estimations underlying tables 4 and 5, with the exception that instead of using dummy variables, two variables capture the number of 6 to 12-year-olds in a household as well as the number of 13 to 16-year-olds in a household.

that the treatment effect (the impact of enrollment) is heterogenous across populations. In that case the instrumental variable estimator captures a local average treatment effect, i.e. the treatment effect for those women who live in households where preschool age children are enrolled due to a specific value of the instrumental variable. In other words, the causal effect of enrollment for those women who live in community-A-households where preschool age children are enrolled *because* they are relatively old may differ from the causal effect for those women who live in community-B-households where preschool age children are enrolled *because* they live in community B. In sum, the main result of the paper, i.e. a positive and significant effect of enrollment on female labor force participation is confirmed when using the alternative instrumental variable, although the coefficient estimates are smaller when based on exploiting the variation in enrollment between communities A and B. Whether the difference in the estimates is due to potential endogeneity of the place of residence indicator or due to heterogenous treatment effects cannot be concluded.

Finally, it may be argued that the linear probability models estimated so far are not appropriate since the dependent variable is binary. The first two rows of table 9 in the appendix thus shows marginal effects for the enrollment variables calculated after instrumental variable probit for various specifications, both instrumental variables, and using the full samples. In each case both marginal effects at the mean and average marginal effects are calculated. For the estimations making use of the preferred instrumental variable (average age), marginal effects are in general quite close to the coefficient estimates from the linear probability models, although the tend to be slightly larger and have somewhat larger standard errors as well. In three out of four specifications the average marginal effects are closer to the parameter from the linear probability model than marginal effects at the mean. When using the residence indicator as instrument, the same pattern is observed for the marginal effects, however, the deviations with respect to coefficient size and standard error tend to be

larger. Overall, the results do not suggest that the coefficient estimates are are particularly sensitive to assumptions on the functional form of the conditional expectation that is being estimated when the preferred instrumental variable (mean age of 3-5-year olds in the household) is used. Slightly more caution may be warranted when using the alternative instrumental variable.

5 Conclusion

The aim of this paper was to investigate the causal effect of a child of preschool age attending school on the labor supply of women in the same household in the context of a developing country. Results from instrumental variable estimations were presented using data from a recent household survey conducted in southern Togo. They indicate that women in the studied communities are significantly more likely to work when there are fewer children to care for at home. Furthermore, the large positive effect of enrollment on female labor supply appears to be driven by the large response of young women. Results from a comparison with a neighboring community that has easier access to child care confirm the positive effect on labor supply.

The empirical strategy of this paper was to exploit constraints on the supply side in order to identify the causal effect of preschool child enrollment on female labor supply. To measure this effect is of policy relevance only if improved access to preschools actually corresponds to a significant demand. In other words, can full (or even any) take-up of public preschool places be assumed in developing countries? One might be tempted to think that this is not the case given that several studies find that households delay the enrollment of their children into *primary* school in several African countries[19] which may appear to indicate that there is generally a low demand for schooling for the youngest children, and which clearly contradicts predictions of human capital theory[20] The explanations that have been put forward in order to explain delayed enrollment, though, do not necessarily apply to the demand for preschool education. Glewwe and Jacoby (1995) argue that early childhood malnutrition may impede a child's readiness to go to school. Waiting for child growth to compensate in part for the retardation before enrolling the child may then be optimal if the child's readiness affects the efficiency of the human capital investment[21]. However, a child may well be retarded in its physical development but still be "ready" for preschool. This is certainly the case if preschool is mainly considered as an institution providing daycare as compared to one that is aimed at skill formation.[22]

[19] See, for instance, Glewwe and Jacoby (1995), Glewwe and Jacoby (1992), Bommier and Lambert (2000), Glewwe et al. (2001), Alderman et al. (2006). However, delayed primary school enrollment does not appear to play a significant role in the studied communities: as can be seen from table 1 in section 3 for instance, enrollment rates of children of the regular entry age for primary school (six years) are relatively high, and they rise only slightly for older cohorts.

[20] Given that adults who seek to maximize the discounted future income of the children net of schooling costs simultaneously decide over school entry age and the amount of schooling, it would (under typical assumptions) always be optimal to enroll children as early as possible. This will permit to maximize the period during which a child can reap the profits of the earlier human capital investment, dividing life into two specialized periods.

[21] Glewwe and Jacoby (1995) find evidence for their hypothesis using Ghanaian data, Rungo (2008) does so for Brazil.

[22] For the case of West Africa, it has been argued that schooling below the secondary level does not contribute significantly to cognitive skill formation (see Glewwe (1991), Glewwe and Jacoby (1994), Lavy (1996)).

In addition, parents do not face a trade-off between their children's labor and their education in the case of preschool age children, simply because these children are generally too young to contribute significantly to the household's workforce. Thus, the opportunity costs of sending preschool age children to school should be very low. In other words, a household that faces credit constraints, does not have the option to let a preschool age child earn the costs of preschool enrolment first and to send it to preschool afterwards[23]. And, accordingly, there cannot be any potential returns to work experience for these very young children which could enter the households decision making process in any way[24]. Furthermore, all incentives to let some children go to *primary* school earlier than others (due to bride price institutions, for instance, see Bommier and Lambert (2000)) should have no effect on whether a child attends *pre*school or not, as long as preschool attendance does not affect the flexibility of the legal *primary* school enrollment age.

Even though credit constraints would not predict delayed enrolment in preschool, they will of course be relevant for the decision on whether to enroll a child in preschool at all (in fact, the instrumental variable approach used in this paper only works because costs matter for the enrollment decision). However, as has been pointed out in the preceding paragraph, opportunity costs of enrollment are lower for preschool children than for primary school children. In addition, the opportunity costs of caring for children are probably higher when these children are relatively young[25], because at some age, primary school children will no longer need the presence of an adult or older sibling. In sum, the economic incentives to send a child to school are largest when it is of preschool age. Still, in order to achieve high enrolment rates, the provision of preschool education should be at low direct costs for the beneficiaries.

One element of these costs, the distance to the nearest school, has been observed to be a deterrent to primary school enrollment in areas where children have to walk to school[26]. It will of course be particular relevant for the case of preschool enrollment: in the absence of public transport it will be necessary for family members to work their small children to preschool, and the time allocated to that activity increases with geographic distance to school. Accordingly, any preschool program should be targeted at population in cities and towns where preschools can attract enough children within short distance, as in the case studied in this paper. Full coverage of populations in developing countries certainly cannot be the goal for the near future. To sum up, the result that preschool enrollment increases female labor supply is of high policy relevance since enrollment in turn may be effectively increased by expansions of public provision of preschool education at sufficiently low direct costs for the affected households. Thus it may be a convenient means to invest in preschool infrastructure in

[23] Theoretically, such behavior could lead to delayed enrollment of *primary* school enrollment, if the respective children are sufficiently productive workers. However, Glewwe and Jacoby (1995) do not find evidence in favor of this hypothesis.

[24] Bommier and Lambert (2000) argue that there may be large returns to work experience of children of primary school age provide an incentive to delay primary school enrollment.

[25] Serra (2009) names opportunity costs of rearing children as one obvious reason for households to foster out children, a phenomenon which is particular prevalent in West Africa, as she shows.

[26] see Bommier and Lambert (2000), for instance, for evidence from Tanzania

order to reduce poverty.

This policy implication is amplified by the fact that preschool attendance presumably also has positive effects on the human capital development of affected children. Whether that is generally the case in developing countries remains a topic for future research. Any positive impact on human capital development is likely to depend on the quality of a particular preschool program. In that respect, the case of the togolese community studied here might not constitute an example of good practice: it is not clear how sitting along with first-graders in the same classroom without additional supervision is supposed enhance the preschoolers' development. Additional resource would be necessary in order promote female employment and young children's cognitive and physical development at the same time.

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Appendix

Definition of control variables

Age structure of remaining children in HH:[27] (number of 3-5-year-olds in HH), indicators of whether there lives at least one X-year-old child in the household (less than 1-year-old children in HH; X-year-old children in HH), indicator of whether the youngest child in the household is younger than three (youngest child in HH is younger than 3)

Age and age^2 of woman: (age), (age squared)

Fostering-out behavior: indicator of whether there is at least one mother below the age of 26 in the household who reports to have given birth to at least one child which does not live with her (women<26 who have children outside HH)

Woman pregnant: indicator of whether the woman is pregnant (pregnant)

Family status of woman: indicator of whether the woman is the household head (household head), indicator of whether the woman has never been married (single), indicator of whether the woman is divorced (divorced)

Education of woman: indicator of whether the woman went to school but did not obtain any diploma (has completed some school), indicator of whether the women completed "CEPD" or "BEPC" (has completed middle school), indicator of whether the woman completed an apprenticeship (has completed apprenticeship)

Religion of woman: indicators of whether the woman is of religion X (religion: catholic; religion: protestant; religion: pentecostal; religion: muslim)

Occupation of other adults in HH: these variables are defined according to what respondents indicated to be their first occupation. (number of adult farmers in HH), number of adults in the household who indicated to work in "Petit commerces alimentaires", "Autre petit commerce" or "Boutique" (number of adult tradesmen in HH), number of adults in the household who indicated to work in "Autre artisanat" (number of adult craftsmen (cat.1) in HH), indicator of whether there are adult tailors in the household (adult tailors in HH), indicator of whether there are adults working in transportation of goods or people in the household (adults working in transportation in HH), indicator of whether there are adult adults working as teachers, priests or as other "fonctionnaire" in the household (working in public sector in HH), indicator of whether there are adults working as carpenters, mecanics, sawyer or in construction in the household (adult craftsmen (cat.2) in HH)

Education of other adults in HH: (number of adult who completed some school in HH), (number of adult who completed middle school in HH), indicator of whether there are adults in the household who completed "CEPD" or "BEPC" (adults who completed upper sec. school in HH), indicator of whether there are adults in the household who obtained a baccalaureate (adults who obtained baccalauréat in HH), (number of adult who completed apprenticeship in HH)

Number of other adult females in HH: (number of adult females in HH)

Size of dwelling: (number of rooms of dwelling)

S'one in HH owns stereo/mobile/house/land: indicator of whether someone in the household owns X (someone in the HH owns a stereo; someone in the HH owns a cellular phone; someone in the HH owns a house; someone in the HH owns land)

Surface of agricultural land used: surface of total agricultural land used by the household in hectare (surface of agric. land used by HH), surface of total agricultural land used for either cocoa or coffee by the household in hectare (surface used for cash crops)

Cash transfers to the household: indicator of whether the household receives cash transfer from someone living in Togo (HH receives transfers from within Togo), indicator of whether the household receives cash transfers from someone living outside Togo (HH receives transfers from outside Togo)

Table 7: Descriptive statistics

	Community A				Community B		t-test
	all (n=352)		without muslims (n=264)		all (n=36)		column 3 - column 5
Variable	Mean	St.Dev.	Mean	St.Dev.	Mean	St.Dev.	(p-values)
Work*	0.85	0.36	0.86	0.35	0.94	0.23	0.16
# 3-5-year-olds in school	0.53	0.57	0.58	0.58	1.00	0.48	0.00
average age of 3-5-year-olds in HH	4.13	0.71	4.08	0.72	3.90	0.78	0.17
# 3-5-year-olds in HH	1.25	0.56	1.20	0.47	1.25	0.44	0.59
Pregnant*	0.08	0.28	0.09	0.28	0.08	0.28	0.94
Less than 1-year-old children in HH*	0.15	0.36	0.13	0.34	0.08	0.28	0.44
1-year-old children in HH*	0.15	0.36	0.15	0.36	0.17	0.38	0.77
2-year-old children in HH*	0.24	0.43	0.23	0.42	0.19	0.40	0.66
6-year-old children in HH*	0.13	0.33	0.13	0.34	0.03	0.17	0.08
7-year-old children in HH*	0.18	0.38	0.13	0.34	0.17	0.38	0.53
8-year-old children in HH*	0.22	0.41	0.17	0.37	0.36	0.49	0.01
9-year-old children in HH*	0.15	0.36	0.12	0.32	0.03	0.17	0.10
10-year-old children in HH*	0.22	0.41	0.23	0.42	0.11	0.32	0.09
11-year-old children in HH*	0.13	0.33	0.12	0.33	0.08	0.28	0.51
12-year-old children in HH*	0.16	0.37	0.14	0.35	0.06	0.23	0.16
13-year-old children in HH*	0.12	0.32	0.12	0.32	0.03	0.17	0.10
14-year-old children in HH*	0.11	0.31	0.10	0.30	0.11	0.32	0.81
15-year-old children in HH*	0.14	0.34	0.13	0.34	0.00	0.00	0.02
16-year-old children in HH*	0.09	0.29	0.10	0.30	0.00	0.00	0.05
Age	34.19	14.60	34.30	14.36	39.00	15.32	0.07
Age squared	1381.62	1334.92	1381.73	1313.32	1749.11	1446.58	0.12
Women<26 who have children outside HH	0.12	0.32	0.11	0.32	0.06	0.23	0.29
Youngest child in HH is younger than 3	0.48	0.50	0.47	0.50	0.44	0.50	0.81
Household head*	0.14	0.35	0.17	0.37	0.19	0.40	0.68
Single*	0.15	0.36	0.14	0.35	0.06	0.23	0.16
Divorced*	0.05	0.21	0.06	0.25	0.17	0.38	0.03
Has completed some school*	0.39	0.49	0.44	0.50	0.58	0.50	0.10
Has completed middle school*	0.29	0.45	0.35	0.48	0.36	0.49	0.88
Has completed apprenticeship*	0.24	0.43	0.27	0.45	0.19	0.40	0.32
Religion: catholic*	0.49	0.50	0.65	0.48	0.86	0.35	0.01
Religion: protestant*	0.11	0.31	0.14	0.35	0.00	0.00	0.01
Religion: pentecostal*	0.12	0.32	0.16	0.37	0.11	0.32	0.46
Religion: muslim*	0.25	0.43					
# adults farmers in HH	1.36	2.03	1.38	2.13	1.44	1.40	0.87
# adults tradesmen in HH	0.43	0.76	0.35	0.72	0.31	0.52	0.73
# adults craftsmen (cat.1) in HH	0.19	0.53	0.17	0.53	0.19	0.47	0.80
Adult tailors in HH*	0.08	0.27	0.09	0.28	0.00	0.00	0.07
Adults working in transportation in HH*	0.05	0.21	0.05	0.22	0.03	0.17	0.57
Adults working in public sector in HH*	0.07	0.26	0.09	0.29	0.06	0.23	0.48
Adult craftsmen (cat.2) in HH*	0.08	0.28	0.08	0.27	0.03	0.17	0.27
# adults who completed some school in HH	0.70	0.92	0.71	0.92	1.08	1.00	0.02
# adults who completed middle school in HH	0.96	1.21	1.12	1.29	0.89	0.92	0.30
Adults who compl. upper sec. school in HH*	0.16	0.37	0.17	0.38	0.00	0.00	0.01
Adults who obtained baccalauréat in HH*	0.07	0.26	0.09	0.29	0.00	0.00	0.06
# adults who compl. apprenticeship in HH	0.66	0.81	0.69	0.81	0.72	0.57	0.81
# adults females in HH	1.09	1.49	1.10	1.64	0.83	0.81	0.34
# rooms of dwelling	3.30	2.09	3.01	1.81	3.08	1.50	0.81
Someone in the HH owns a stereo*	0.60	0.49	0.60	0.49	0.61	0.49	0.89
Someone in the HH owns a cellular phone*	0.36	0.48	0.34	0.48	0.06	0.23	0.00
Someone in the HH owns a house*	0.39	0.49	0.37	0.48	0.42	0.50	0.57
Someone in the HH owns land*	0.42	0.49	0.43	0.50	0.50	0.51	0.42
Surface of agric. land used by HH	13.64	20.37	13.19	19.24	16.53	14.46	0.32
Surface used for cash crops	5.18	11.53	5.49	12.36	6.31	9.49	0.70
HH receives transfers from within Togo*	0.09	0.29	0.10	0.30	0.00	0.00	0.04
HH receives transfers from outside Togo*	0.05	0.21	0.05	0.22	0.11	0.32	0.13

Sample: all women above the age of 16 in the studied community who live in a household with at least one child of 3 to 5 years of age. Asterisks indicate dummy variables. For a definition of the variables see the preceding page

Table 8: First and second stage: remaining coefficients

	first stage		second stage	
	coeff.	robust s.e.	coeff.	robust s.e.
Work* # 3-5-year-olds in school			.373***	.131
average age of 3-5-year-olds in HH	.226***	.044		
# 3-5-year-olds in HH	.373***	.074	-.180***	.062
Pregnant*	-.203*	.109	.099	.073
Less than 1-year-old children in HH*	-.045	.080	-.006	.062
1-year-old children in HH*	.072	.099	-.128**	.062
2-year-old children in HH*	.089	.075	-.104**	.053
6-year-old children in HH*	-.084	.087	.172***	.066
7-year-old children in HH*	.035	.079	.196***	.049
8-year-old children in HH*	-.078	.082	.075	.048
9-year-old children in HH*	.075	.085	.030	.051
10-year-old children in HH*	-.045	.076	.052	.051
11-year-old children in HH*	-.067	.091	-.018	.061
12-year-old children in HH*	-.214**	.105	.100	.067
13-year-old children in HH*	.269***	.102	-.050	.057
14-year-old children in HH*	-.023	.089	.082	.062
15-year-old children in HH*	-.104	.092	.016	.070
16-year-old children in HH*	-.243*	.139	-.061	.096
Age	-.003	.010	.020***	.007
Age squared	.00004	.0001	-.0003***	.00008
Household head*	.187*	.097	.034	.070
Single*	-.058	.084	-.095	.068
Divorced*	.052	.152	-.119	.105
Has completed some school*	.128*	.071	-.093*	.055
Has completed middle school*	.113	.077	.024	.056
Has completed apprenticeship*	.094	.068	.034	.042
Religion: catholic*	-.014	.168	.099	.108
Religion: protestant*	.145	.197	.009	.124
Religion: pentecostal*	-.001	.182	.111	.115
Religion: muslim*	-.059	.179	-.071	.123
# adults farmers in HH	-.046	.031	.116***	.024
# adults tradesmen in HH	.027	.057	.055	.046
# adults craftsmen (cat.1) in HH	-.0001	.056	.077*	.041
Adult tailors in HH*	.252***	.097	-.043	.074
Adults working in transportation in HH*	.118	.138	.081	.094
Adults working in public sector in HH*	.127	.133	.023	.108
Adult craftsmen (cat.2) in HH*	-.223**	.111	.226***	.077
# adults who completed some school in HH	.062	.041	-.079***	.029
# adults who completed middle school in HH	.093**	.041	-.084***	.031
Adults who compl. upper sec. school in HH*	.256***	.093	-.291***	.065
Adults who obtained baccalauréat in HH*	.296**	.131	-.301**	.119
# adults who compl. apprenticeship in HH	-.045	.041	-.003	.035
# adults females in HH	.009	.037	-.038	.028
# rooms of dwelling	-.065***	.019	.045***	.017
Someone in the HH owns a stereo*	.069	.071	-.030	.044
Someone in the HH owns a cellular phone*	.057	.079	-.067	.047
Someone in the HH owns a house*	.180***	.068	-.011	.052
Someone in the HH owns land*	.047	.069	-.051	.046
Surface of agric. land used by HH	.0002	.002	.002	.001
Surface used for cash crops	.004	.004	-.0006	.002
HH receives transfers from within Togo*	.013	.104	-.032	.073
HH receives transfers from outside Togo*	.042	.111	-.019	.086
cons	-.979***	.309	.418**	.196

Table 9: Marginal effects obtained after IV-probit

Coefficient for the number of 3-5-year-olds in school	Specification											
	(1)			(2)			(3)			(4)		
	IV	MEM	AME	IV	MEM	AME	IV	MEM	AME	IV	MEM	AME
IV: "age"	.277	.295	.291	.282	.318	.331	.380	.401	.390	.374	.396	.388
enr.: regular	(.110)**	(.111)***		(.109)***	(.130)**		(.129)***	(.158)**		(.130)***	(.158)**	
IV: "community"	.281	.490	.354	.163	.328	.301	.144	.255	.286	.125	.180	.244
enr.: regular	(.110)**	(.179)***		(.090)*	(.238)		(.084)*	(.196)		(.080)	(.156)	

Dependent variable: indicator of whether the individual works. Instrumental variable: "age" refers to the mean age of 3-5-year-olds in the household; "community" refers to an indicator of whether the individual lives in community B or not. "IV"-columns repeat coefficient estimates from the linear probability model, "MEM"-columns report marginal effects after IV-probit evaluated at the sample mean, "AME"-columns report average marginal effects. Robust standard errors are reported in parentheses. A definition of the sample is given in the text.