The demand for child care and female labor supply in developing countries - First results from field work in southern Togo*

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April 1, 2009

Abstract: The aim of this paper is to investigate the causal effect of school enrollment of child of preschool age on the labor supply of women who live in the same household in the context of a developing country. Using data from a recent household survey conducted in southern Togo, results from instrumental variable estimations are presented exploiting variations in the accessability of child care within the studied community. The estimations indicate that women 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 strong response of young women. Since opportunity costs of child care in a preschool are low while the opportunity costs of caring for them at home, a reduction of direct costs of preschool enrollment would induce large increases in enrollment. In combination with this paper's results, this suggests that preschool expansion programs in developing countries may lead to substantial increases in female labor force participation.

JEL-classification: J22, J13
Keywords: Preschool Enrollment, Female Labor Supply, Developing Countries, Togo

*First draft. Comments are welcome.

1 Introduction

The purpose of this paper is to investigate whether increasing enrollment of preschool age children would positively affect 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 identification strategy in this paper will make use of instrumental variables and exploit data resulting from a new household survey in southern Togo.

Knowing the causal effect that preschool children's attendance in formal care has on women's labor supply will help to judge the benefits of expanding the provision of preschool seats in developing countries. As Cascio (2009) points out, schools fulfill a dual purpose: They both enhance a child's cognitive (and probably also non-cognitive) development and provide an implicit subsidy for child care. Here, I am only interested in the latter purpose. I would like to know whether subsidizing child care by facilitating access to public child care institutions has a positive impact on female labor supply. 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 investigated empirically so far (with Lokshin et al. (2000), to the best of my knowledge, being the only exception). In industrial countries, on the other hand, a strong link between child care and mothers' labor supply is common sense and has manifested itself in numerous studies. Many studies simulate child care price elasticities of female labor supply on the basis of parameter estimates of structural models (see Michalopoulos et al. (1992) and Ribar (1995), for instance), and they typically find a negative elasticity. A few studies have exploited expansions of preschool provision or child care subsidy programs as natural experiments (Baker et al. (2008); Berlinski and Galiani (2007); Cascio (2009); Schlosser (2005)). Most related to the approach taken here, Gelbach (2002) finds a positive effect of a child's preschool attendance on its mother's labor supply in the US using instrumental variables.

The aim of this research is to estimate the causal effect of a child of preschool age (3 to 5 years) receiving care outside the household on the labor supply of women in the same household in the context of a developing country. I present instrumental variable estimates of the effect of additional children of preschool age not being cared for at home on the labor supply of any adult female household member. The data used here result from a survey of 956 households in southern Togo in October 2008 where the whole population of two communities was surveyed. I exploit the fact that the costs of sending an additional preschool age child to school in the larger one of the studied communities currently depends on the age distribution of children in a household. 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 reviews rudimentary theoretical arguments and related empirical literature, section 3 describes my dataset and the studied communities, section 4 explains the identification strategy, results are presented in section 5, and section 6 concludes.

2 Related empirical literature and theoretical considerations

The aim of this paper is to investigate the hypothesis that increasing the number of preschool age children who are enrolled in school (while holding constant the total number of preschool age children in a household) will increase the labor supply of women living in that household. In the cultural context of West Africa, 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)). 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.

To the best of my knowledge, the only study on preschool enrollment and female employment in a developing country so far is Lokshin et al. (2000) which shows a positive relation between early childhood development programs and female employment in Kenya. In addition, a few studies investigate the relationship for emerging countries (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).

For industrial countries, the relationship between enrollment of preschool age children and female employment has been studied extensively. However, many of these studies suffer from methodological weaknesses due to the lack of experimental data. Most of them (and also the ones cited in the preceding paragraph, with the exception of Berlinski and Galiani (2007)) have tried to estimate the elasticity of female labor supply with respect to child care costs using non-experimental data (see, for instance, Ribar (1992) for the U.S.; additional literature is reviewed in Anderson and Levine (1999); similar studies used Canadian data: Cleveland et al. (1996), Michalopoulos and Robins (2000), Michalopoulos and Robins (2002), Powell (1997)). Typically, structural parameters of utility functions are estimated in order to use them for simulations of labor-supply elasticities (see, for example, Blau and Robins (1988), Connelly (1992) Michalopoulos et al. (1992), Kimmel (1998)). In these studies, which normally find a negative elasticity of labor supply (although there exists a large range of elasticities, and the

[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.

results are ambiguous for single mothers) child care cost variables are constructed from either observed household expenditures or area-level averages of prices or expenditures. However, the studies cannot rely on exogenous variations in these expenditure variables. Consequently, recent studies for industrial countries have relied on natural experiments in order to identify labor supply responses.

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 childcare subsidy programs. Baker et al. (2008) exploit the expansion of subsidized provision of childcare in a Canadian province, and they find a positive effect of childcare 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.

2.1 The demand for childcare in Sub-Sahara-Africa

Can full (or even any) take-up of public preschool places be assumed in developing countries? The empirical strategy of this paper will be to exploit constraints on the supply side in order to identify the causal effect of preschool child enrollment on female labor supply. This will only result in a useful measure if improved access to preschools actually corresponds to a significant demand. Hence, it has to be asked whether there is any significant (potential) demand for preschool education 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 (Glewwe and Jacoby (1995), Glewwe and Jacoby (1992), Bommier and Lambert (2000), Glewwe et al. (2001), Alderman et al. (2006)) which may appear to indicate that there is generally a low demand

for schooling for the youngest children. The incidence of delayed enrollment contradicts predictions of human capital theory: 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.

Several explanations have been put forward in order to explain delayed enrollment. 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. Glewwe and Jacoby (1995) find evidence for their hypothesis using Ghanaian data, Rungo (2008) does so for Brazil. Distance to the nearest primary school may play a role in areas where children have to walk to school, Bommier and Lambert (2000) observe a respective effect for Tanzanian children. Furthermore, the latter argue that there may be large returns to work experience prior to elementary school providing an incentive to delay enrollment. In addition, they argue, gender differences in the timing of enrollment may be due to bride price practices.[2] Moreover, credit constraints may induce households to let children work first in order to earn what they will have to dispense for schooling later on. Finally, if primary school places are rationed, in a given year preference during enrollment may be given to older children who did not get access during previous years. Glewwe and Jacoby (1995) do not find evidence for the latter two hypotheses.

Whatever the reason for delayed primary school enrollment may be, however, it does not necessarily preclude that the same children would be enrolled in preschools if they had access to them. The potential reasons for delayed primary school enrollment do not apply to the decision of whether to send a child to preschool or not. For instance, 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.[3] Distance to the nearest preschool may of course be relevant as a factor increasing the costs of sending a child to preschool (typically the opportunity costs of time for those bringing the children to preschool). Naturally, preschool programs are targeted at the population living in reasonable walking distance to respective institutions. Accordingly, this study focuses on the population of a single rural community where access to schools is relatively evenly distributed with respect to the distance of households to the nearest school. Work experience should also be irrelevant for children eligible for preschool as they are simply too young. Furthermore, all incentives to let some children go to *primary* school earlier than

[2] Field and Ambrus (2008) show that incentives to marry young may affect the duration of schooling, they do not, however, investigate the timing of enrollment.

[3] 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)).

others (due to a bride price for instance) 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. After all, 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 4 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.

Thus, for preschool enrollment it is only relevant whether the benefits of sending a child to preschool exceed the costs of doing so. This is likely to be the case for most households in rural areas of developing countries. For preschool age children, parents typically do not face a trade-off between their children's labor and their education, 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. Furthermore, households will have large incentives to send preschool age children to school even in the absence of any effects on future earnings of their children. Preschools could rather be considered as institutions offering daycare for young children. Just like in developed countries, households face substantial opportunity costs of caring for small children. Accordingly, 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. Consequently, it is of relevance to investigate the labor market impacts of enrollment since enrollment in turn may be effectively increased by expansions of public provision of preschool education.

3 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[4] 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. 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

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

in community A as described in section 4. 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 (a phenomenon quite common in West Africa, see Serra (2009), Glewwe and Jacoby (1994)) or rent rooms in the community. Almost all households farm. Many do so on a subsistence level, a few produce cocoa and a little coffee for export. 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, who are distantly related to the Ewe. Furthermore, the community has experienced considerable immigration from other parts of Togo and neighboring countries, leading to a mix of ethnicity as well as religion, with Christian churches dominating. Given its economic activities, infrastructure, and its ethnic and religious composition, the community 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 observations from community A[5] and 36 observations from community B. Based on these samples, table 6 in the appendix reports descriptive statistics for the variables used for the analysis in section 5.

4 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 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

[5]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.

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.[6]

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. The public provision of child care is often interpreted as an implicit subsidy for child care. In a static model of labor supply, it leads to ambiguous implications for labor supply (depending on whether an individual purchase more or less than the daily number of hours of public child care without the subsidy, or no hours at all) while the impact on enrollment is unambiguously positive (Gelbach, 2002). Thus, an exogenous source of variation in the accessability of public child care will provide a valid instrument for the number of preschool age children enrolled in school (holding constant the number of all preschool age children in a household).

For the sample of women from community A, I propose the mean 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). 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 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

[6] 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.

mature enough to pass on.

In that context I argue that sending a child to school "too early" will be easier the closer the child is to the regular enrollment age of six years. If the child is too young, it may be more likely to revolt against being sent to school. Moreover, primary schools who generously offer this type of daycare services will have limited capacities for it, and they may 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). For the estimations below, the mean of age of five-year-olds in a household will be used 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). It will be shown in section 5 that the first stage relationship between the instrumental variable and the endogenous explanatory variable is fairly strong.

Can the source of variation that is exploited here be considered as being exogenous? There are two potential reasons why the instrumental variable may be correlated with the error term in the labor supply equation. While the variable mean age of preschool age children should not depend on the fertility decision of all women in the household in general (that is, the number of children) it does depend on the timing of births. Thus, in order for the instrument to be endogenous, the decision of *when* a women has a child would have to be made jointly by the household members and simultaneously with the labor supply decision of the women for the next three to five years. Such sophisticated family planning is unlikely to take place even in households with only one woman of childbearing age in a society where the use of contraceptive methods is still limited and where it is the desire of most parents to have many children. A second reason for endogeneity of the instrumental variable could be that the decision to foster-out children is not taken into account. If for instance, households that foster-out children of preschool age differ from other households in unobserved characteristics that also affect labor supply decisions, then my estimates would be biased. While this cannot be ruled out for the estimations presented here, subsequent work will take this problem into account: Further waves are supposed to be added to the household survey underlying this study, and the respective questionnaires will include modules on family members/former household members not/no longer living in the household.

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 3, community 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

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.

the community without access to a preschool.[7] In fact, this is reflected in the large fraction of children in the relevant age group in community B who are enrolled in school: 27 out 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 in place of the average-age-variable.

Whether this source of variation is actually random 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 communities with respect to observed characteristics may, however, indicate whether they are similar in general or not. Table 6 in the appendix compares means of all variables used in the analysis for the two communities separately.[8] While the comparison remains unsatisfying due to the small sample size the populations from the two communities appear reasonably similar with respect to the covariates at first sight. Women from community B, however, 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.

5 Results

The causal effect of enrollment of preschool age children on the labor supply of women in the same household is estimated using an instrumental variables approach. The mean of 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. The

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

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

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 or not.[9] In addition, results are presented that make use of an alternative instrumental, an indicator of whether the woman lives in community B or not.

For each approach and sample four different specifications are estimated. Table 2 indicates which groups of covariates each specification includes. Definitions of the respective variables are given in the Appendix.

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

The first row of table 2 reports OLS-estimates of the partial correlation 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 5.2 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 2 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.

Columns one and two of table 7 in the Appendix display coefficient estimates and standard errors respectively for the remaining explanatory variables in the first stage regression when using specification 4. While it is not the aim of this paper to investigate the determinants of the enrollment of preschool children, it is useful to check whether the effects found for the remaining covariates are plausible enough in order to give confidence in the whole research design. 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

[9] 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 2: 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	.226
	$(.041)^{***}$	$(.042)^{***}$	$(.044)^{***}$	$(.044)^{***}$
number of 3-5-year-olds in HH	.351	.365	.372	.373
	$(.074)^{***}$	$(.072)^{***}$	$(.073)^{***}$	$(.074)^{***}$
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	✓	✓	✓	✓
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.

(assuming that more educated women prefer high enrollment). Supporting this view, the education of other adult household members clearly does matter for enrollment. 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 enrolll 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. To sum up, while some patterns are not as clear as might have been expected, none of the estimated coefficients appears particularly implausible, and the first stage regressions actually explain observed enrollment quite well (as measured by R^2 which is .38 for specification 4).

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

The first panel of table 3 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. Before interpreting these coefficient estimates I would like to briefly discuss the general picture on the determinants of labor supply that emerges from table 7 in the appendix. 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

Table 3: 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)	.287 (.111)**	.075 (.035)**	.282 (.109)***	.111 (.036)***	.377 (.131)***	.125 (.037)***	.373 (.131)***	.125 (.037)***
F-test of IV	37.703		37.344		26.147		25.738	
Women>18 (n=332)	.269 (.118)**	.076 (.036)**	.256 (.115)**	.108 (.037)***	.339 (.136)**	.122 (.038)***	.336 (.135)**	.122 (.039)***
F-test of IV	32.029		32.333		21.81		21.66	
Women>20 (n=301)	.162 (.115)	.053 (.037)	.144 (.117)	.086 (.038)**	.228 (.132)*	.105 (.039)***	.23 (.131)*	.104 (.039)***
F-test of IV	24.269		21.907		15.513		15.451	
Women>25 (n=235)	.063 (.115)	.04 (.04)	.066 (.115)	.078 (.041)*	.107 (.125)	.102 (.045)**	.112 (.123)	.1 (.045)**
F-test of IV	20.058		21.854		17.625		18.095	
Women>30 (n=159)	-.042 (.139)	.028 (.048)	-.021 (.13)	.069 (.053)	.015 (.165)	.069 (.062)	.016 (.164)	.069 (.062)
F-test of IV	16.521		20.533		14.048		13.563	

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.

very likely to be enrolled in school, as seen in table 1 in section 4. Accordingly, their presence in the average household is actually 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.

Returning now to table 3, the estimates in the first panel show that 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 with children three to five years of age is 37 percent larger for each additional child of that age group that is enrolled (holding constant the total number of 3-5-year-olds in the household). The coefficient is estimated more precisely when additional controls are included; it is statistically insignificant for the first specification. Furthermore, the IV-estimate is always larger than the respective coefficient from

OLS-estimation, implying that the latter exhibit a negative simultaneity bias.

Next, as shown in the remaining panels of table 3, it is investigated how sensitive the estimates are to the exclusion of younger women. The original sample includes all women older than 16. It could be argued that some of these women are still in school and thus no impact on their labor supply would be expected.[10]. In fact, almost none of the women older than 18 still go to school. Excluding 17- and 18-year-olds from the sample does not considerably change the enrollment coefficient. The more cohorts are excluded from the sample, the less precise the coefficient is estimated, which is most likely due to the large reductions in sample size. However, it cannot be ruled out that there is a differential effect of the enrollment variable with respect to the age of the women.

The potential for a differential effect of the enrollment variable with respect to the age of the women is further investigated in table 4 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 is, to a large extent, driven by relatively young women. This could be due to the fact that younger women are more likely to be mothers of young children. 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 a further robustness check, I experimented with a different instrumental variable. As described in section 4, the analysis can be repeated by pooling (non-muslim) 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 constitute an interesting exercise, and it would increase confidence in the preceding estimates if the results can be replicated when using the alternative instrumental variable.

Table 5 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. The estimates 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 may be due to heterogeneity between women from

[10] 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 older 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)	.287	.075	.282	.111	.377	.125	.373	.125
	(.111)**	(.035)**	(.109)***	(.036)***	(.131)***	(.037)***	(.131)***	(.037)***
F-test of IV	37.703		37.344		26.147		25.738	
Women<60 (n=327)	.29	.093	.292	.135	.367	.145	.359	.146
	(.11)***	(.035)***	(.106)***	(.036)***	(.128)***	(.037)***	(.127)***	(.037)***
F-test of IV	37.548		36.746		25.524		25.556	
Women<50 (n=300)	.295	.094	.302	.134	.377	.14	.367	.14
	(.112)***	(.035)***	(.109)***	(.037)***	(.126)***	(.038)***	(.124)***	(.038)***
F-test of IV	35.245		32.035		25.151		24.943	
Women<40 (n=257)	.401	.111	.389	.144	.475	.152	.469	.152
	(.134)***	(.044)**	(.124)***	(.045)***	(.142)***	(.046)***	(.139)***	(.046)***
F-test of IV	32.151		29.508		25.229		24.919	
Women<30 (n=174)	.478	.151	.495	.176	.554	.169	.538	.167
	(.164)***	(.059)**	(.161)***	(.056)***	(.207)***	(.057)***	(.21)**	(.058)***
F-test of IV	25.041		17.593		10.663		9.821	

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.

the two communities in the added control variables. As with the original IV-strategy, the first stage relationship between the instrument and the endogenous explanatory variable is fairly strong. In sum, the main result of the paper is confirmed when using the alternative instrumental variable, although the coefficient estimates based on exploiting the variation in enrollment between communities A and B should be interpreted with care.

Finally, it may be argued that the linear probability models estimated so far are not appropriate since the dependent variable is binary. Table 8 in the appendix thus shows marginal effects for the enrollment variables calculated after instrumental variable probit for various specifications, samples, and both instrumental variables. When these marginal effects are compared to the respective parameter

Table 5: 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=299)	.312	.085	.14	.1	.135	.111	.117	.106
	(.107)***	(.037)**	(.083)*	(.035)***	(.083)	(.035)***	(.081)	(.035)***
F-test of IV	21.685		25.693		32.287		30.662	
Women<50 (n=254)	.316	.097	.152	.113	.176	.118	.166	.117
	(.092)***	(.037)***	(.068)**	(.035)***	(.075)**	(.035)***	(.073)**	(.035)***
F-test of IV	20.962		24.015		28.356		27.423	
Women<40 (n=220)	.347	.106	.185	.127	.211	.135	.2	.134
	(.099)***	(.045)**	(.073)**	(.043)***	(.08)***	(.044)***	(.077)***	(.044)***
F-test of IV	21.121		28.111		29.732		28.677	

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.

estimates from the linear probability models it turns out that the results are robust 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, although standard errors tend to be large. When using the alternative instrumental variable, however, probit results may deviate.

6 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.

These results are relevant for evaluating what impact expansions of preschool provision may have in developing countries. It can be expected that preschool expansion programs would induce high take up rates because the opportunity costs and direct costs of sending children to preschool are low while the opportunity costs of caring for them at home are high. The result would be a large increase in enrollment of 3 to 5-year-olds which would in turn result in an economically significant increase in female labor force participation. Thus it may be a convenient means to invest in preschool infrastructure in 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.

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Appendix

Definition of control variables

Age structure of remaining children in HH:[11] (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)

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

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 6: Descriptive statistics

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

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 appendix ??

Table 7: 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 8: Marginal effects obtained after IV probit

Coefficient for the number of 3-5-year-olds in school	Specification							
	(1)		(2)		(3)		(4)	
	IV	Probit	IV	Probit	IV	Probit	IV	Probit
All women	.287	.319	.282	.320	.377	.375	.373	.373
IV: "age"	(.111)**	(.110)***	(.109)***	(.125)**	(.131)***	(.163)**	(.131)***	(.162)**
Women<40	.401	.428	.389	.426	.475	.265	.469	.273
IV: "age"	(.134)***	(.122)***	(.124)***	(.140)***	(.142)***	(.178)	(.139)***	(.171)
All women	.312	.504	.14	.198	.135	.126	.117	.073
IV: "community"	(.107)***	(.195)**	(.083)*	(.214)	(.083)	(.152)	(.081)	(.091)
Women<40	.347	.815	.185	.XXX	.211	.XXX	.2	.XXX
IV: "community"	(.099)***	(.040)***	(.073)**	(.XXX)	(.08)***	(.XXX)	(.077)***	(.XXX)

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. Robust standard errors are reported in parentheses. A definition of the sample is given in the text.