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Effects of Fertility on Poverty in Niger

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Abstracts

This paper evaluated correlation between fertility and the level of poverty of the households in Niger. We use data from the survey of the living conditions of the households and agriculture realized in 2015 by the national institute of statistics, on 8,880 households in Niger. We used instrumental variable model to isolate the effect of the endogenous fertility on poverty.We found that fertility and poverty of the households are simultaneously determined. With fertility being endogenous to the level of poverty of the households.Being correlated with the number of children in the household and not correlated with the status of poverty, a binary variable for the statusof polygamouswas used asan instrument in this work. Our results showed a very strong correlation between poverty and fertility in Niger. That confirms the presumption of causality between these two phenomena. Besides fertility, a certain number of variables likethe woman headship, number of migrated members of the household, the age of the households' head, increase the risk of poverty of the households.

Keywords: Fertility, Poverty, Endogenous, Instrument

I. Introduction

Fertility is a very developed phenomenon, especially in the developing countries in our era. These countries, sometimes very far from their demographic transition also bears a broad dimension of poverty that riches sometimes 55% of the population (the case of Niger in 2014). That suggests a presumption of linkage between these two phenomena, even if researchers strongly contest this assumption.

Niger is among the poorest nations of the planet, ranked 189thout of 189 countries in terms of human development index (UNDP, 2018). The living conditions are very tough, especially in rural areas, hosting the majority of the population (85%) and where the incidence of poverty in 2015 reached 52,4%, against 9,1% in the urban centers (INS, 2016 a).The country also presents the highest fertility index of the planet, with on average 7,2 children per woman what corresponds to a natural increase rateof 3,8% (INS, 2016b). This high fertility is initially explained by the fact that the agricultural system in the country is still traditional and uses a great quantity of labor. The households, more than 90% farmers, are thus incited to have more children to meet this great family labor demand. The use of this family labor, especially the case of children, offset their possibility of studying and has a qualified human capital.That leads to the assumption of the inter-generational transmission of poverty. This fact reinforces the assumption of endogenous fertility to thestatus of poverty of the households.

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The lack or imperfection of the life insurance and social security markets also encourages the great demand of the children in the developing countries. Children being a source of social security for old age, parentsinvest in them as a way of covering their old age needs. This reason is in line with the economic theory in which Becker and Thomas define children as consumption goods which satisfy utility function of the parents (BEAKER & DIVIDED INTO VOLUMES, 1976).

Several studies illustrated a causal relation between high fertility and poverty, attesting that the number of children by household is significant to explain the level of poverty in this household. ANAND(1977) showed that the incidence of poverty in Malaysia depends on the size of the households and varies from 24% for households with one person to 46% of the households with 10 people and more. Aassve, Kedir & Weldegebriel (2006) analyzed the link between pregnancy and poverty in the rural and urban communities of Ethiopia. They found that the households with high incomes (urban centers) have a low fertility, which leads to a higher investment in the human capital of their children. Their results also show that in rural areas, the number of children does not have any causality with the poverty of the households.

The objective of this paper is to determine the linkage between fertility and poverty level of householdsin Niger. Specifically, our work aims to:

- Measure the scale of the effect of fertility on poverty in Niger Using micro data on living conditions of the Households and Agriculture (ECVM/A) of 2015,
- identify the other determinants of poverty in Niger.

To achieve these objectives, we will test the following hypothesis:

- Fertility has ended a significant effect on the poverty of rural households in Niger.
- Many other variables determine the severity of the poverty of the households

The rest of this article is divided as follows: the next section presents the method of analysis, the section III highlights the data we will use in this paper and its descriptive analysis. The econometric results will be presented in section IV, and the last section will present the conclusion and recommendations.

II. Method of analysis

In this part of the paper, we will present the model of selection of the statusof poverty before establishing the empirical link between poverty and fertility.

1. Poverty Measurement

There are several ways to measure the poverty of households. Very often people define the monetary value of a basket of consumption goods which satisfies a certain threshold of calories per individual per day. Followingthe World Health Organization (WHO) (Aassve, Kedir & Weldegebriel, 2006) built a threshold $\tau$for which the weight depends on the age and gender of individuals (see Ravallion & Bidani, 1994). They thus have derived a threshold of poverty of 2100 K calories per individual per day. As for FAO,it recommends a standard of 2300 K calories (Aassve, Kedir & Weldegebriel, 2006). The Oxford Poverty and Human development initiatives (OPHI) of the Oxford University and the Office of the report on the human development of the UNDP launched in 2010 another indicator called the global multidimensional indicator of poverty (MPI). This indicator replaces and supplements certain gaps of the human poverty index (HPI) which appears in the report on the human development since 1997.

In this paper we used the value of 1.25 USD as the poverty threshold, which corresponds to the measurement of the "extreme" poverty of the World Bank. This choice is based on the fact that this threshold is not only more convenient given the nature of our data, butis alsoused by the national policies like the sustainable development goals (SDGs). We thus considered the monthly expenditure per capita to determine the poverty threshold. The model of selection of thestatus of poverty is given as follows:

$$P_i = \begin{cases} 1 & if Y_i = \beta X_i + \varepsilon_i < \tau \\ 0 & if Y_i = \beta X_i + \varepsilon_i \geq \tau \end{cases}$$

P_i is a binary variable which takes 1 if the household $i$is below the poverty threshold and 0 otherwise. $Y_i$is a variable representing the amount of monthly income of the household$i$and is related to its characteristics (household head)X_i.$\varepsilon_i$is the error term following a normal distribution, $N(0,1)$and $\tau$is the poverty threshold.

2. Empirical model of fertility and poverty

We assume on the basis of aforementioned argumentsthatthe statusof povertyand fertility are simultaneously determined. Thus fertility here is endogenous to the statusof poverty of the households. On the basis of this assumption and following (Gupta& Dubey, 2003), we will use a Logit model with instrumental variable to determine the effect of fertility on poverty. We thus will present two models, a simple probit in which poverty is presented as exogenous to fertility and the model with endogenous fertility. Dueto the constraints of data, we considered the number of children under five as proxy of household fertility. The empirical models are presented as follows:

Let$P_i$be the statusof poverty of the household$i$,Z_i the number of children under five in the household. The relationship between fertility and poverty is written as follows:

$$P_i = \gamma X_i + \theta Z_i + \epsilon_i,$$

With $X_i$controls, likely to influence the status of poverty of the individual$i$, $\epsilon_i$is the error term that isiid and following a normal distribution. In this model, fertility is exogenous in the determination of poverty of households. The model with endogenous fertility is as follows:

$$P_i = \gamma X_i + \theta Z_i + \epsilon_i ,$$
$$Z_i = \rho X_i + \varphi F_2 + v_i$$

With $v_i$the error term following a normal distribution and is supposed to be correlated withϵ_i. $F_2$is a dummy variable used as instrument and which takes 1 if the household's head is polygamous and 0 if not.Since the polygamous status of the household's shead is directly correlated with fertility in the household, but not correlated with the poverty status of the household'shead, this variable is a valid instrument in our study.

III. Data and Descriptive Statistics

The data we use in this analysis is from the survey of the living conditions of the households and agriculture carried out in 2015 (ECVM/A 2015) by the National institute of statistics of Niger, with the financial support of FAO and other organizations. The survey concerned 21,668 households across the country. After the analysis and the purification of the data by correction for missing data, we retained 8,880 households. The variables of the study and their description are presented in table1 below. The dependent variable in this study is the statusof poverty of the households, which takes two values, 1 if the household has per adult equivalent monthly income lower than the threshold, and 0 otherwise. The threshold here is given as the monetary equivalent of a basket of consumption goods that satisfies a certain calorie per adult per day. We note that the majority of households (89.6%) are below the poverty threshold. The status of polygamy of the household's head is a dummy variable that takes 1 if the household's head is polygamous and 0 if not. This variable was used as an instrument in the endogenous probit model. The statistical analysis shows that only 20% of the sampled households are polygamous.However, a significant difference is found between the poor households of which 21% are polygamous and the non-poor (above the threshold) of which only 9% are polygamous. The variable number of children under five is used asa proxy of fertility of the households in this study. We found that the households have on average two children.

Table 1: Presentation and description of the variables

		non-poor	poor	Combined
Variables	***Code***	Mean	Mean	Mean
Dependent variable				
Status of Poverty of households (1=poor)	**PV_STAT1**	-	-	0.896
Instrumental variable				(0.304)
Status of monogamy or polygamy (1=polygamy)	F_2	0.098 (0.298)	0.211 (0.408)	0.200 (0.399)
Endogenous variable				
children under five	**N_ENF**	0.954 (1.34)	1.8 (1.62)	1.7 (1.61)
Variables of control				
Age of the household's head	**AGE**	39.05 (15.7)	43.84 (14.8)	43.34 (15.00)
Sex of the household's head (1=homme)	**SEX**	0.881 (0.323)	0.897 (0.305)	0.895 (0.303)
Duration of food stock (month)	**DUR_STO**	3.73 (3.87)	2.54 (2.74)	2.67 (2.90)
Shock born by the household	**SHOCK**	0.37 (0.483)	0.44 (0.496)	0.433 (0.495)
Size of the household	**N_MEM**	0.412 (2.83)	0.713 (3.83)	0.682 (3.85)
Number of active members	**N_ACTIFS**	0.316 (2.25)	0.513 (3.20)	0.492 (3.17)
Child labor	**ENF_ACTIF**	1.98 (0.121)	1.97 (0.161)	1.97 (0.157)
Numbers members in exodus	**N_EXOD**	0.194 (0.700)	0.83 (0.745)	0.274 (0.741)
Standard errors in brackets				

Households' heads above the poverty threshold are relatively younger (39 years) than their counterparts below the poverty threshold (approximately 44 years). However, the overall age of the households'head is on average 43 years. There are on average 31 active for 100 people in the households above the poverty threshold, while in poor households, more than 50 members per 100 are active.

Table 2 gives the description of the qualitative variables of the model. We see that the main activity of rural households in Niger is agriculture (more than 66% of our sample), while the sum of the two greatest activity field after agriculture (rearing animals and trade) are lower than 20% of the sample. The class of food consumption scores is a variable defined from foodstuffs consumed by the household during the last 7 days. A weight is attributed to each food, and the final score is calculated for each household. Three classes are defined that are the class of poor food consumption (score ranging between 0 and 28), the class of intermediate food consumption (score ranging between 28 and 42), and class of acceptable food consumption (sore higher than 42). Thus in our sample more than 50% of the households belong to the class of acceptable food consumption, while 21.8% and 24.1% of the sample are respectively in the class of poor and intermediate food consumption.

Table 2: Presentation and description of the qualitative variables of the model

VARIABLE	*CODE*	*Modalities*	*Proportions (%)*
Principal activity from household	**P_ACTIVITE**	Agriculture Rearing animals and trade Others	66.25 17.30 16.45
Classify food score of consumption	**CFCS**	*Poor* *Intermediate* *acceptable*	21.8 24.1 53.9
Educational level	**N_INSTR**	Primary Secondary Higher education Other	20 6 0.8 73.20

Education of the household's head is a variable which takes several modalities, but here we present only three modalities including the primary school education which represents 20% of households, the secondary school 6% and the higher education 0.8% of the sample. The primary school education is thus better represented in the formal education from households.

IV. Econometricresults

The econometric results of the two models are presented in this part, the probit model with exogenous fertility and the endogenous fertility model.

1. Simple Probit model

The model estimated here is globally significant (Table 3), because *the pseudo* $R^2$is 0.1163 meaning that the explanatory variables determine 11.63% of the variability of the dependent variable. The percentage of correct prediction is 89.86%. The Waldχ^2enables us to test the assumption of the nullity of all the coefficients of the model and is 380.79 at 1 %. χ^2red with 11 degrees of freedom and at 1 % is 24.72. We therefore reject the null hypothesis of the nullity of the coefficients of the model.

Table 3: result of the simple probit model (exogenous fertility)

Variables	**coefficient**	**Standard error**
_cons	1.511 ***	0.326
N_ENF	0.223 ***	0.027
DUR_STO	- 0.056 ***	0.006
ENF_ACTIF	-0158	0.147
P_ACTIVITE	-0.043 ***	0.006
SHOCK	-0.032	0.040
SEX	0.228 ***	0.081
AGE	0.013 ***	0.001
CFCS	-0.221 ***	0.026
SATAT_MAT	-0.133	0.009
N_INSTR	-0.021 **	0.037
N_EXOD	0.039	0.024
F_2	0.248 ***	0.063
Dependent variable	**Status of poverty of the households**	
Log likelihood	-25,143,745	
Wald $\chi^2(11)$	380.79	
Probability $> \chi^2$	0.0000	
Pseudo R^2	0.1163	
% correct prediction	89.86%	

Source: Authors, with ECVM/A, 2015

* significant at10% ** 5% *** 1%

All the variables of the model have the expected signs. The variables number of wives of the household's head, age, female headship, and our variable of interest, number of children under five have a positive and significant effect on the poverty of the households. That means that a unit increase in each of these variables increases the probability of an average individual to fall below the poverty threshold.

On the other side, the variable duration of the stock of food of the household, main activity of the household's head (the reference is agriculture), the classes of food consumption score (the reference is the class of poor food consumption), education of the household's head have negative and significant effects on poverty of the households. That means a unitincrease in each one of these variables decreases the probability for an average household to fall below the poverty threshold.

Table 4 presents the marginal effects of the variables of the simple probit model. We see that the birth of an additional child increases the probability of the household to fall below the poverty threshold by 3.2 %.

Table 4: marginal effects (exogenous fertility)

Variables	(d_x/d_y)	**Standard error**
N_ENF	0.032 ***	0.032
DUR_STO	-0.008 ***	0.000
ENF_ACTIF	-0.023	0.021
P_ACTIVITE	0.006 ***	0.000
SHOCK	-0.004	0.005
SEX	0.033 ***	0.012
AGE	0.001 ***	0.000
CFCS	-0.032 ***	0.003
SATAT_MAT	-0.019 ***	0.003
N_INSTR	0.003 **	0.001
N_EXOD	0.005	0.005

significant at 10% (*), 5%(**), 1% (***)

2. The probitmodel with endogenous fertility:

Tables 5 and 6 present the two stages of the probit model with instrumental variable. The Wald χ^2 of this regression is 531.74, far from χ^2 read at 11 degrees of freedom and 1% probability. This results in rejection of the null hypothesis of the nullity of all the coefficients of the model. The statistic of the test of exogenous fertility is 15.76 and significant at 1%. That enables the rejection of the null hypothesis of non-endogenous fertility, leading to the suitability of the endogenous probit modelto analyze the link between fertility and poverty in Niger.

In the regression of the first stage (table 5) the variables which significantly determine the number of children in the household in our specification are the duration of the stock of food of the household, bearing a shock in the household, the age of the household's head, the matrimonial status of the household's head and the number of members in exodus in the household. However, the number of members in exodus in the household presents an unexpected effect on fertility that the increase in the number of members in exodus in the household results in the increase of the probability of having an additional child in the household. That counterintuitive result can be explained by the fact that if a member of the household leaves to exodus, the probability of replacing him and so having an additional child increases in the household. The variable duration of stock has a positive and significant effect on the number of children in the household. If the duration of stock increases by one month, the probability of having an additional child in the household increases. The age of the household's head has a negative effect on fertility. The older the household's head is, the lower his probability to have an additional child becomes. Finally, polygamy increases considerably the probability of the household to have additional children.

Table 5: Regression of the first stage

Variables	Coefficient	SD
_cons	2,881 ***	0.248
DUR_STO	0.017 ***	0.005
ENF_ACTIF	0.001	0.112
P_ACTIVITE	0.0003	0.006
SHOCK	-0.215 ***	0.033
SEX	-0.065	0.061
AGE	-0.018 ***	0.001
CFCS	0. 005	0. 020
SATAT_MAT	-0.025 ***	0.018
N_INSTR	0.011	0.007
N_EXOD	0.089 ***	0.034
F_2	1,426 ***	0.053
Variable dependent = **Number of children under five in the household (N_ENF)**		

Source: estimate of the authors with ECVM/A, 2015
significant at 10% (*), 5%(**), 1% (***)

Table 6 presents the effects of the variables of the model on poverty. The variable duration of stockdecrease the probability of a household to fall below the poverty threshold. On the other hand, variables like women headship,having a poor food consumption score,agriculture production as main activity,education and age of the household'shead increase the probability of a household to fall below the poverty threshold. Our variable of interest, fertility has a positive and significant effect on poverty of the households. Table 7 below presents the marginal effects of the variables of the model on poverty. We see that the birth of an additional child in a household increases its probability to fall below the poverty threshold by 38.5%, justifying a great causality between household's fertility and its level of poverty. This result is similar to the finding of Gupta & Dubey(2003) in the case of rural households in India. They used micro data of the five-year survey of 1993-94 and found that the effect of fertility on poverty is strongly positive and is haft when endogenous fertility is admitted. It is also the result found the World Bank using data on health and demographyof 22 countries of sub-SaharanAfrica. Their result showed that fertility drops with the improvement of the living standards.

When the duration of the food stock of the household increases by one month, the probability of this household to fall below the poverty threshold decreases by 5.7%. This result means that the food stock of households is a means of reducing the level of poverty of these households. Agriculture as the main activity of the household's head deceases the risk of the household to fall below the poverty threshold by 4.2%. This result shows that the development of agriculture can help reducepoverty in Niger.

Table 6: Result of the probit model with instrumental variable (endogenous fertility)

Variables	coefficients	SD
_ Cons	0.976	0.346
N_ENF	0.385 ***	0.044
DUR_STO	-0.057 ***	0.005
ENF_ACTIF	-0.153	0.142
P_ACTIVITE	-0.042 ***	0.007
SHOCK	-0.004	0.041
SEX	0.232 ***	0.077
AGE	0.016 ***	0.001
CFCS	-0. 215 ***	0. 026
SATAT_MAT	-0.085 ***	0.023
N_INSTR	-0.023 **	0.009
N_EXOD	0.023	0.029
Dependent variable	**Status poverty of households**	
Ratio of probability	-18,065.79	
Wald $\chi^2(11)$	531.74	
Probability $> \chi^2$	0.0000	
P-value of endogeneity test Probability $> \chi^2$	15.76 0.0001	
% correct prediction	89.90%	

Source: estimate of the authors with ECVM/A, 2015
significant at 10% (*), 5%(**), 1% (***)

Women headship increases the risks to fall in poverty by 23.2%. This result is explained by the fact that asa household's head, womenspend less time outside than men and therefore provide less source of life than the latter. The age of the household'shead increases his risk to fall under the poverty threshold by 1.6%. this explains why the householdsheaded by relatively old people are more likely to have a lower per capitaincome. Being in the poor class of food consumption score increases the risk of one to fall among poor households by 21.5%. That justifies the assertion of Amartya SEN according to whom the famines are, among other causes, due to a lack of access to foodstuffs (CLEMENT, 2009). The availability of the foodstuffs and the control of their price (markets' imperfection) are a significant way to fight the poverty of the households.Married households' heads have 8.5% more risk to be found under the poverty threshold. That can be explained by the increase in the burden of the household due to the continuous increase in the number of wives and children.

Table 7: marginal effects (endogenous fertility)

Variables	(d_x/d_y)	SD
N_ENF	0.385 ***	0.036
DUR_STO	-0.057 ***	0.005
ENF_ACTIF	-0.153	0.142
P_ACTIVITE	0.042 ***	0.007
SHOCK	0.004	0.041
SEX	0.232 ***	0.077
AGE	0.016 ***	0.001
CFCS	-0.215 ***	0.026
SATAT_MAT	-0.085 ***	0.023
N_INSTR	0.023 **	0.009
N_EXOD	0.023	0.029

significant at 10% (*), 5%(**), 1% (***)

The level of education of the household's head increases the probability of the household to fall below the poverty threshold by 2.3%. This result is consistent with the findings of Gupta & Dubey, 2003, and which show that in contrast to the women's education, the man education increases the risk of poverty of the household by 13%. They thus conclude that education is not a good investment at the men level in the rural zones of India. We can also explain this result by the fact that since the main activity of the rural areas is agriculture, the men with a primary education are more efficient in this field compared to those with the secondary and higher education (Hoang, 2012).

V. Conclusions

This article explores the links between the level of fertility and the poverty of the households in Niger. We use an instrumental variable model to determine this effect as fertility is endogenous to the level of poverty of the households. Our instrument is whether or not the household's head is polygamous (have one or more wives). Socio-economic variablesthat determine not only the fertility but also the poverty of the households are used, on the basis of data from the survey of the living conditions of the households and agriculture [ECVM/A 2015]. We initially tested a simple probit model in which we consider fertility as exogenous to poverty. Our results show that fertilityaffects significantly the poverty of the households, but that the effect is weak with exogenous fertility. We then estimate the instrumental variable model.

Our results show that fertility significantly increase the level of poverty of the households. That means having an additional child in the household increases the risk of this household to fall below the poverty threshold by 38.5%. Besides fertility, other variables like the woman headship, the age of the household's head, the level of education, having a poor food consumption score increase the risk of poverty of these households. However, variables related to the duration of the stock of food of the household decrease the risk of poverty of the households.

Fertility of the households increases significantly with this duration of the stock of food of households, with polygamy of the household's head and the number of members in exodus in the household.

On the contrary, fertility decreases with shocks born by the household, and the age of the household's head. The reduction of the poverty in Niger would thus pass among other things by the increase in the expenditure [Youssoufou, 2013], and especially the food expenditure of the households. That implies the reinforcement of the principal activity of these rural zones which is agriculture, through effective agricultural policies for a notable improvement of the incomes of households,providingfoodstuffsin the local markets and controlling the price of these foodstuffs.

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