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Analysing the Effects of Crop Shocks on Child Work: the Case of the Morondava District in Madagascar

Augendra BHUKUTH

Institut International des Sciences Sociales
Antananarivo - Madagascar
&

Jérôme BALLET

GREThA, CNRS, UMR 5113
Université de Bordeaux
&

Bako Nirina RABEVOHITRA

Réseau des Observatoires Ruraux (ROR)
Madagascar
&

Patrick RASOLOFO

Institut International des Sciences Sociales
Antananarivo - Madagascar

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GRETHA UMR CNRS 5113
Université de Bordeaux
Avenue Léon Duguit - 33608 PESSAC - FRANCE
Tel : +33 (0)5.56.84.25.75 - Fax : +33 (0)5.56.84.86.47 - www.gretha.fr

Analyser l'effet des chocs agricoles sur le travail des enfants : le cas du district de Morondava à Madagascar

Résumé

Dans un contexte de rationnement du crédit, les chocs auxquels les ménages sont exposés impactent le travail des enfants. Cet article analyse l'impact d'un choc de sécheresse dans le district de Morondava à Madagascar en 2006. Il s'agit d'une zone de production de riz. Nous utilisons les données d'une enquête réalisée par le Réseau des Observatoires Ruraux (ROR) pour tester la validité de l'effet du choc sur le travail des enfants, et nous explorons l'impact du rationnement du crédit et l'hypothèse de buffer-stock.

Mots-clés : travail des enfants, buffer stock, rationnement du crédit, lissage de la consommation.

Analysing the Effects of Crop Shocks on Child Work: the Case of the Morondava District in Madagascar

Abstract

In a context where credit is squeezed, the shocks to which household are exposed impact on child work. This article analyses the impact of a drought on the Morondava rural district in Madagascar in 2006. This is a rice growing area. We used data from the surveys conducted by the Réseau des Observatoires Ruraux (ROR) to test the validity of the effect of the shock on child labour, and to explore the impact of the credit squeeze and the relevance of buffer-stock hypothesis.

Keywords: Child work, Buffer stocks, credit constraints, consumption smoothing.

JEL: J82, J22, G20, O16

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Introduction

Poverty now forms an inevitable part of any attempt to account for child work, but it is important to distinguish between chronic and transitory forms of poverty (Ravallion 1988). Several studies have shown recently that the shocks to which households are exposed impact on child work, particularly in rural areas (Beegle et al., 2006; Canagarajah and Nielsen, 2001; Dendir, 2007; Guarcello et al. 2002, 2007; Jacoby and Skoufias, 1997). These findings should be related to the way households respond to shocks, in particular in a context of a credit squeeze (Baland and Robinson, 2000, Ranjan, 2001) and in the light of the buffer-stock hypothesis (Deaton, 1992). In this context, child work is seen to be an alternative strategy adopted by households to smooth their consumption if they can neither obtain credit nor sell anything.

Following on from these studies, in this article we analyse the effect of a climate shock, and specifically that of a drought on agricultural production, and thus on child work in the rural area of Morondava in Madagascar.

The article is structured as follows: in the first section we describe the methods used to collect the data and the basic statistics. In the second section, we describe the empirical verification, which is mainly based on that proposed by Beegle et al. (2006). In the third section we report the findings of our study.

I. Methodology of the study and statistics

I.1. Data collection methods

The data used were obtained during surveys carried out in the Réseau des Observatoires Ruraux (ROR)[1]. These were retrospective surveys, and so reported the assessment of an agricultural year. The period considered extended from the October of one year (n-1) to the September of the next year (n). The data collected concerned the surveys of the years 2006 and 2007. In other words, the 2006 (2007) data covered the period between the last quarter of 2005 (2006) and the third quarter (inclusive) of 2006 (2007). The household constitutes the

[1] The Réseau des Observatoires Ruraux (ROR) was set up in 1999. It carries out surveys involving repeated annual surveys of rural households. This is an institution that is under the direct supervision of the Prime Minister's Office.

basic statistical unit, and the surveys usually covered about 500 households. Each year at the same period of time the same households are surveyed. Thus the observatory permits to draw the households' situations overtime.

Our data consist specifically of data collected by the Morondava observatory, which is located in the Menabe Region, on the west coast of the Mozambique Channel. The surveys used covered 449 households. However, we restricted out study to households with at least one child or young between 5 and 17 years of age, i.e. 358 households. Usually, studies on child work retain children between 5 and 14 years old. The main reason is that schooling is obligatory until 14 years old. However, as our study main objective is to understand household reaction strategy when facing a shock we do not limit child age at 14 years old. Instead, we considered all adjustments on children including those between 15 and 17 years old. The inclusion of all children whatever the age group is important to have a better understanding of households' reaction to shocks. Indeed, households can use children between 15 and 17 years old to respond to shocks. Excluding them from the study could lead to think that households do not react. To the extent that we will insert an age variable in the model, the inclusion of children between 15 and 17 years old allows us to enrich the analysis.

Furthermore, we do not discuss of deschooling in this paper. Indeed, the main reason that limits the age of children to 14 years old in studies on child work is the effect of work on schooling. However, our objective is not to analyze the deschooling, but child work; and it was stressed that the increase of child work does not necessarily mean their deschooling (Assaad et al., 2003; Beegle et al., 2004; Boozer and Suri, 2001; Bourguigon et al., 2003; Canals-Cerda and Ridao-Cano, 2004; Guar cello et al., 2005; Hazarika and Bedi, 2003; Psacharopoulos, 1997; Ravallion and Wodon, 2000; Schultz, 2004; Skoufias and Parker, 2001).

The sampling method was devised jointly with the financial sponsor of the ROR network, and the operator in the field responsible for gathering the data from each observatory. A collaborative venture of this type involves a rational choice in selecting which households to survey, which means that the indicators obtained from the data are of an illustrative but not representative nature at the national, regional or even district levels. The households of the panel were selected because of their living, production and vulnerability conditions. The panel data do not have the aim to be representative at the national level but to illustrate the situations of households selected and considered as being in poverty. The panel data of the observatory cannot be extrapolated at the national level, the results can only be interpreted at

the local level, which of course represents a limit of such data. The advantage of data from observatory is to present the situation of the households year after year, so that, in our case study, we seek to estimate the vulnerability to drought in Morondava. The results of our study are of course not representative at the national level. The situation of children due to drought could be different in other parts of Madagascar. Therefore, it describes how the households use children when they are vulnerable to climate change. Not all the household face vulnerability in the same way. The use of child work depends on the perception of the households' vulnerability.

Morondava is characterised by two main features relevant to our topic. Firstly, it has a high level of child work, and in this respect it reflects the situation in the country as a whole, where one child in three between the ages of 5 and 17 years is already part of the workforce (OIT/IPEC 2008). The surveys do not provide any information about the time devoted to the various activities. Child work is therefore evaluated firstly on the basis of the main activity of the 5 to 17-year age group. "*The main activity is that which is of greatest importance in terms of its contribution to the resources of the household (food and/or financial resources), and which occupies most of the time of the person engaging in it"*[2]. If a child attended school, education was assumed to constitute his or her main activity. A child was classified as working if he or she was neither attending school nor inactive. Unlike the usual ILO definition, domestic chores are regarded here as a category of child labour.

Levison and Murray-Close (2007), for example, have pointed out that the ILO classification of child labour is unsatisfactory, because it permits some types of work that are implicitly considered to be harmful for children, in particular domestic chores. This classification seems to be based on a distinction between productive and (re)unproductive work. However, a not-inconsiderable proportion of children do domestic chores but are not classified as "working". Levison and Moe (1998) point out that in Peru, girls who do domestic chores often stop attending school. When these children no longer attend school, they are classified as "No Where". However, there is no doubt that the vast majority of children of school age who do not in fact attend school, and who are not classified as working, do in fact work [Cigno and Rosati (2002), Sinha (2003), Malhotra et al. (2004)]. However, Lieten et al. (2005) think that this is exaggerated. On the basis of a study of 45 children in four States in India, these authors record a range of possible situations. A first category of children leave school because it does not interest them, and their parents then find them work to do. A

[2] Réseau des Observatoires Ruraux (ROR), Investigator's manual 2002 to 2007

second category of children leaves school for health reasons, and these children do not work. A third category is withdrawn from school in order to work and provide the family with additional income. A fourth category leaves school in order to undertake a considerable proportion of the domestic chores. Lachaud (2007) demonstrated that in the case of the Comores there is an inverted U-shaped relationship between the income of households and households with children who are neither working nor attending school.

The data reported here provide us with quite a lot of information about domestic work when it is designated as being the main activity.

The second relevant characteristic of the area investigated is that it is exposed to variations in climate that can influence agricultural yields. Morondava is sometimes struck by cyclones, and may also have low rainfall. In 2006, it was hit by an unusually severe drought.

Furthermore, agriculture is the main activity of nearly all heads of households. In general, Morondava is characterised by a high level of rice production, which is the main crop. In our panel, all households produce rice. We must notice nevertheless that rice production is not intended for market. All the production is consumed by the households. However, other crops including tapioca, maize, sweet potatoes, beans, black-eyed peas and peanuts are also commonly grown; maize is the second most commonly-grown cereal crop, and is used for both human and animal consumption. Concerning human consumption, other crops are essentially used during the gap period when the rice crop production is totally eaten by households, waiting for the new season (see for instance Ravoninjatovo and Ranaivoson, 2011 for a good description of households eating strategies). The importance of rice growing in the district led us to distinguish between damage to the rice crop and that caused to other crops as a result of the drought.

The data obtained concern the characteristics of households and the work done by children, a set of information concerning the assets they possess, and the taking out of loans. The assets taken into account here consist of livestock and land. This information allows us to test the importance of the credit constraint and buffer-stock hypothesis for child work.

1.2. Statistics

Table 1 reports the basic statistics. These data indicate that 39% of households were affected by the shock of the 2006 drought. The shock of the drought is evaluated here on the

basis of the household's response. Every household that reported having suffered harm as a result of the drought was considered to have suffered a shock of this sort. A comparison between the households that had been exposed to the shock and those that had not reveal some minor differences. The proportion of boys working was slightly higher in the households than had experienced drought shock than in the other households. In contrast, we see the opposite for the girls. The proportion of households headed by someone who had never attended school was slightly higher amongst the households exposed to the shock than in the others. Finally, the proportion of households which had taken out a loan in 2007 after the shock was higher than the proportion of other households (which had not been exposed to the shock) that had taken out a loan in that year. This finding suggests that taking out a loan was a strategy intended to smooth consumption when confronted by shocks.

Table 1. Summary of statistics

	Total number Of households		**Households not exposed to the shock**		**Households exposed to the shock**	
Households	358		220		138	
Proportion	100		61		39	
Child labour						
Boys (%)	37		34		42	
Girls (%)	33		38		27	
Mean age of the boys	10.3	(3.2)	10.2	(3.0)	10.3	(3.4)
Mean age of the girls	10.3	(3.3)	10.7	(3.3)	9.4	(3.1)
Characteristics of the households						
Head of household has never attended school (%)	39		32		49	
Number of years of schooling by the head of the household	3.4	(3.5)	3.7	(3.6)	2.7	(3.3)
Female head of household (%)	15		16		12	
Size of household	6.3	(2.5)	6.2	(2.5)	6.5	(2.5)
Headed by a farmer (%)	95		94		96	
Age of the head of the household	47.1	(12.7)	48.0	(12.7)	45.8	(12.5)
Number of other activities of the head of the household	0.9	(0.8)	0.9	(0.8)	1.0	(0.8)
Assets						
Households with zebus (%)	59		60		58	
Number of cattle owned	6.3	(14.4)	6.4	(14.7)	6.3	(14.1)
Landowning households (%)	96		95		98	
Number of plots owned	2.1	(1.2)	2.1	(1.2)	2.0	(1.1)
Realisation of assets						
Households that sold cattle in 2007 (%)	11		13		9	
Access to credit						
Households who took out a loan in 2007 (%)	18		13		25	

Standard deviations are shown in parentheses

2. Empirical strategy

The empirical verification strategy described in this article is based on that proposed by Beegle et al. (2006). We started by checking that the shock caused by the drought did indeed constitute a temporary shock for the households concerned, i.e. that the likelihood that a household j would suffer a shock during period t was not linked to the probability of its having suffered a shock during the period t-1

$$\Pr(shock_{jt} = 1) = f(shock_{jt-1}, X_{jt}) \quad (1)$$

where Xjt is a set of control variables including the characteristics of the households.

This first check is important, because if the shock was not temporary, the household could anticipate a permanent reduction of its income and was able to adapt to this situation. A temporary shock in contrast implies the need to adopt a temporary strategy in response to the shock. The temporary situation of the drought is captured by the survey, in the sense that all the households in the panel are asked the same question which consists of determining their situation due to vulnerability of climate change. Thus, the answers vary according to the households. The vulnerability of the household is subjective and depends on the households' perception on the impact of drought on their economic situation and can vary each year. Therefore, due to the perception not all the households are affected in the same way by the drought.

We next checked that the shock was exogenous. What this involves was identifying the causal link between the shock and child work. Either we thought that the shock was exogenous in nature and would an impact on the work of the children i of household j, or else we thought that the likelihood that household j would suffer a shock was greater if the household used the labour of these children i. We used the following strategy to check the direction of the causality, and therefore to confirm the exogenous nature of the shock:

$$\Pr(shock^{z}_{jt} = 1) = f(childwork_{ijt}, X_{jt}) \quad (2)$$

Our specification differs from the analysis of Beegle et al. (2006) in two respects. In the first place, we distinguished between two categories of shock z: shocks affecting the rice crop and those affecting other crops. Secondly, the likelihood that a crop would suffer a shock

during t was tested on the basis of the work done by the children in the same year. The first difference is related to the importance of rice growing in the observatory compared to other crops. The second difference is justified due to the interval between the dates when the rice was planted out and the harvest relative to the recording of the data. We should recall here that the surveys we are using covered a full agricultural season i.e. from October of year n-1 to September of the year n. The crop calendar for the main rice-growing season includes a planting out period, which takes place in about January and a harvest period in May – June. The drought shocks affecting crops therefore occurred between the planting out and the harvesting periods. We can see that the period extending from November to the end of March of the following year normally corresponds to the rainy season.

Finally, we analyse the impact of the drought shock on child work. This analysis consists of two steps. In the first step, we considered the work of children i belonging to household j as a function of the characteristics of the household and of the children.

$$childwork_{ijt} = \alpha_0 + \alpha_1 X_{ijt} + \varepsilon_{ijt} \quad (3)$$

In the second step we analyse child work after introducing the effect of the shocks, and the ability of households to respond via sale of assets, taking out loans etc.

$$childwork_{ijt+1} = \alpha_0 + \alpha_1 X_{ijt+1} + \alpha_2 shock_{jt} + \alpha_3 \left(shock_{jt+1} \cdot assets_{jt+1}\right) + \alpha_4 assets_{jt+1} + \alpha_5 loan_{jt+1} + \varepsilon_{ijt+1} \quad (4)$$

Compared to Beegle et al (2006) we identified here the difference due to temporal specification. Child work was analysed during t+1. In our analysis therefore we used the data from 2007, even though these reflected the period after the 2006 harvest. The drought shock recorded in the data for 2006 occurred just after the rice planting out period. We assume that households waited for the harvest between May-June before reacting. In other words, their reaction took place essentially after they had seen the harvest. They had not anticipated the poor harvest, but reacted after it occurred. This reaction was therefore recorded in the 2007 data (which record the situation from October 2006). The time lag before the reaction corresponds to the information that we have about the behaviour of the households. They responded mainly once the harvest they had obtained began to run out.

Assets measure the possession of livestock (poultry, zebus, pigs, sheep or goats) and land. The shocks affecting their assets corresponded to the effects of selling assets (sold during the

2007 period). We also introduce the role of the availability of credit, which allows us to check the hypothesis that sees the credit squeeze as having a decisive impact on child work.

3. Results

We first checked that the drought shocks were indeed temporary, and highlighted the economic significance of the shock. We will test the causal link between the drought shocks and child work. This involved finding out whether the shock could be considered as being exogenous to child work or whether, on the contrary, child work accounted for the occurrence of the shocks. Once the causal link was confirmed, we tested the effect of the drought shock on the likelihood of child work. We then propose some extensions from the breakdown of the activity of children between school attendance, agricultural work and domestic chores.

3.1. The general occurrence and effects of crop shocks

Table 2 shows the extent of the shocks on the households over three years. Drought is not yet considered to be chronic in the Morondava observatory. Even though 33% of households were exposed to drought in 2005, the impact of the shock was much more severe in 2006 when 31% of households suffered either the total destruction or severe damage of their agricultural production. In contrast, only a tiny fraction of the households was confronted by drought in 2007, which highlights its essentially temporary nature. Although a considerable proportion of households was affected in 2006, few suffered the complete destruction of their crops. As Beegle et al. (2006) point out, the complete destruction of crops makes child work pointless in agriculture. However, this does not mean that all child work becomes pointless, since children can be used to do other things, either domestic chores or paid work on the market.

Table 2 Magnitude of drought shocks

	Crops destroyed	Considerable damage	Minor damage	No damage
2005	5%	10%	18%	67%
2006	4%	27%	8%	61%
2007	0%	1%	2%	96%

Table 3 predicts the occurrence of drought shocks in 2006 on the basis of the characteristics of the household and the occurrence of shocks in 2005. Here we divide the households in two categories: those who have not suffered shocks and those who have undergone a shock regardless of its magnitude. In other words, we do not consider the magnitude of the shock in the following results. The results indicate that the households affected by drought shock in 2006 were not significantly the same as those affected by drought in 2005. Two characteristics of the households affected stand out. Firstly, the more education the head of the household had received (measured here as the number of years of schooling) the less likely it was that the household would experience drought shock. Finally, the bigger the household the more likely it was to experience a shock. No other characteristic of the household used in our model was significant. We are not, of course, saying that it is these characteristics of the household that account for the shocks, rather that in general it is households that display these characteristics that are most affected by the shock because they are likely to have less good land or because they are not aware about practical to protect their land from shocks. In other words, some households are certainly capable of implementing *ex ante* strategies to avoid shocks, in particular households headed by the most educated.

Table 3
Predicting the occurrence of shocks

2006 shocks model/shocks 2005		
Dependent variable	2006 drought	
Specification	Probit	
2005-drought	0.242	(0.156)
Years of schooling of the head of household	-0.048**	(0.022)
Household headed by a woman	-0.036	(0.225)
Size of household	0.054*	(0.030)
Household headed by a farmer	-0.079	(0.364)
Age of the head of the household	-0.009	(0.006)
Number of subsidiary activities of the head of the household	0.094	(0.089)
Constant	-0.084	(0.528)
Observations	315	
LR chi2(7)	14.49	
Prob > chi2	0.043	
Pseudo R2	0.034	

Regressions are at the household level. Marginal coefficients are shown.
Standard errors are in parentheses.
*** indicates significance at 1%; ** at 5%; and * at 10%.
The gender of the head of the household, the main activity of the head of the household, and the ownership of sheep/goats and pigs are variables that are included, but not reported by the model.

To summarize, we can say that although some characteristics of the households have a significant impact on the likelihood affected by a drought shock, overall, the households affected by the drought are not the same from one year to another. Nevertheless, we can say that our sample contains three categories of households: (1) those who were not exposed to drought conditions, (2) those who were exposed to drought conditions and had crop damage, and (3) those who were exposed to drought conditions but were able to minimize the damage and hence did not report damage due to drought in the survey. If indeed there are type (3) households, they are recorded as type (1) households in this analysis. Does it matter for our analysis? Yes and no. Yes because one category of households does not appear as such. But no if we consider child work as an *ex post* strategy for fighting against drought shocks. In the same time this first result gives us a first answer: child work will be limited to households that can not implement *ex ante* prevention strategies against drought shocks. A second result follows this first one. If the reported droughts were random, we could expect none of the variables in the model to be statistically significant. Given the results shown in Tables 3 where household head education and household size are correlated with the reported drought variables, droughts can not be consider purely random. Meanwhile, for households who do not use *ex ante* strategies drought shocks remain random. Here we recall it is the same households surveyed each year so that if drought shocks do not affect each year the same households it means shocks are random among households who do not use *ex ante* strategies. So that we can consider drought shock as quasi-random: random for some categories of households.

3.2. The causal link between crop shock and child work

Taking it as established that the shocks are temporary, we checked the causal relationship between child work and the occurrence of the shock in 2006. In other words, we asked whether the likelihood of a shock was not significantly linked to the existence of child work rather than the contrary (i.e. it is the child work that accounts for the shock and not vice versa). In other words, we wanted to find out whether the shock is exogenous. To do this we distinguished between the damage caused by drought to the rice crop and that to other crops, such as maize and sweet potatoes. We adopted this distinction in view of the importance of rice growing in the district compared to other crops.

Table 4 shows that the causal link seems to support the hypothesis that the shock was exogenous relative to child work. Child work does not significantly account for the

occurrence of the shock whether due to damage to the rice crop (first column) or to other crops (second column). Furthermore, the results are consistent with previous results concerning the occurrence of shocks. When a household increases in size, the probability that the shock will also increase significantly, both for damage to the rice crop and to other crops. In contrast, the number of years for which the head of the household has attended school has a significant effect only on the damage to other crops, whereas the age of the head of the household has a significant effect only on the damage to the rice crop. This difference may be interpreted in knowledge concerning crops. One assumption is that older people have a different knowledge from those more educated concerning means against shocks. But without further information, we can not say more about this result. Finally, if the head of the household has several activities, this significantly increases the likelihood of a shock due to damage to both rice and other crops.

Table 4. 2006Shock /child work 2006

	(1)		(2)	
Dependent variable	Damage to rice		Damage to other crops	
Specification	Probit		Probit	
Child work	-0.009	(0.108)	-0.149	(0.099)
Years of schooling of the head of the household	-0.019	(0.015)	-0.135***	(0.017)
Household headed by a woman	-0.230	(0.172)	0.248	(0.186)
Size of the household	-0.035*	(0.020)	0.118***	(0.019)
Household headed by a farmer	0.104	(0.277)	0.415	(0.402)
Age of the head of the household	-0.007*	(0.004)	-0.004	(0.004)
Head of the household has several activities	0.156***	(0.0602695)	0.1139674*	(0.0594268)
Constant	-0.157	(0.3777155)	-1.21231	(0.4687844)
Observations	792		812	
LR chi2	(7) 23.00		(7) 92.19	
Prob > chi2	0.0017		0.0000	
Pseudo R2	0.0248		0.0889	

Marginal coefficients are shown. Standard errors are in parentheses.
*** indicates significance at 1%; ** at 5%; and * at 10%.

Overall, even though some factors do predict a greater (or lower) likelihood of shocks, child work does not account for the probability of a shock. This means that the hypothesis that an exogenous shock leads to an increase in child work as a reaction can be tested.

3.3. The effect of crop shocks on child work

We analysed the effect of a shock in two steps. First we tested the probability of child work as a function of the characteristics of the household and of the children (age and gender). Then we added drought shock to the model depending on the crop (rice and other crops) and any reactions to the shock, such as selling assets or borrowing. The results are shown in Table 5.

Table 5. Child work

	(1)		(2)	
Dependent variable	Child work		Child work	
Specification	Probit		Probit	
Gender	0.127*	(0.074)	0.385**	(0.193)
Age	0.083***	(0.012)	0.043	(0.031)
Years of schooling of the head of the household	-0.094***	(0.012)	-0.115***	(0.032)
Household headed by a woman	0.148	(0.121)	-	-
Size of the household	0.028*	(0.015)	0.108**	(0.047)
Household headed by a farmer	0.510*	(0.261)	-	-
Age of the head of the household	-0.010***	(0.003)	0.001	(0.009)
Head of the household has several activities	-0.067	(0.046)	0.266*	(0.148)
Damage to rice			0.572***	(0.222)
Damage to other crops			0.616	(0.401)
Quartile with most cattle			-0.575***	(0.220)
Quartile with most poultry			-0.087	(0.207)
Quartiles with most land			0.314	(0.230)
Sale value of the cattle			-4.73E-06***	(1.71E-06)
Loan			-0.627*	(0.353)
Constant	-1.129	(0.332)	-1.674	(0.608)
Observations	1271		241	
LR chi2	(8) 120.90		(13)50.56	
Prob > chi2	0.0000		0.0000	
Pseudo R2	0.0732		0.1683	

Marginal coefficients are shown. Standard errors are in parentheses.
*** indicates significance at 1%; ** at 5%; and * at 10%.

The first model (column 1) shows child work as a function of the characteristics of the households. Of course, the unit of analysis in the models under consideration is the children and not the household. It shows that the characteristics of the children (age and gender) were significant. The older the children, the more likely they were to work. Being a boy also increased the likelihood of working. The following characteristics of the households were significant: the number of years of schooling of the head of the household which had a negative effect, the size of the household which had a positive effect, the fact that the head of the household was a farmer significantly increased the likelihood that the children would work, and the older the head of the household was the less likely it is that the children would work. We find here our previous results. Some households may have *ex ante* strategies that allow them to reduce the damage caused by drought shocks. In this case child work is not necessary.

The second model (column 2) reports the shocks and the possible *ex post* reactions to shocks. The table indicates that damage to the rice crop significantly increased the likelihood that the children would work, whereas damage to other crops had no significant impact on child work. We used various other assets to account for other types of reaction of the households to shocks: their ownership of livestock (the number of cattle, pigs, sheep, goats and/or poultry) and land, the realisation of their assets (sold in 2007) and taking out a loan. Note that the survey does not reveal the area of land owned, but does record the number of plots owned by the household. We therefore analysed land ownership by the households in terms of quartiles of the possession of plots. We also categorised ownership of other assets (zebu and poultry) by the households in terms of quartiles. However, in the case of pigs, sheep and goats, we used binary variables that simply indicated whether the household had any or not.

Our findings highlight that in the households with the most cattle (the richest quartile in terms of cattle ownership) the likelihood that the children would work was significantly lower, which was not the case for poultry ownership[3]. The sale value of the cattle also had a significant impact on the likelihood that the children would work. Thus, the higher the value of the cattle, the less likely it was that the children would work, but its magnitude is very low. Land ownership had no significant influence (we should remember though that the survey did not provide data about land area, but only about the number of plots). This is a shortcoming, since the number of plots does not really reflect the household's wealth in terms of land.

[3] We tested ownership of cattle in general. This variable did not yield significant results. Similarly, no other significant result emerged for the other quartiles. The same is true of their other assets. So, in the end, we only used the richest quartile for each type of asset.

Finally, taking out a loan could considerably reduce the likelihood of child work. These findings support the idea that there is a range of possible *ex post* reactions by household confronted by shocks involving the realisation of some assets and/or borrowing and thus reducing considerably the likelihood that the children will have to work.

We should also note that relative to the first specification, the age of the children is no longer significant. We can interpret this finding by the fact that, independently of the occurrence of shocks, age is an important factor in children's being sent to work, whereas when a shock occurs households use all child work available, regardless of age, to respond to the shock and compensate for the losses.

3.4. Extensions

We will now use the same main specification, but distinguish the effect of the shocks on the children's school attendance (child work does not necessarily imply that the children involved cease to attend school, they may combine both activities; on this point see for example the analyses of Assaad et al., 2003; Beegle et al., 2004; Boozer and Suri, 2001; Bourguigon et al., 2003; Canals-Cerda and Ridao-Cano, 2004; Guar cello et al., 2005; Hazarika and Bedi, 2003; Psacharopoulos, 1997; Ravallion and Wodon, 2000; Schultz, 2004; Skoufias and Parker, 2001), and on two specific categories of child work about which the surveys do provide information: agricultural work and domestic chores.

The first specification (column 1) concerning school attendance reveals three significant variables: the damage to the rice crop: the shock on rice production had the effect of removing children from school; the age of the children: the older the child the more likely he or she was to be attending school; the level of education of the head of the household: the lower this was, the less likely it was that the children would be attending school.

The second specification (column 2) concerns agricultural work. Here damage to the rice crop did not constitute a significant variable. In contrast, the wealth of the household in terms of poultry ownership was significant. The more poultry the household owned, the less likely it was that the children would be working. This finding can be interpreted as being due to the fact that the household is less dependent on the rice crop for its survival. Once again we find that the age of the children had a significant positive effect. Similarly, we also found that the size of the household had a significant positive effect.

The third specification (column 3) concerns domestic chores. Damage to other crops had a significant positive effect. Damage to other crops resulting from the drought increased the

likelihood that children would be assigned domestic chores, whereas this was not the case for damage to the rice crop. Here too we find that age had a significant effect, but this time the correlation was negative. As the children got older, the less likely they were to be assigned domestic chores. We also found that the level of education of the head of the household had a significant positive impact. Finally, the more livestock the household possessed, the less likely it was that the children would be assigned domestic chores. However, this does not allow us to conclude that the children were assigned to looking after the livestock, as the survey does not provide any information about this.

Table 6. Extensions of child work

	(1)		(2)		(3)	
Dependent variable	School attendance		Agricultural work		Domestic Chores	
Specification	Probit		Probit		Probit	
Gender	-0.137	(0.178)	0.285	(0.326)	0.311	(0.223)
Age	0.084***	(0.027)	0.266***	(0.061)	-0.109***	(0.037)
Years of schooling of the head of the household	0.094***	(0.028)	-0.078	(0.070)	-0.07	(0.034)
Household headed by a woman	0.098	(0.749)	-	-	-	-
Size of the household	-0.071	(0.043)	0.276***	(0.086)	-0.035	(0.054)
Household headed by a farmer	-0.212	(0.728)				
Age of the head of the household	0.008	(0.008)	-0.021	(0.015)	0.016	(0.010)
Head of the household has several activities	0.047	(0.124)	0.234	(0.236)	0.248	(0.164)
Damage to rice	-0.546***	(0.211)	0.445	(0.465)	0.098	(0.253)
Damage to other crops	-0.541	(0.398)	-	-	1.563***	(0.435)
Quartile with most cattle	0.335	(0.206)	0.186	(0.377)	-0.758***	(0.248)
Quartile with most poultry	0.650	(0.188)	-0.875**	(0.401)	0.342	(0.235)
Quartile with most plots of land	-0.139	(0.213)	0.534	(0.368)	0.199	(0.268)
Sale value of cattle	-5.07E-08	(7.33E-07)	-2.25E-06	(1.83E-06)	-4.78E-06	(3.15E-06)
Loan	0.033	(0.311)			-0.108	(0.363)
Constant	-0.419	(0.917)	-5.409	(1.110)	-0.325	(0.670)
Observations	265		201		241	
LR chi2	(16) 46.81		(11)61.50		(13)55.63	
Prob > chi2	0.0001		0.0000		0.0000	
Pseudo R2	0.1329		0.3972		0.2286	

Marginal coefficients are shown. Standard errors are in parentheses.
*** indicates significance at 1%; ** at 5%; and * at 10%.
We used the same model for all the specifications. The coefficients missing from the table were eliminated from the model during iterations.

We can deduce some main implications from these findings. Firstly, damage to the rice crop affected school attendance by the children, whereas this was not the case for other crops. This difference probably results from the importance of rice compared to other crops.

Secondly, with regard to the age of the children, we can conclude that as they got older, the likelihood that they would be working in the absence of shocks increased significantly. However when households were exposed to shocks, age was no longer significant (see Table 5), whereas age was still a significant, albeit negative, variable if we take only domestic chores into account (the likelihood of doing domestic chores was higher the younger the children), we can conclude that a context of shocks households tended to assign domestic chores to their youngest children, probably in order to free up their own time and that of the older children for other activities.

Thirdly, the gender of the children was not a significant variable under any circumstances. Unlike previous studies (UNICEF, 2000) we did not find here that households made any distinction between boys and girls in their strategy of assigning tasks to their children. In particular boys were no less often assigned domestic chores than girls. The significant variable from this point of view is age and not gender.

4. Conclusion

In this paper we have investigated the impact of drought shocks on child work in the rural observatory of Morondava in Madagascar. This region was subjected to an unusual drought during the agricultural year of 2006. The article also analyses the role of the reactions of the households in implementing various strategies to smooth their consumption by child work.

The results corroborate the findings reported in previous articles (notably Beegle et al. 2006). Drought shock significantly increases the likelihood that children will be working. However, the households were not devoid of other responses. Realising their assets (mainly by selling cattle) and taking out loans can reduce the impact of the shock on child work. Our findings are therefore consistent with the hypotheses advancing a credit squeeze and buffer-stock as explanatory factors for child work.

Two other main findings also emerge. Firstly, the effect of the drought affected the likelihood that children would be working only as a result of the damage to the rice crop that it causes.

Damage to other crops did not have any significant influence on child work. This finding is related to the predominance of the rice crop in the observatory. Secondly, children were assigned domestic tasks independently of their gender. Both girls and boys were assigned domestic chores in response to the drought shock. This is a rather unusual finding, as domestic chores tend to be associated with girls. Nevertheless, our result must not be interpreted in an excessive meaning. It does not signify that girls are not more assigned to domestic chores than boys, but only that they are not assigned more domestic chores than boys for main activity. They can be assigned more domestic chores than boys for secondary activity, a point we have not tested in our paper. Here we can note that, even if the definition of activities we retain in the study is bounded due to data collection, it goes beyond some difficulties with the ILO definition of child work taking into account domestic chores. It is an important point especially as children working in domestic chores appear a main way of households' adaptation to shocks.

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Tel : +33 (0)5.56.84.25.75
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