BARRIERS TO CHILDREN'S COGNITIVE ACHIEVEMENTS: EVIDENCE

FROM SENEGAL

A Thesis

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ABSTRACT

Children's poor learning represents a major constraint to escape from poverty and develop a productive work force in much of the developing world. In this thesis, I focus on one particular barrier to children's learning that has yet not been well explored in the literature: the impact of father's unemployment on children's cognitive achievements. This analysis has significant implications for policy makers. If short term shocks reduce children's human capital, these may have long term effects on children and may be a cause of persistent poverty across generations. Using household panel data from Senegal, I analyze the relationship between father's unemployment and children's human capital (measured by cognitive tests). Results show that having a father unemployed is correlated with a significant reduction of children's cognitive achievement. This suggest that policies that aim at improving life chances of poor children and raising levels of human capital should, in addition to the commonly used methods to target this issue (e.g. investments in schools), also adopt mechanisms to help households coping with risk, such as the provision of unemployment insurance or other social protection programs could improve children's outcomes.

BIOGRAPHICAL SKETCH

Pascale was born in Santiago, Chile where she obtained her high school diploma from Bertait College. Upon completing high school, she moved to East Lansing, Michigan to pursue a B.A. degree in Economics at Michigan State University. After graduating with high honors, she worked for the research department of the World Bank for two years before becoming a graduate student at Cornell University in 2009.

This thesis is dedicated to my grandmother, Elvira, who has been one of the most influential people in my life. Her immense love, understanding and support have been essential towards my professional and personal development.

ACKNOWLEDGMENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

BACKGROUND ON INCOME SHOCKS AND ITS EFFECTS ON CHILDREN'S

COGNITIVE ACHIEVMENTS

Introduction

ILO estimates that about 34 million jobs have been lost in the past 3 years after the

recent financial crisis. Worryingly, in a context where financial markets tend to fail

and savings rates are low, unemployed individuals may be forced to rely on non-

market mechanisms to cope with unforeseen income fluctuations, and children may

also suffer the consequences. For instance, some of the impacts of income fluctuations

on children's well-being are well known and suggest that these result in poorer health,

higher likelihood of child labor and school drop out, and lower school attendance and

attainment. Nevertheless, no research has yet explored the impact of negative income

shocks on one of the most crucial elements in determining movement out of poverty

and growth of a country: human capital. With this concern in mind, in chapters 1 and 2

I investigate father's unemployment and its impacts on a direct measure of children's

human capital, i.e. cognitive and non cognitive skills tests. Further, I investigate to

which extent a negative shock may ultimately affect human capital accumulation via

schooling.

The results are important for several reasons. First, these suggest that income shocks

are an important determinant of children's human capital accumulation. Knowing the

underlying causes of the poor levels of human capital is a key factor for eradicating

poverty in much of the developing world. As an example, Senegal is struggling to

achieve key education objectives such as universal primary enrollment. Completion

rates in 2002 were only 49 and 19 percent for primary and secondary school

respectively and only 5 percent of Senegalese attend university. Repetition rates are very high while significant gaps are found in dimensions such as gender wealth and location. Unfortunately, poor levels of human capital are not only a major barrier for development in Senegal, but it is also one of the main constraints in most poor countries.

Second, knowing whether temporary shocks result in long term effects on children reinforcing persistent poverty across generations has important policy implications. If children's development appears to be more affected by temporary income shocks than poverty itself, policies that aim to improve poor children's endowments would be better severed by finding better mechanisms to cope with risk as opposed to, for example, just investing more in schools.

Third, this research contributes to the existing literature in the sense that while an extensive amount of research has already explored the impact of negative shocks on outcomes such as schooling, health and child labor, no study has yet explored the impact of negative shocks on a direct measure of human capital. I intend to provide a much deeper understanding of the consequences of income fluctuations on children since cognitive achievements are likely to capture effects not captured by already studied outcomes such as schooling, health and child labor. For example, while a shock may not have an impact on school, it could indeed affect out of school time devoted to study (e.g. children getting home after school may have to do household chores) and out of school investments (e.g. school materials or health investments) ultimately leading to lower human capital accumulation. Similarly, while knowing the impacts on health and child labor is informative, their long term impacts are not well understood.

Moreover, human capital not only depends on years of education, it also depends on innate ability, quality of schools, out of school investments, health, home inputs (e.g. parent's education), etc. Thus, learning about the impacts on cognitive achievements is especially meaningful since it is human capital (and not schooling) the factor that is presumed to affect subsequent productivity and the growth of a country (Hanushek and Woessmann 2008), and well as one of the main channels through which poor people may escape from poverty.

Lastly, looking at how a negative shock affects children's cognitive achievements after controlling for schooling provides relevant information for studies that have looked at the impacts of shocks on schooling as a measure of human capital. If there still appears to be a significant negative impact after controlling for schooling, this suggests that previous research may have underestimated the true impact of shocks on human capital.

Literature

Jacoby and Skoufias (1997) were among the first researchers to empirically look at the use of children as risk-coping instruments. Using the ICRISAT India panel data for rural households, they find that income shocks cause a reduction in school attendance. Then, several empirical studies have followed the lead of this paper. Duryea et al. (2003) show that male household head unemployment in Brazil increases child labor and decreases school advancement. Guarcello et al. (2003) show similar household responses to risk in Guatemala, and in addition they find that children who are sent to work are then less likely to return to school. Parker and Skoufias (2006) find that shocks affect girls' school attainment and attendance. Beegle et al. (2006) and Jensen (2000) find that agricultural shocks increase child labor and reduce school attainment

3

in Cote d'Ivoire and Tanzania respectively. De Janvry et al. (2006) find that in Mexico shocks such as unemployment or illness of the household head have large effects in taking children out of school and the children who dropped out of school are less likely to subsequently enroll again. Furthermore, they find that conditional cash transfers (CCT) help to protect enrollment, but did not restrain parents from increasing child work in response to shocks suggesting that CCT may effectively act as safety nets for the schooling of the poor. Lastly, Gubert and Robilliard (2007) find that in Madagascar, shocks significantly affect children's school dropout behaviors but not school entrance.

In addition to the impacts on schooling and child labor, shocks may also affect children's health status. For instance, a shock may negatively affect the child's nutritional status (because of lower or less nutritious calorie intake) resulting in poorer health outcomes. Alternatively, health may deteriorate as households are likely to consume less health services.

In turn, poorer health leads to a lower human capital accumulation. In fact, several studies show that improved health results in higher cognitive outcomes. For example, in Guatemala, children exposed to a nutritional intervention have better reading comprehension and perform better on tests of cognitive development in adulthood, and earn higher wages (Hoddinott and Kinsey 2001).

There is a large literature that analyzes at the effects of shocks on child health (in particular infant mortality, height and weight). Studies focusing on mortality outcomes have found consistent results. Cutler et al. (2002) find that economic contractions are associated with increased child mortality of about 8 percent in Mexico. Paxson and

Schady (2005) explored the effects of the 1980 crisis in Peru on infant mortality and find that the crisis increased child mortality from 50 to 75 per 1,000 children born. Furthermore, they find that during the crisis, there is a decline in health services utilization. A study done in India finds that in rural areas infant mortality appears to increase by 0.14 percentage points when an economic contraction occurs (Bhalotra 2007). Lastly, using data from DHS covering 59 developing countries and approximately 1.7 million children, Baird et al. (2007) show that income shocks have a large negative effect on children mortality; a 1 percent decrease in per capita GDP is associated with an increase in infant mortality between 0.31 and 0.79 percent.

Similarly, strong evidence suggests negative impacts of shocks on height and weight. Stillman and Thomas (2004) look at the impact of a Russian economic contraction in 1998 on height-for-age and weight-for-height of children finding that shocks result in a weight-for-height z-score decline of about 0.11 points. Maluccio (2005) finds that sharp reductions in the price of coffee in Nicaraguan coffee-growing areas results in a decline in the height-for-age z score of children aged 6 to 48 months of 0.15 points. Pongou et al. (2006) find that in Cameroon macroeconomic declines are associated with an increase in weight-for-age malnutrition of 9 percentage points for boys and 3 percentage points for girls. Furthermore, they find bigger effects for children whose mothers had less education and where households had fewer assets.

Furthermore, various studies have evaluated the impact of droughts on height and weight. Jensen (2000) finds that an exposure to drought is associated with an increase of 3.5 percentage points in the fraction of children with weight-forage more than two standard deviations below the international norm. In Ethiopia, Yamano et al. (2005) find that drought is associated with a decline in child growth rate of approximately

0.12 centimeter over a six-month period. Alderman et al. (2006) looked at the effects of a two-year drought in Zimbabwe finding that children who were exposed to the drought showed to have a significantly lower height-for-age. Moreover, children who were shorter as a result of the drought do not recover these growth deficits later on and just become shorter adolescents. This result is consistent with Hoddinott and Kinsey (2001) where they find that children aged 12 to 24 months lose 1.5-2 cm of growth in the aftermath of a drought. Lastly, in Tanzania, Alderman et al. (2009) using a 10 year panel find that children who experienced weather shocks in early childhood were more likely to have low height-for-age, start school late, and have completed fewer years of schooling by the time they were adolescents. Moreover, they use different simulations to show that this, in turn, translates into substantial reductions in earnings in adulthood.

Lastly, Macours et al. (2008) look at how a randomized cash transfer program in rural Nicaragua affect cognitive development in early childhood. They find that the program had significant effect on cognitive outcomes. Furthermore, they find that the program increased intake of nutrient-rich foods, early stimulation, and the use of preventive health care (all factors thought to have an affect on children's development).

Mechanisms
There are various mechanisms through which a negative income shock may ultimately affect children's human capital. As mention above, multiple studies show that negative income shocks lead to a higher likelihood of dropping out from school and child labor, a reduction in schooling attendance and attainment, lower health status measured by

weight for height and height for age, and a reduction on health visits. In turn, all of these impacts ultimately affect the human capital accumulation of children.
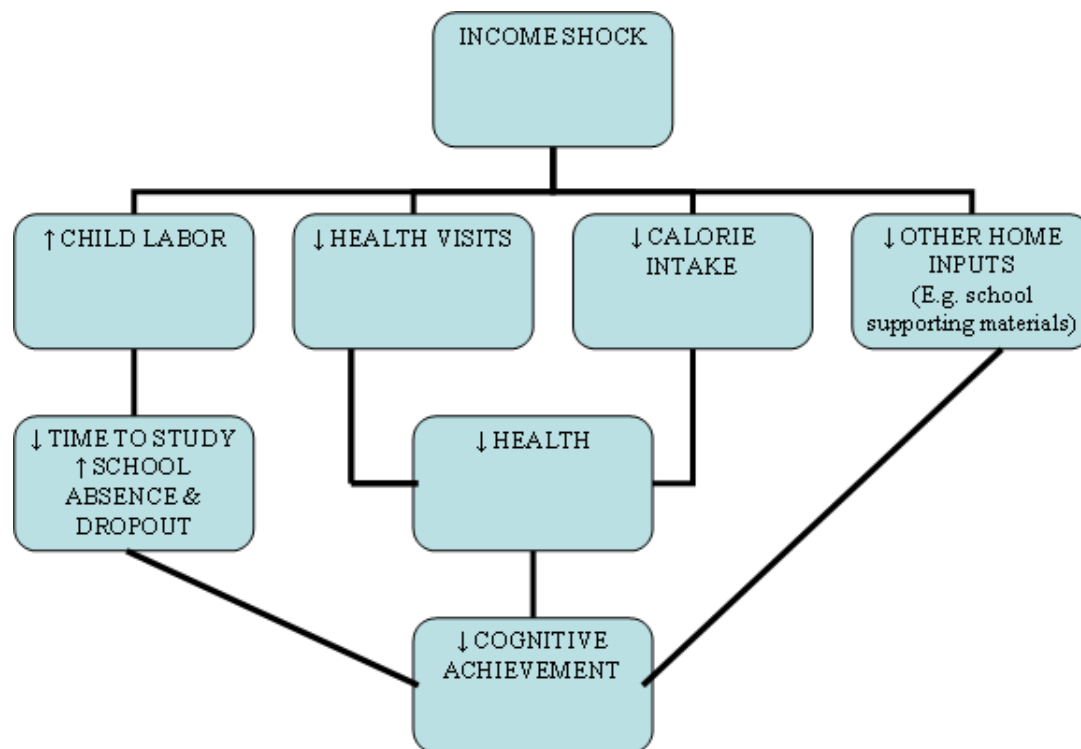
Figure 1: Mechanisms leading to a reduction in human capital

In addition to the effects of income shocks just mentioned, other likely effects not well explored in the literature yet include reductions in the time for studying and home inputs (e.g. school supporting materials), and a decrease in learning through labor exhaustion. Below there is a simplified sketch showing the different mechanisms leading from an income shock to a reduction in human capital.

CHAPTER 2

QUANTITATIVE ANALYSIS ON INCOME SHOCKS AND ITS IMPACT ON

CHILDREN'S COGNITIVE ACHIEVEMENTS

Data used

I use two waves from a panel data set containing a direct measure of human capital (test score data) for children in Senegal. The first wave, known as PASEC (Programme d'Analyse des Systemes Educatifs de la CONFEMEN), administered tests of written math and French to a cohort of students (who were at school) beginning in 2nd grade in 1996. The second wave, the Education et Bien-être des Ménages au Sénégal (EBMS) survey, attempted to relocate PASEC in 2003, who were now aged between 14 and 17. In addition to the children interviewed in 1996, this survey also administered tests to additional current students as well as to children no longer, or never enrolled in order to create a more representative sample of children. Furthermore, while the first wave did not collect much information on household's characteristics, the second wave did also collect detailed household information. Because the first data wave only contains restricted information and a non-representative sample of children (individuals not enroll in school at the time of interview were not enumerated), this paper only makes use of the first wave as a way to perform robustness tests.

The sample of the second wave covers 60 communities (32 rural and 28 urban) and tests were given in written French and math, oral math, and 'life skills'. While the oral math test measures basic competence in mathematical calculations and solving simple problems, the life skills test measures basic practical knowledge (as opposed to academic knowledge), and included questions about nutrition and health practices,

HIV/AIDS, government institutions and organization and other topics. This information was matched to detailed school and community surveys containing a full range of factors potentially affecting schooling and cognitive outcomes (see Glick and Sahn 2007).

Descriptive statistics

There are a total of 1,958 children in the sample (this excludes children that were interviewed in 2003 but did not take any of the cognitive tests). Of these children, 625 also took cognitive tests in the year 1996. While oral tests (life skills and math) had a high response rate, written tests did not and consequently in this paper only oral tests will be used. In fact, Glick and Sahn (2007) find that while people taking and not taking oral tests do not significantly differ in observable and unobservable characteristics, for written tests participant's characteristics do differ substantially from the overall sample (in terms of both, observables and unobservables). For instance they find that for written tests there is a positive selection (better off children select into test taking) occurring on characteristics such as assets and parental education.

The unemployment variable used in this paper is defined in the following way: household members were asked retrospective questions about each period in which they had either lost their job (as a salary worker) or had to stop/close their business (as a self employed worker) for at least one month during the past 10 years. Since there is evidence in the data suggesting that the further away in time this event occur, the more likely it is that they do not recall this properly, in this paper I only focus on the events that happened in the near past (during the 3 years previous to the survey). In years 2000-2002 4.2 and 2.5 percent of fathers in urban and rural areas respectively reported

being unemployed. Figure 2 shows the distribution of the duration of unemployment. Father's duration of unemployment has mean and median of 4.7 and 3 months respectively.

Percentage
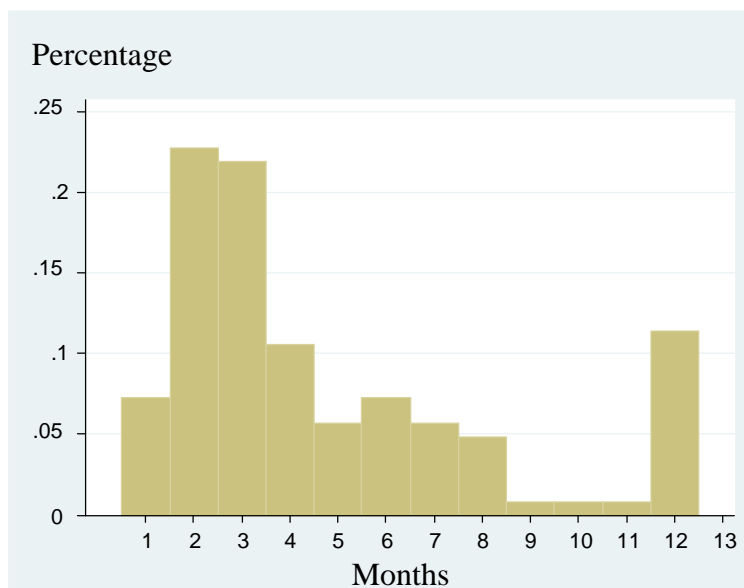
Figure 2: Duration of Unemployment. Note: graph corrected for outliers.

Table 1 below shows the average test performance (in terms of standard deviations) for children that suffered and did not suffered from father's unemployment.

Table 1: Average Tests performance in standard deviation terms

	Father was unemployed	Father was not unemployed
Math	-0.15464	0.00476
Life Skills	-0.2896	0.0231

From this table one can infer that children whose father suffered from unemployment perform worst in both tests. Later on, I explore how this correlation changes as one control for various factors that affect test performance.

Table 2 shows various children's characteristics by employment status. Children whose father is unemployed have on average a lower level of education attained. Also, their fathers appear to have a slightly lower education which is consistent with the fact that less skilled people are more likely to be unemployed. Lastly, a larger share of children's whose father is unemployed quit school and reported being sick.

Table 2: Children's Characteristics by Father's Employment Status (means or percentages)

	Father was unemployed	Father was not unemployed
Highest Level of Education	1.5493	1.8172
Child Quit School	43.66%	33.05%
Highest Level of Education Father	1.0563	1.3158
Highest Level of Education Mother	0.662	0.6245
Child was Sick	11.27%	8.19%

Econometric approach

The basic specification to examine the effect of father's unemployment on test scores is:

$$\text{(1)} \qquad y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 U_{it-1} + \varepsilon_{it}$$

Where subscripts index individuals (i) and time (t); y is a measure of human capital (oral math and "life skills" tests); shock is a measure of father's unemployment and X contains a set of controls including individual, household and school characteristics. The coefficient of interest is β_2 which is expected to be negative. Under this specification, the identifying assumption for an unbiased estimate of β_2 requires that conditional on covariates X, the shock is not correlated with the error

term. Off course in reality this assumption does not necessarily need to hold, but a causal interpretation of the findings is subject to this condition holding.

A particular concern from the specified model is that there may be community level unobservable characteristics that can affect test scores and also be correlated with father's unemployment. For example, a low income community may be associated with both, high unemployment and low quality schools that in turn affect test scores. Hence, 60 dummy variables are included for each community found in the sample and the alternative specification is:

$$(2) \qquad Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 U_{it-1} + \delta_c + \varepsilon_{it}$$

Where δ_c are the community fixed effects. Even though this specification has the advantage of eliminating any unobservable characteristics at the community level, it does not allow anymore to evaluate the various school quality variables since we are only exploiting the within community variation and these variables are defined at the community level.

Lastly, one has to keep in mind that even after including community dummy variables, father's unemployment may be correlated with unobservables such as father's ability that is likely to be associated with both, father's unemployment and children test scores. Hence, even though there is a significant relationship between unemployment and cognitive achievements, a causal interpretation of this finding is subject to the assumption that after controlling for community level heterogeneity and observables at the household and individual level, father's unemployment is exogenous.

Empirical results

To estimate the impact of father's unemployment on oral math and life skill tests, raw test scores are transformed into standardized scores with zero mean and standard deviation equal to one, using the pooled girl and boy sample for each test.

Table 3: Least squares regression oral math test

	Model 1	Model 2	Model 3
Father Unemployed 2000-2002	-0.421***	-0.297***	-0.297***
	[0.120]	[0.100]	[0.099]
Highest Education Level		0.147***	0.136***
		[0.008]	[0.009]
Asset Index			0.015
			[0.031]
Highest Education Level Father			0.018
			[0.011]
Highest Education Level Mother			0.058***
			[0.016]
Child was Sick			0.072
			[0.073]
Director Experience			0.003
			[0.003]
School Enrollment			0
			[0.000]
School has separate toilet			0.072
			[0.045]
Director Gender			-0.013
			[0.088]
R Sq.	0.147	0.283	0.293
No. of obs	1862	1862	1862

Notes: All regressions control for region, ethnicity and age dummies. Robust standard errors in brackets. * Significant at 10% ** Significant at 5% *** Significant at 1%.

Model 1 from tables 3 and 4 suggests that after controlling for region, ethnicity and age dummies, father's unemployment is associated with a reduction in the performance of the math and life skills tests by 0.42 and 0.49 standard deviations respectively. Model 2 shows that once we control for schooling the effect is considerably smaller (0.30 and 0.38 standard deviations for math and life skills respectively).

Table 4: Least squares regression life skills test

	Model 1	Model 2	Model 3
Father Unemployed 2000-2002	-0.487***	-0.378***	-0.373***
	[0.120]	[0.113]	[0.110]
Highest Education Level		0.136***	0.122***
		[0.008]	[0.008]
Asset Index			0.057*
			[0.031]
Highest Education Level Father			0.01
			[0.011]
Highest Education Level Mother			0.053***
			[0.016]
Child was Sick			-0.022
			[0.065]
Director Experience			-0.001
			[0.003]
School Enrollment			0.000***
			[0.000]
School has separate toilet			0.100**
			[0.044]
Director Gender			0.014
			[0.092]
R Sq.	0.183	0.298	0.312
No. of obs	1959	1959	1959

Notes: All regressions control for region, ethnicity and age dummies. Robust standard errors in brackets. * Significant at 10% ** Significant at 5% *** Significant at 1%.

Nevertheless, after controlling for schooling the negative impact of unemployment is still significant and large in terms of its magnitude suggesting that schooling is not the only channel through which a negative income shock may affect children's human capital accumulation. Lastly, model 3 suggests that as we control for additional variables in order to account for possible sources of bias, the coefficient of interest does not considerably change for either test.

Tables 5 and 6 show the results when using community fixed effects. As expected, the magnitude of the effect becomes smaller since it is likely to have less variation within communities (-0.24 and -0.30 for math and life skills respectively in models 3). Again, as the highest level of education is included in model 2, there is a considerable reduction on the coefficient of interest, however the effect still remains substantial.

Table 5: Community fixed effects regression oral math test

	Model 1	Model 2	Model 3
Father Unemployed 2000-2002	-0.300**	-0.237**	-0.238**
	[0.126]	[0.106]	[0.104]
Highest Education Level		0.145***	0.137***
		[0.008]	[0.009]
Asset Index			0.026
			[0.033]
Highest Education Level Father			0.021*
			[0.011]
Highest Education Level Mother			0.043***
			[0.016]
Child was Sick			0.051
			[0.069]
R Sq.	0.254	0.372	0.377
No. of obs	1862	1862	1862

Notes: All regressions control for ethnicity and age dummies. Robust standard errors in brackets. * Significant at 10% ** Significant at 5% *** Significant at 1%.

In sum, the results are robust across the various specifications and suggest a significant relationship between father's unemployment and cognitive achievement. Furthermore, the magnitude of the relationship is considerably large relative to the effect of schooling which is 0.137 and 0.123 standard deviations for math and like skills respectively (based on model 3 from tables 5 and 6 respectively).

Table 6: Community fixed effects regression life skills test

	Model 1	Model 2	Model 3
Father Unemployed 2000-2002	-0.360***	-0.309***	-0.298***
	[0.114]	[0.106]	[0.104]
Highest Education Level		0.131***	0.123***
		[0.008]	[0.009]
Asset Index			0.035
			[0.033]
Highest Education Level Father			0.019*
			[0.011]
Highest Education Level Mother			0.039**
			[0.016]
Child was Sick			-0.063
			[0.065]
R Sq.	0.293	0.387	0.394
No. of obs	1959	1959	1959

Notes: All regressions control for ethnicity and age dummies. Robust standard errors in brackets. * Significant at 10% ** Significant at 5% *** Significant at 1%.

This suggests that the effect of a shock on cognitive achievements may be equivalent to the effect of attaining almost 2 grades less for math and more than 2 grades less for life skills.

Lastly, once the level of schooling is controlled for in the regressions, the impact of unemployment decreases between 21-30% and 14-22% (depending on whether

community fixed effect are used) for math and like skills respectively. This suggests that even though schooling is an important mechanism through which human capital is affected in the presence of a negative shock other mechanisms may play a major role in reducing children's human capital.

Robustness Tests

In order to test whether coefficients are significant due to spurious correlation, a placebo regression using OLS and community fixed effects is run in which the dependent variable is the test score that children took before the shock happened.

Table 7: Community fixed effects regression life skills test

	OLS	Community FE
Father Unemployed 2000-2002	0.055	0.07
	[0.264]	[0.262]
Highest Education Level	0.172***	0.173***
	[0.024]	[0.024]
Asset Index	0.096	-0.006
	[0.065]	[0.070]
Highest Education Level Father	-0.037	-0.043*
	[0.026]	[0.025]
Highest Education Level Mother	0.07	0.069
	[0.043]	[0.043]
Child was Sick	0.14	0.058
	[0.115]	[0.120]
R Sq.	0.247	0.391
No. of obs	506	506

Notes: Robust standard errors in brackets. All models control for ethnicity and age dummies. OLS controls for regions.* Significant at 10% ** Significant at 5% *** Significant at 1%.

Clearly, we expect the coefficient on unemployment to be insignificant since this one cannot affect something that happened in the past. As the table 7 show, in fact, none of

these coefficients in any of the 2 models are significant suggesting that results are not due to unobserved characteristics of households that experience unemployment shocks.

Table 8: Father's unemployment - Do 1996 test scores help predict father's subsequent unemployment?

	Model 1	Model 2	Model 3	Model 4
Pre French Test	-0.016			
	[0.014]			
Pre Math Test		0.004		
		[0.014]		
Post French Test			-0.001	
			[0.013]	
Post Math Test				-0.002
				[0.012]
Highest Education Level	0.002	-0.001	0.002	0.002
	[0.006]	[0.006]	[0.006]	[0.007]
Asset Index	0.012	0.013	0.008	0.008
	[0.019]	[0.017]	[0.017]	[0.017]
Highest Education Level	-0.002	-0.002	0.001	0.001
Father	[0.005]	[0.005]	[0.005]	[0.005]
Highest Education Level	-0.004	-0.003	-0.006	-0.006
Mother	[0.008]	[0.007]	[0.008]	[0.007]
Child was Sick	0.054	0.051	0.058	0.058
	[0.044]	[0.039]	[0.039]	[0.039]
R Sq.	0.142	0.129	0.143	0.143
No. of obs	481	506	497	496

Notes: Robust standard errors in brackets. All regressions control for ethnicity and age dummies and include community FE. Test scores are standardized.* Significant at 10% ** Significant at 5% *** Significant at 1%.

Another possible source of bias of the coefficient of interest is that children that suffered and did not suffer from father's unemployment may have had different ability prior to the shock. A way to test whether this is the case is to run models where father's unemployment is the dependent variable and the different tests scores (before the shock happened) are the explanatory variables. If children suffering and not suffering from shocks did not initially differ in ability, then we would expect coefficients on tests scores to be insignificant. Table 8 shows that none of the coefficients on tests scores are significant providing evidence in favor of a causal interpretation of the coefficient on father's unemployment. Nevertheless, these results are subject to only represent this particular restricted sample of children (as the panel data contains a subsample of the 2003 data).

Interactions: how does having educated household members helps mitigating the effect of unemployment?

Literacy has externalities that are widely accepted; and illiterate who is in close proximity to a literate person may benefit from this proximity (Basu and Lee 2009). In a similar way, we can think that if there is a well-educated household member, the effect of income fluctuations on children's cognitive achievement may be partially mitigated. To test whether this is the case, I run models 3 (from tables 5 and 6 for math and life skills respectively) and add the education level of the household member that has the highest education in the household and then add an interaction of this variable with father's unemployment. When adding this interaction, the total effect of unemployment becomes:

(3) $$\frac{\partial H_{it}}{\partial U_{it-1}} = \beta_1 + \beta_2 E_{it}$$

Where β_1 is the coefficient on unemployment, β_2 is the coefficient on the interaction term and E_{it} is the education level from the household member that has the highest education. In order to compute the new effect of unemployment, I calculate the equation above using the mean of E_{it}. Once controlling for this interaction term, father's unemployment has a -0.23 and -0.33 standard deviation effect (at the 1 and 5 percent significance level) on children's cognitive achievement for math and life skills respectively. The coefficient on the interaction term (the effect of having an educated member when a shock happens) is 0.034 and 0.01 for math and life skills respectively. This result suggests that having other educated members in the household does significantly help to mitigate the negative effect of father's unemployment. Still, the magnitude of the effect is not as large compared to other components included in the production of human capital such as years of school.

Conclusion

Results suggest that having a father unemployed is associated with a significant reduction on children's cognitive achievement and the results are robust across different model specifications. The magnitude of the effect is relatively big when one considers the magnitude of the impact of schooling on cognitive tests. Also, results suggest that schooling is only one of the mechanisms through which a shock may affect human capital accumulation and that additional mechanisms may play a major role. Previous studies that look at the impact of shocks using the level of schooling as a proxy for human capital may be underestimating the true impact on human capital.

More importantly, findings suggest that short term income fluctuations may translate into long lasting effects reinforcing persistent poverty across generations. Hence, policies that aim at improving life chances of poor children and raising levels of

human capital may not only consider the commonly used methods to target this issue (e.g. higher investments in schools) but should also consider adopting better mechanisms to help households cope with risk such as the provision of unemployment insurance could improve children's outcomes.

Limitations and further research

Given the data limitations, there are some issues that have to be kept in mind when interpreting the results. First, the unemployment variable is likely to be noisy which possibly leads to a downward bias in the estimates of the impact. This noise is due to two main reasons. First, in Senegal most workers participate in the informal sector and hence when asked about unemployment, it is not straight forward the meaning of being unemployed (e.g. different households may interpret unemployment differently). Second, since the unemployment variable is based on retrospective questions, households may not be able to recall properly past events. Nevertheless, under the assumption that these two sources of noise are randomly distributed, this measurement error does work against us finding a significant result and are not a source of bias.

Additionally, a causal interpretation of findings is subject to the assumption that after controlling for community level heterogeneity and household and individual level characteristics, unemployment is exogenously determined. In order to try to address this issue, several econometric methods were applied. For instance, the difference of test scores between 1996 and 2003 was used as the dependent variable (as opposed to the 2003 tests scores by themselves), and then control variables from 2003 were added. Results suggest a negative impact of father's unemployment however the result is not significant. Nevertheless, this result is not surprising since by having to use the 1996 data, not only the sample size gets reduced significantly (from about 2,000

21

observations to less than 600 observations), but also this new reduced sample of children is not representative (since the 1996 data is a school based sample). Hence, since in Senegal there is a big portion of children not enrolled in school, all of these relatively worst off children, are excluded from this estimation. Similarly, child fixed effects were used resulting in again a negative but insignificant effect. This result is again expected because of the same reasons mentioned above. The difference between using child fixed effects and the other just mentioned method is that in this later one it is not possible to control for 2003 variables (since these control variables are only found in the 2003 data).

Lastly, another alternative solution to this issue was to use an instrumental variable approach. For instance, two interactions terms are used as instruments for father's unemployment; the likelihood that other people in the community becomes unemployed interacted with the father's age and age squared. These interactions are likely to affect father's unemployment but do not directly affect children's test scores which are necessary conditions for the instrument to be valid. For instance, the probability that a father is unemployed will be associated on a large extent on the percentage of other unemployed people in that community as well as his own age. At the same time, age has a quadratic impact on unemployment since depending on the type work, being too young or too old affects your chances of being unemployed differently. Results from this method suggest that father's unemployment leads to a reduction in children's cognitive achievements and the coefficients are significant. Also, validation tests of instruments suggest that the instruments used were valid. Nevertheless, when adding community fixed effects to this estimation results become insignificant.

Another point to keep in mind is that the effects of a shock that happened between 2000-2002 may still not be fully realized by 2003 (leading to a downward bias of the magnitude of the effect). To understand longer term impacts, the data that will be collected in the next wave of the survey1 could be used to estimate the impact of the shock during childhood when it is fully realized during their early adulthood.

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[1] A new wave of the survey is currently being designed and will be implemented during the last quarter of 2010.

APPENDIX

ANECDOTAL EVIDENCE FROM SANDIARA

In order to get a sense about what people actually think the main barriers to children's learning are, I spent a few days in Sandiara talking with households about their perceptions on constraints to children's learning. In Sandiara, a small rural community in Senegal, human capital is a severe problem. In 2003, more than half of children aged 14 to 17 had not even completed primary school when completion age for primary school is supposed to be between 10 and 11 years old. Further, 78% of children repeated a grade at least once. In a recent field visit to this community, households expressed their opinions on the poor schooling and learning outcomes of children. After discussing with different households and community leaders, the main barriers for learning identified were household's financial constraints combined with personal preferences and incentives to invest in children.

Even though the school tuition is free, households reported that they still have to incur in other non-tuition costs that are not able to afford when their income earning activities do not go well. For example, there is a registration fee which must be paid in full at the beginning of the year. If this fee is not paid before the classes start, children are not allowed to enter schools until they pay. Further, even though this fee is modest (ranging form $4 to $20 depending on the school level), since households have an average of 8 children this fee becomes a significant barrier for school entry.

Unfortunately, due to their volatile jobs and high income fluctuations, many times they do not have the means to pay the all fees up front at the beginning of the year for all of their children. Based on the 2003 data, none of the households in Sandiara are

salaried workers and they either leave from agricultural activities (own consumption as well as cash crops depending on needs), or small scale commerce leaving them vulnerable to a variety of shocks such as droughts, pests, demand and price fluctuations. Indeed, most households reported that in at least one school year they did not have the means necessary to pay the fees on time causing their children to enter school months after the school year had already started. Once children are finally able enter school several months after the classes have started, they have difficulties learning the material often times leading to grade repetition.

In addition, households reported often not being able to afford buying school materials. Consequently, many children go to school without all the necessary learning materials resulting again in poorer learning outcomes. At the same time, many times households need their children to help them with their income generating activities such as agricultural field work. This results in a higher school absence rate leading to poorer performance.

Lastly, the extremely high repetition rates act as a tremendous disincentive to households to invest in the schooling of their children. Table 9 (below) shows that 54% of children repeated school at least two times. This fact also creates a bigger financial burden for households as they have to pay more than once all the costs incurred for a same grade. Additionally, it also creates uncertainties in the returns to schooling for their children possibly leading more risk adverse households to under invest in schooling. This finding is confirmed by a study done by Andre Pierre (2009) where he shows that grade repetition has a negative effect on the probability of being enroll in school the following year.

Table 9: Number of times the child repeated school in Sandiara

Number of repetition times	Percent
0	22%
1	24%
2	38%
3	14%
4	2%

To conclude, there is a variety of factors contributing to children's poor learning and possible solutions to some of the barriers. For instance, in order to alleviate financial constraints to households the school fee that must be paid at the beginning of the year could be paid all throughout the year in smaller pieces. Alternatively, for households with many children the government could consider imposing a smaller fee. Another possible solution is the introduction of a cash transfer program targeted to large poor households with many children. Lastly, since grade repetition poses a significant disincentive for households to send children to school, the education system could be revised in order to reduce the number of children repeating grades.

REFERENCES

Alderman, H., Hoddinott, J., Kinsey, B, 2006. Long-Term Consequences of Early
Childhood Malnutrition. Oxford Economic Papers, 58(3), 450–74.

Alderman, H., Hoogeveen, H., Rossi, M., 2009. Preschool Nutrition and Subsequent
Schooling Attainment: Longitudinal Evidence from Tanzania. Economic
Development and Cultural Change, University of Chicago Press, 57(2), 239-
260.

Baird, S., Friedman, J., Schady, N., 2007. Aggregate Income Shocks and Infant
Mortality in the Developing World. World Bank Policy Research Working
Paper 4346.

Basu, K., Lee, T., 2009. A new and easy-to-use measure of literacy, its axiomatic
properties and an application. Social Choice and Welfare, Springer, 32(2), 181-
196.

Beegle, K., Dehejia, R., Gatti, R., 2006. Child labour and agricultural shocks. Journal
of Development Economics, 81(1), 80–96.

Bhalotra, S., 2007. Fatal Fluctuations? - Cyclicality in Infant Mortality in India. The
Centre for Market and Public Organisation, Department of Economics,
University of Bristol, UK.

Cutler, D., Knaul, F., Lozano, R., Mendez, O., Zurita, B., 2002. Financial Crisis
Health Outcomes, and Ageing: Mexico in the 1980s and 1990s. Journal of
Public Economics 84(1), 279–303.

De Janvry A., Finan, F., Sadoulet, E., 2006. Can conditional cash transfer programs
serve as safety nets in keeping children at school and from working when
exposed to shocks? Journal of Development Economics, 79 (2), 349–73.

Duryea, S., Lam, D., Levison, D., 2003. Effects of Economic Shocks on Children's Employment and Schooling in Brazil. PSC Research Report 03–541.

Glick P., Sahn D., 2007. Cognitive Skills among Children in Senegal: Disentangling the Roles of Schooling and Family Background. Cornell Food and Nutrition Policy Program Working Paper No. 189.

Guarcello, L., Mealli, F., Rosati, F., 2003. Household vulnerability and child labor: the effects of shocks, credit rationing, and insurance. Understanding Children's Work, An Inter-Agency Research Cooperation Project (ILO, UNICEF, World Bank Group).

Gubert, F., Robilliard, A., 2007. Risk and Schooling Decisions in Rural Madagascar: A Panel Data-Analysis. Journal of African Economies, 17(2), 207–238.

Hanushek, E., Woessmann, L., 2008. The Role of Cognitive Skills in Economic Development. Journal of Economic Literature, 46(3), 607-668.

Hoddinott, J., Kinsey, B., 2001. Child Growth in the Time of Drought. Oxford Bulletin of Economics and Statistics 63(4), 409–36.

Jacoby, H., Skoufias, E., 1997. Risk, financial markets and human capital in a developing country. Review of Economic Studies, 64, 311–35.

Jensen, R., 2000. Agricultural volatility and investments in children. American Economic Review Papers and Proceedings, 90(2), 399–404.

Macours K., Schady N., Vakis R., 2008. Cash Transfers, Behavioral Changes, and Cognitive Development in Early Childhood Evidence from a Randomized Experiment. World Bank Policy Research Working Paper 4759.

Maluccio, J., 2005. Coping with the 'Coffee Crisis' in Central America: The Role of the Nicaraguan Red de Proteccio´n Social. Discussion Paper 188, Food Consumption and Nutrition Division, International Food Policy Research Institute, Washington, DC.

Paxson, C., Schady, N., 2005. Child Health and Economic Crisis in Peru. World Bank Economic Review, 19(2), 203-223.

Parker, S., Skoufias, E., 2006. Job loss and family adjustments in work and schooling during the Mexican peso crisis. Journal of Population Economics, 19 (1), 163–81.

Pierre, A., 2009. Is grade repetition one of the causes of early school dropout?: Evidence from Senegalese primary schools. MPRA Paper No. 25665.

Pongou, R., Salomon, J., Ezzati, M., 2006. Health Impacts of Macroeconomic Crises and Policies: Determinants of Variation in Childhood Malnutrition Trends in Cameroon. International Journal of Epidemiology 35, 648–56.

Stillman, S., Thomas, D., 2004. 'The Effect of Economic Crises on Nutritional Status: Evidence from Russia. IZA Discussion Paper 1092.

Yamano, T., Alderman, H., Christiaensen, L., 2005. Child Growth, Shocks, and Food Aid in Rural Ethiopia. American Journal of Agricultural Economics 87(2), 273–88.