Health, Shocks and Poverty Persistence

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Abstract:
In this paper we review the evidence on the impact of large shocks, such as drought, on child and adult health, with particular emphasis on Zimbabwe and Ethiopia. Our focus is on the impact of shocks on long-term outcomes, and we ask whether there are intrahousehold differences in these effects. The evidence suggests substantial fluctuations in body weight and growth retardation in response to shocks. While there appears to be no differential impact between boys and girls, adult women are often worse affected by these shocks. For children, there is no full recovery from these losses, affecting adult health and education outcomes, as well as lifetime earnings. For adults, there is no evidence of persistent effects from transitory shocks in our data.

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1. Introduction

The starting point for many of the contributions in this book is that households in developing countries often experience weather-related and other shocks that drastically affect incomes. Much has been written before on how households respond to these shocks and on the effectiveness of these strategies in reducing fluctuations in consumption (see the survey in chapter 1 of this book). A principal result that emerges is that some, but not all, households can smooth consumption. In particular, households facing liquidity constraints or without formal or informal support networks have limited smoothing ability. For these households, therefore, income fluctuations will generate a welfare loss.

This chapter complements studies on the effectiveness of these strategies, but differs in focus. Our interest is in exploring the impact of shocks on child and adult health, making particular use of recent studies undertaken in Ethiopia and Zimbabwe. One attraction of such a focus is that health status is, in its own right, a valid indicator of welfare. A second stems from the growing literature on allocation processes within the household (Behrman, 1995; Haddad, Hoddinott and Alderman, 1997). This stresses that changes observed at the household level have different effects on individuals within the household, depending on intrahousehold allocation mechanisms. As health status is observed at the level of the individual, it is possible to observe directly the joint consequences of these shocks and the intrahousehold allocation processes.

A third reason for this focus follows from the apparent causal relationship between health status and other dimensions of well-being. Young children are believed to be especially vulnerable to shocks that lead to growth faltering (Martorell, 1999; Martorell et. al. 1994; Beaton; 1993; Waterlow, 1988). Children that experience slow height growth are found to perform less well in school, score poorly on tests of cognitive function, have poorer psychomotor development and fine motor skills. They tend to have lower activity levels, interact less frequently in their environments and fail to acquire skills at normal rates (Grantham-McGregor et. al., 1997, 1999; Johnston et. al., 1987; Lasky et. al., 1981). A small but growing literature, discussed below, explores whether health shocks have permanent or transitory effects on child health status. This is especially important in light of the epidemiological evidence that stature by age three is strongly correlated with attained body size at adulthood (Martorell, 1995, 1999). Adult height is correlated with earnings and productivity, poorer cognitive outcomes and premature mortality due to increased risk of cardiovascular and obstructive lung disease. Taller women experience fewer complications during child birth, typically have children with higher birthweights and experience lower risks of child and maternal mortality (World Bank, 1993). In the case of adults, an increasing body of evidence links adult weight or BMI [1] (the Body Mass Index, also known as the Quetelet Index) to agricultural productivity and wages (Dasgupta, 1993; Dercon and Krishnan, 2000; Strauss and Thomas, 1998; Pitt, Rosenzweig and Hassan, 1990). Low BMI is correlated with a large number of health-related indicators, including early onset of chronic conditions and increased risk of premature mortality (North, 1999; Waaler, 1984 cited in Higgins and Alderman, 1997).

The common feature across both child and adult studies is that *temporary* shocks can have *permanent* effects. As such, conventional studies that focus on the short-term welfare losses associated with reduced consumption following shocks that are not fully

[1] BMI is the Body Mass Index, defined as weight in kg, divided by the square of height in meters.

insured against may *understate* the full consequences of these shocks[2]. Shocks affecting health may then even be a cause for a form of poverty trap: a permanently lower equilibrium income stream in the long-run following a negative shock, making previously feasible outcomes impossible.

2. Shocks and child health

We begin by sketching a model that links shocks and child health. A fuller development of these models is found in Behrman, Deolalikar and Lavy (1995), Foster (1995) and Alderman, Gertler, Strauss and Thomas (1994) and Hoddinott and Kinsey (2001). Households are assumed to maximize intertemporal expected utility. Utility in each period is a function of consumption of goods (x), the number of surviving children (n) and a vector indicating the health, or 'quality' of each child (q) and may also be affected by household characteristics (A) such as its life cycle position and the education of household members that act as preference shifters. The (instantaneous or sub-) utility function for time period t is:

$$U_t = u_t(x_t, n_t, q_t; A) \qquad (1)$$

Preferences are assumed to be inter-temporally additive and individual sub-utility functions are increasing and concave in their arguments, so that individuals are risk-averse. Fertility decisions are taken as given and that there is no replacement response to mortality and we ignore for the time being the complications involved in recasting this as a ‘collective’ model (Alderman, Chiappori, Haddad, Hoddinott and Kanbur 1995). The

[2]The issue of persistent consequences from shocks is also discussed in Jalan and Ravallion in this volume (see also Lokshin and Ravallion, 2000). Their focus is however different: they look at shocks to overall earnings and ask whether they can detect paths of intertemporal adjustment consistent with persistence. In

household faces a budget constraint in each period. Wealth in period t+1 (W_{t+1},) is the sum of wealth in the previous period (W_t) plus the difference between income (y_t) and expenditure (x_t). Denoting prices as p_t and the interest rate on both savings and debt as r_t yields:

$$W_{t+1} = W_t (1 + r_t) + (y_t - p_t x_t) \quad (2)$$

Next, we specify a health production function that allows for the impact of shocks. In a static context, child health is a function of physical inputs such as nutrients, time spent caring for children and illness (Behrman and Deolalikar, 1988). The technology by which these inputs are combined will be affected by characteristics of the principal carer such as education and age. In a dynamic context, it is necessary to note that the production of current health is a function of past health (and thus shocks that affected health in previous periods). Consider a well-nourished, healthy child that is growing along a biologically predetermined growth path. Now suppose this child experiences an illness that temporarily reduces growth. Given the pre-ordained nature of this child's growth, she will grow faster, or 'catch up', in the post-illness period in order to return to her long run growth path. Such a process may also reflect deliberate decisions made by the household, as where additional resources are provided to children who have recently suffered health shocks.

Accordingly, a general formulation of the determinants of child health in period t+1 has two components: investments associated with increases in child health, the first term in (3), and initial child health, the second term:

$$H_{t+1} = h(H_t , g_t , c_t , M_t , A, Z_t , \varepsilon_C) + H_t \quad (3)$$

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this paper, we directly look into the links between shocks and health outcomes in the short-run and long-run.

where: H_t is child health at period t; g_t includes physical inputs such as nutrients (which are a subset of x_t) and non-physical inputs such as child care used to produce health, c_t are child characteristics such as age and sex, M_t captures characteristics of the principal care giver and Z_t refers to the health and sanitation environment which is assumed to influence illness and therefore growth. ε_C captures characteristics of the child such as inherent healthiness, growth potential or inherited immunities.

We assume that at time t, these young children do not contribute to household income. But at some future date, children may contribute to household income via providing labour time, remittances or other transfers. These contributions are a function of expected future wages that will vary by sex (given labour market discrimination), age, health (via the links between health-child quality and productivity reviewed in Strauss and Thomas, 1998) and community or cultural factors (θ). For example, where bridewealth is practiced, the groom and his family are required to transfer resources in the form of cattle and money to provide compensation for the woman. The present value of these contributions at time t can be expressed as (again suppressing the child subscript):

$$R_t = r(c_t , q_t , \theta) \quad (4)$$

This constrained maximization problem generates a set of first order conditions that can be solved out to yield a set of reduced form commodity and child health demand functions. Maintaining the assumption of inter-temporal separability, the discounted expected value of additional income is constant, implying as Alderman et al. (1994) and Foster (1995) note, that analogous to a consumer durable, households will seek to smooth fluctuations in child health, so that over time, the expected marginal utility of health is equal, up to appropriate discounting. In the case of height, this would imply a smooth growth path over time, provided there are no binding liquidity constraints. But unlike commodity demands, child growth is affected by the height of the child, since the extent to which child growth can be increased between t and t+1 is itself affected by the level at t. It therefore takes the form:

$$H_{t+1} - H_t = h_t(H_t , c_t , M_t , W_t , A, Z_t , p_t, \theta_t , \varepsilon_C) \quad (5)$$

A number of studies use this framework, or variants on it, to explore the links between shocks that affect child health at time period t and health states measured subsequently at period t+1, including Behrman, Deolalikar and Lavy (1995), Foster (1995) and Deolalikar (1996). A related literature, using a slightly amended version of this conceptual model, explores the relationship between child health at time period t and schooling attainments at period t+1. Examples of this include Glewwe, Jacoby and King (2001) and Alderman, Behrman, Lavy, and Menon (2001). Grantham-McGregor et al., (1999; especially pp. 65-70) provide an exhaustive summary of the epidemiological literature.

Hoddinott and Kinsey (2001) use this framework to examine the impact of the 1994/95 drought on the heights of children living in three resettlement areas in Zimbabwe. Using longitudinal data across five years (1993 through 1997), they estimate a village fixed effects regression of the determinants of annual growth in stature of pre-school children by age cohort with controls for child (initial height, age, sex), maternal (height, age, education, relation to household head), household (livestock holdings, land quality). Their core results are replicated in Table 1. Children aged 12 to 24 months at the end of the drought – who are deemed to be at particular risk from shocks - grew more slowly than comparable children in non-drought years. The slowdown in growth, -1.73 cm, is equivalent to a loss of about 15-20 per cent in growth velocity. Running identical regressions for children in three older age groups: 24-36 months; 36-48 months; and 48-60 months show that the 1994-95 drought had no impact on the growth rates of these older children. These effects are robust to a variety of estimation issues, including the presence of maternal fixed effects, endogeneity of initial health states and the method used to calculate the standard errors.

Hoddinott and Kinsey (2001) extend this analysis by estimating a maternal fixed effects model of the determinants of the stature of cohorts of children aged 60-72 months. Children who were initially aged 12-24 in the year after the 1994/95 drought have z scores for height-for-age that are about six tenths of a standard deviation below that of comparable children not exposed to this drought. A refinement to their basic specification adds an interaction term between exposure to drought and a variable that indicates whether pre-drought, the household had livestock holdings below or above the sample median. Children from wealthier households appear to have suffered no long-term effects from this drought. Children from poorer households, by contrast, appear to have experienced a growth slowdown that has persisted to age 60-72 months.

Alderman, Hoddinott and Kinsey (2002) use a similar framework to examine the impact of the 1982/83/84 droughts in Zimbabwe, as well as exposure to the civil war preceding independence, on longer-term measures of child health and education. Exposure to the civil war lowers stature as does drought shocks if the child is in the critical 12-24 month age category. These children were interviewed again 13 to 16 years later. Using an instrumental variables - maternal fixed effects estimator, they also show that lowered stature as a pre-schooler leads to lowered in late adolescence as well as delays in school enrollment and reductions in grade completion. The magnitudes of these impacts are meaningful. The mean initial height-for-age z score for these children as pre-schoolers is –1.25. If this population had the nutritional status of well-nourished children, the median z score would be 0. Applying the IV-MFE parameter estimates, this would result in an additional 4.6 centimeters of height in adolescence, an additional 0.7 grades of schooling and starting school seven months earlier. Further, exposure to the 1982-84 drought reduced height-for-age z scores by 0.63. Using the IV-MFE estimates, this implies that this transitory shock resulted in a loss of stature of 2.3 centimeters, 0.4 grades of schooling, and a delay in starting school of 3.7 months.Using the values for the returns to education and age/job experience in the Zimbabwean manufacturing sector provided by Bigsten *et al.* (2000, Table 5), the impact of these shocks translates into a 7 per cent loss in lifetime earnings.

In the model, A are preference shifters. It may well be that these preference also include preferences of the parents regarding preferential treatment of some of the children relative to others, allowing discrimination to be considered, even in a unitary household framework, using (5). Furthermore, analysing intrahousehold issues in non-unitary models would also be possible and under certain assumptions, (5) would still be valid. For example, let parents decide over the well-being of children, but allow each parent to have different preferences, which cannot be trivially be resolved (i.e. there is no accepted dictator and no identical preferences). Assume further that they resolve their differences in the form of a cooperative bargaining solution, so that we can use a 'collective' model to represent their preferences. Let W be the aggregator function of preferences of each of the parents, $W(U_t^m, U^f_t)$, with U_t^m and U^f_t defined as in (1), for the male and female partner. If we then interpret A as variables reflecting the relative bargaining position of the male versus the female partner then (5) would still be the basis for testing the impact of shocks, even in a non-unitary model, such as the collective model.

While Hoddinott and Kinsey (2001) and Alderman, Hoddinott and Kinsey (2002) show that health shocks have differential impacts when pre-schoolers are disaggregated by age, they do not consider gender-differentiated impacts. However, this is straightforward to accomplish by interacting their drought shock variable with child sex. When we do so using their data, we find no evidence to indicate that either the 1982/83/84 or 1994/95 droughts have different effects on boys or girls health.

It is also possible to explore whether the impact of the 1994/95 differed according to the relationship of the child to the household head. In these resettlement areas, there are an increasing number of mothers in these households who are daughters or daughters-in-law of the head. The important distinction lies between children whose mothers are spouses or daughters-in-law of the household head, and those children whose mothers are daughters of the head. Rights and obligations regarding the former are clear-cut - these children belong to the family. But the position of children of daughters of the head who are born out of wedlock or whose parents have divorced is considerably more ambiguous. They may, or may not, be receiving support from the father and the father's family. They may be considered part of the father's or mother's family. If the mother marries, or re-marries, these children will leave the household and the family will have no claim on them for future labour, transfers or bridewealth payments (Armstrong, 1997). Alternatively, these mothers may have little bargaining power within the household.

These considerations provide an *a priori* reason for suspecting that, *ceteris paribus*, these children may have poorer access to household resources. When we interact child's relationship to the household head with the representation of the drought shock, we find that children whose mothers are daughters of the head have a greater loss in growth velocity than other children in the household, but this effect is not statistically significant.

These Zimbabwe data do not suggest a gender-specific impact of drought shocks on pre-schooler health and there is no evidence suggesting a differential impact of health shocks on long-term well-being of girls relative boys (as distinct from differential *levels* of health or other measures of well-being). While such findings are consistent with Svedberg's (1990) claim that, in sub-Saharan Africa, gender bias in health outcomes is largely absent, Foster (1995), using data from Bangladesh, does not find any sex bias in the evolution of child growth during and after the severe floods in Bangladesh in 1988. Still, using other health indicators, there is some evidence of sex bias in India in response to shocks in poor households: Rose (1999) finds that in rural India negative rainfall shocks are associated with higher mortality rates for girls and that this is more pronounced in landless households.

3. Shocks and adult health

Modelling adult health is not fundamentally different from modelling child health. Individuals can be assumed to have a sub-utility function at time t, defined in terms of health q, consumption of goods x and, as before, some preference shifters A, such as educational background or other characteristics.

$$U_t = u_t(q_t, x_t; A) \qquad (6)$$

In the context of adult health in this paper, we could think of weight or BMI as a good indicator. Note that this implies using a 'stock' rather than a flow as argument in the utility function, implying again that the analysis is analogous to the analysis of durables or capital goods. The individual is assumed to maximise her expected intertemporal additive utility. As before, individual sub-utility functions are increasing in all arguments and individuals are risk-averse.

A first constraint is the adult health production function, which is similar to (3). Following Grossman (1972), adult health at t+1 is determined by health in period t in the previous period plus net investment in adult health. Focusing on BMI, net investment in adult BMI includes the loss of weight even in a state of rest, which is similar to depreciation of capital goods [3], as well as the addition of weight through nutrition, including via food consumption, and the impact of expending energy through working. Other health variables, including morbidity and the general health and sanitation environment, will enter as well.

$$H_{t+1} = h(H_t , g_t , a_t , L_t , Z_t , \varepsilon_C) + \delta H_t \qquad (7)$$

where: H_t is adult BMI at period t and $(1-\delta)$ is the person's BMR. The function h(.) is the health production function, transforming nutrients g_t into BMI, net of energy expended by working L_t. The efficiency of this transformation is affected by individual characteristics a_t such as age and sex, Z_t capture morbidity status and the general health and sanitation environment, and ε_a captures specific health characteristics of the adult such as metabolism, inherent healthiness or inherited immunities.

[3] A person needs to assure her basal metabolic rate, BMR, i.e. the food energy intake needed to support bodily functions at rest, otherwise she will experience net weight loss at rest.

The budget constraint, linking period t and t+1, is again similar to (2), but a direct link between earnings can be written by defining income at period t, y_t, as a function of market wages, labour expended and adult health, reflecting adult health and productivity links (Strauss and Thomas, 1998).

$$W_{t+1} = W_t (1 + r_t) + y_t (w_t, L_t, H_t) - p_t x_t \qquad (8)$$

The assumptions imply that the interior solution for an optimum path of BMI involves constant expected marginal utilities over time, up to appropriate discounting, provided there are no credit constraints. To write the solution, define a user cost of additional weight, similar to the rental cost of durables or capital goods, i.e. the marginal cost of boosting nutritional status for one period only. The optimal path of BMI will then involve equal expected marginal utility benefits from additional BMI in each period, up to discounted relative user costs. This user cost is affected by all the sources of individual heterogeneity described in the adult weight production function – suggesting that initial or past weight may well be a helpful predictor for changes in weight or BMI over time. Furthermore, in each period, prices of nutrients (such as food prices) and wages would also affect user costs. To the extent that relative user costs change over time, they could also be a source of variable BMI over time.

Dercon and Krishnan (2000) use a similar model to discuss adult BMI movements across seasons using panel data in Ethiopia. Their key results are summarised in table 2. Predictable movements in relative prices and wages could affect the optimal path of nutritional status over the seasons, with price variability and differential returns to labour in off-peak and peak seasons encouraging the use of the body as a store of energy, provided that returns to other liquid assets are low, resulting in different 'optimal' weights across the seasons: feast when prices are low and fast when prices are high. They find indeed evidence that this is happening, with higher body weights in correlated with the peak season as well as with the post-harvest period: during: BMI increases by about 0.5 percent during periods of peak labour needs, while up to 0.5 percent in the period immediately after the harvest[4]. The effects are typically only significant and large for households with low land holdings, so that "feast now, fast later" is a strategy typically used by poorer households[5]. This use of body weight as a consumption smoothing device is consistent with imperfections in asset and food markets, suggesting that returns to assets, food stocks and returns to using the body as a store of energy are not integrated and arbitrage is profitable. Given the aversion to fluctuations in nutrition by individuals (given concave utility), welfare improvements, especially for the poor, could be obtained by asset and food markets that function better. Evidence in Behrman and Deolalikar (1989), using the ICRISAT Indian data, on the impact of weight-for-height on wages, suggests that body fat may well be used to store energy for later use, suggesting possible failure in optimally smoothing nutritional status over the seasons. Evidence from Pakistan (Berhman, Foster and Rosenzweig, 1997) suggests that storing calories in the body does not result in an optimal allocation of energy over the seasons, with calorie consumption rising in the post harvest period relative to peak labour periods such as the planting season, but the marginal return to calories is still very high, suggesting that more calories ought to be consumed during the planting season.

[4]Dugdale and Payne (1987) discuss similar results using data from Gambia and Burma.

[5] Their empirical results are based on the GMM estimation of the growth in BMI, using shock variables, lagged BMI and a number of controls as regressors, allowing for heterogeneity using fixed effects in the growth path.

The evidence on the lack of optimal smoothing in nutritional status even across seasons – which imply relatively predictable fluctuations in prices and needs - suggests that shocks may have substantial effects as well. Dercon and Krishnan (2000) show that rainfall shocks significantly affect BMI. Even though rainfall was relatively favourable in the period of their study, relatively poor rainfall in some communities lowered BMI by about 0.9 percent for households with low land holdings (table 2).

Their study investigates also the intrahousehold effects of shocks, more specifically on whether husbands and wives protect each other from the effects of shocks to the earnings capacity of their partner. If the household were to operate as a perfect risk-sharing group, then there should be no separate effect from such shocks on a particular individual, beyond a general loss of resources to the household. While in most households this seems to be occurring, in poor households in the South of the country it does appear not to be the case. In particular, women seem not to be protected by the husbands, even though the reverse holds. The negative effects on women are substantial: for a typical length of an illness episode (5.5 days), BMI would go down by an additional 2 percent for these women[6]. Hoddinott and Kinsey (1999) also explore the determinants of adult body mass, again using data from Zimbabwe. Controlling for individual, household and community factors, and individual fixed, unobservable effects, they find women, but not men, are adversely affected by the 1994/95 drought. However, these effects are not borne equally by all women. The BMIs of daughters-in-law of the household head are unaffected by drought. Both wives and daughters are adversely

[6] Table 2 only reports the results for the full sample of adults. Restricting the sample to couples only confirms these results, as did an alternative specification based on the risk-sharing model was estimated, whereby the impact of individual shocks on the relative path of BMI for husbands and wives was tested (Dercon and Krishnan (2000))

affected, with a 10 per cent reduction in rainfall corresponding to a 2.2 and 3.9 per cent reduction in BMIs respectively. Although higher livestock holdings protect wives of the household head from drought shocks, this is not true for daughters.

The question of persistence of low BMI after a substantial negative shock remains largely unanswered in both studies; the available evidence suggests that recovery in body weight can and does occur. In Hoddinott and Kinsey (1999), no persistence of the reduction in BMI is noted in Zimbabwe. In Dercon and Krishnan (2000) on rural Ethiopia, there is evidence of lags in adjustment to 'optimal' levels. In particular, they find that past levels of BMI significantly affect the growth path of adult BMI. But the adjustment or 'catching up' costs implied are empirically relatively small (i.e. weight can be increased and decreased relatively easily), making persistent effects unlikely in this context. However, the specification used does not answer the question of persistence directly (see e.g. Jalan and Ravallion in this volume). Furthermore, the rainfall and other community shocks observed in their data set were relatively small, so whether for large shocks persistent effects exist, remains to be seen. Still, since most evidence suggests that returns to labour and BMI are positively correlated, the lack of perfect insurance against fluctuations in BMI will in any case imply at least a temporary loss of earnings and therefore lower lifetime earnings.

4. Conclusion

In this chapter, we have explored the impact of shocks on health status, making particular use of evidence from Ethiopia and Zimbabwe on the impact of droughts and other serious shocks. We find that health status, as measured by height and body mass, is affected by these shocks, suggesting that they are imperfectly insured against. Livestock and other assets play a role in mitigating these shocks. The evidence also suggests that poor people are using their body as a store of energy, in ways consistent with poorly functioning asset and food markets. This implies welfare losses and puts them at risk of further ill-being.

A commonality across these studies is that the impact of shocks is not uniform within the household. Younger preschoolers are more adversely affected than older preschoolers. Adult women are more often adversely affected than adult men. Amongst adult women, daughters of the household head are more vulnerable than other women. Lastly, these shocks can have long-term consequences, reducing final attained stature and schooling outcomes. This adversely affects the employment prospects and productivity of these young people. Further, taller (and better educated) women have, on average, taller (and healthier) children, and so the impact of these transitory shocks may well be felt for several generations.

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Table 1: The impact of the 1994/95 Zimbabwean drought on growth in stature by age group

Age group	Estimated coefficient on period of observation being 1995-96 (drought cohort)	Asymptotic t statistics based on Huber-White standard errors	Sample size
Children initially aged 12-24 months	-1.727	2.029**	222
Children initially aged 24-36 months	-0.745	0.910	209
Children initially aged 36-48 months	0.068	0.142	239
Children initially aged 48-60 months	-0.173	0.254	194

Notes:
1. Dependent variable is annual (12 month) growth rate in child height.
2. * significant at the 10% level; ** significant at the 5% level.
3. Full results available on request.

Table 2:
The impact of shocks during 1994/95 on the Quetelet (or Body Mass Index) of Ethiopian adults (1,787 adults)

source of shock and fluctuation (by group)	Estimated coefficient	t-statistic
selected community and household level shocks		
peak labour period for males	0.0039	1.70*
peak labour period for females	0.0050	2.10**
postharvest period (land rich household)	0.0015	0.69
postharvest period (land poor household)	0.0049	2.45***
rain shock (land rich households)	-0.0012	-0.14
rain shock (land poor households)	0.0089	2.01**
individual specific shocks		
own illness if male in South (land rich household)	-0.0010	-0.95
own illness if male in South (land poor household)	0.0001	0.04
own illness if female in South (land rich household)	-0.0022	-1.17
own illness if female in South (land poor household)	-0.0042	-5.90***
own illness if male in North (land rich household)	0.0013	1.17
own illness if male in North (land poor household)	-0.0016	-1.35
own illness if female in North (land rich household)	0.0004	0.32
own illness if female in North (land poor household)	-0.0007	-0.81

Notes:
1. The dependent variable is the natural logarithm of BMI
2. The results are based on a model regressing the change in BMI on the previous level of BMI, shocks and a number of time -varying control variables, as well as controlling for fixed effects in the change in BMI. The Arrellano-Bond GMM estimator is used. Group specific effects are obtained via interaction terms.
3. land poor households have less than the median level of land per adult per village
4.* significant at the 10% level; ** significant at the 5% level.
5. Further details and full results in Dercon and Krishnan (2000)