FCNDP No. 155

FCND DISCUSSION PAPER NO. 155

CONSUMPTION INSURANCE AND VULNERABILITY TO POVERTY: A SYNTHESIS OF THE EVIDENCE FROM BANGLADESH, ETHIOPIA, MALI, MEXICO, AND RUSSIA

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August 2003

Abstract

This paper synthesizes the results of five studies using household panel data from Bangladesh, Ethiopia, Mali, Mexico and Russia, which examine the extent to which households are able through formal and/or informal arrangements to insure their consumption from specific economic shocks and fluctuations in their real income. Building on the recent literature of consumption smoothing and risk sharing, the degree of consumption insurance is defined by the degree to which the growth rate of household consumption covaries with the growth rate of household income. All the case studies show that food consumption is better insured than nonfood consumption from idiosyncratic shocks. Adjustments in nonfood consumption appear to act as a mechanism for partially insuring ex-post the consumption of food from the effects of income changes. Food consumption is also more likely to be covered by informal insurance arrangements at the community level than nonfood consumption. Linkages among consumption variability, the level of household consumption, the incidence of poverty, and the probability of being ever poor and the proportion of time spent in poverty are also explored for Bangladesh, Ethiopia, and Russia. All the case studies also show that households use a portfolio of risk-coping strategies, but that different types of households may have differential ability to use these strategies. In particular, poorer households may be less able to use mechanisms that rely to initial wealth as collateral. In this regard, public transfer programs may have a more redistributive effect.

Keywords: Bangladesh, consumption, Ethiopia, income, Mali, Mexico, poverty, risk-sharing, Russia, vulnerability

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Acknowledgments

Funding for the research reported here was provided by the World Bank as part of work being undertaken by the International Food Policy Research Institute (IFPRI) on consumption smoothing and vulnerability. The findings, interpretations, and conclusions expressed in this paper are entirely the authors' and do not necessarily reflect the views of the World Bank, the Inter-American Development Bank, or IFPRI. We thank Stefan Dercon, Lant Pritchett, Paul Glewwe, and Emil Tesliuc for helpful comments and suggestions. All errors and omissions are ours.

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1. Introduction and Motivation

During the last few years, the increasing recognition that there are considerable flows into and out of the poverty pool (e.g., Baulch and Hoddinott 2000) has focused interest in household vulnerability as the basis for a social protection strategy. As advocated by Holzmann and Jorgensen (2000), in a dynamic environment where adverse economic shocks may be more easily transmitted across geographic borders, a social protection scheme might be able to perform more effectively the task of protecting households from the adverse effects of poverty by adopting a forward-looking approach that not only identifies the groups of households that are presently poor but also the households that are vulnerable to economic shocks and other risks, such as natural disasters and climate conditions. Whether households can effectively insure their consumption against shocks may be an important element determining their vulnerability to poverty, particularly if shocks have longer-term effects.

This paper brings together some of the empirical work conducted by International Food Policy Research Institute (IFPRI) researchers that investigates linkages among the degree of consumption insurance, household vulnerability to poverty, and household use of formal and informal coping mechanisms, using the same empirical approach in five countries. Building on the recent literature of consumption smoothing and risk-sharing, the degree of consumption insurance is defined by the degree to which the growth rate of household consumption covaries with the growth rate of household income. This definition of consumption insurance explicitly acknowledges that households may adopt a variety of risk management strategies and instruments to protect themselves from risk. Households in a community, for example, may informally agree to insure each other or provide state contingent transfers and remittances to friends and neighbors (Rosenzweig 1988; Besley 1995; Morduch 1999). Households may undertake ex ante income-smoothing strategies and adopt low-return, low-risk crop and asset portfolios (Rosenzweig and Binswanger 1993). Households may use their savings (Paxson 1992), take loans from the formal financial sector to carry them through the difficult times (Udry

1994), sell assets (Deaton 1992), or send their children to work instead of school to supplement income (Jacoby and Skoufias 1997). These actions enable households to spread the effects of income shocks through time. Additional strategies include the management of income risk through ex post adjustments in labor supply, such as multiple job holding, and engaging in other informal economic activities (Morduch 1995; Kochar 1999).[1]

Independent of the combination of strategies accessible to households, the risk-sharing literature suggests that attempts to insure consumption from shocks are related to the extent to which the growth rate of consumption is correlated with the size of the shock. In fact, in its extreme version, the perfect risk-sharing hypothesis implies that—once aggregate shocks are taken into consideration—the growth rate of consumption is independent of any idiosyncratic shock affecting the resources of, or income available to, the household (e.g., Mace 1991; Cochrane 1991; Deaton 1992; Townsend 1994). The measure of consumption insurance adopted here builds on these insights provided by the consumption smoothing and risk-sharing literature. An implicit assumption in this measure of insurance is that the greater the correlation between the growth rate of household consumption and income, the less effective the risk management strategy adopted by the household.

The presentation begins with a discussion of the theoretical framework motivating the proposed measure of insurance, and its relation to other measures that have been empirically implemented in the recent literature. Section 3 summarizes the main findings from the five studies representing five very different socioeconomic environments: Bangladesh, Ethiopia, Zone Lacustre in Mali, Mexico, and Russia.

All five studies begin by investigating the extent to which households in their respective sample manage to protect their consumption from specific shocks such as loss

[1] According to the terminology of Seigel and Alwang (1999), the preceding actions represent a combination of ex ante risk-mitigating and ex post coping actions both aimed at smoothing consumption. Households may adopt ex ante risk-reducing management strategies such as diversifying the mix of income-generating activities from their given asset base (Morduch 1994, 1995).

of productive time due to illness (Mali, Bangladesh, and Ethiopia), loss of livestock (due to theft or death), and wage and employment shocks (Russia). In addition, all five studies examine how household consumption correlates with income changes.

At this aggregate level, three main questions are addressed. The first asks the extent to which households are able to smooth their food consumption and nonfood consumption across time.

The second question examines the relationship between consumption insurance and vulnerability to poverty. This analysis is conducted at a more disaggregated level by examining whether specific groups of households defined by observable characteristics of the household or its head (such as age, occupation, etc.) are more or less vulnerable to economic shocks. In the Bangladesh, Ethiopia, and Russia case studies, repeated observations per household are used to construct a household-specific consumption insurance measure.[2] This allows one to examine in more detail the partial correlation of household consumption insurance with household characteristics as well as the extent to which households' ability to insure consumption is correlated with the current status of poverty of the household and the probability of a household becoming poor over time.

The third question relates to the different strategies households adopt to smooth consumption. In particular, it asks whether consumption smoothing is achieved primarily through cross-sectional risk-pooling institutions, credit markets that spread the effects of income shocks through time, or by adjustments in labor supply and occupation.

Understanding the specific strategies that households adopt to buffer income fluctuations is critical to the design of an effective social safety net system in any country. Chronic and transient poverty could be simultaneously reduced by providing the appropriate risk-management instruments to the households that do not have access to them.

[2] The Russia case study has five repeated observations per household while the Bangladesh and Ethiopia studies have four.

2. An Economic Framework for Vulnerability to Risk and Some Discussion

The theoretical model guiding the empirical analysis is based on the consumer's optimization problem in the context of a complete market for state contingent commodities (e.g., Deaton 1992). The assumption of a complete market for state contingent commodities may be considered as a simple approximation to all the formal and informal arrangements across space and over time that households can enter into to protect themselves from risk. With this in mind, households within a given insurance community, such as a family, village, city, or even nation, are assumed to purchase state contingent commodities so as to maximize

$$V^h = \sum_{s=1}^{S}\sum_{t=1}^{T} \pi_s \upsilon_t\left(c_{ts}^h\right) = \sum_{s=1}^{S}\sum_{t=1}^{T} \pi_s \left(1+\delta\right)^{-t} \upsilon\left(c_{ts}^h\right), \tag{1}$$

where $\upsilon_t\left(c_{ts}^h\right)$ is the period-specific "felicity" function of household *h* in period *t* as a function of its consumption in state *s* and in period *t*, assumed to be discounted to the present by the subjective discount rate, δ, and π_s is the probability of state *s* (assumed to be the same for all households). With the ability to buy in period 1 a unit of consumption in state *s* at time *t* for $p_{st}(1+r)^{-t}$, and assuming that household *h* has initial assets, A_1^h, and labor income in period *t* and state *s*, denoted by y_{st}^h, the lifetime budget constraint of household *h* can be expressed as

$$\sum_{s=1}^{S}\sum_{t=1}^{T} p_{st} c_{st}^h \left(1+r\right)^{-t} = A_1^h + \sum_{s=1}^{S}\sum_{t=1}^{T} p_{st} y_{st}^h \left(1+r\right)^{-t}. \tag{2}$$

Thus the existence of the market in contingent claims allows the problem to be written as the maximization of expected utility subject to an expected value budget constraint. The first order optimization condition for equation (1) subject to equation (2) with the associated Lagrange multiplier for household *h*, denoted by θ^h, is

$$\lambda_t\left(c_{st}^h\right)=\upsilon_t^{/}\left(c_{st}^h\right)=\theta^h\left(\frac{1+\delta}{1+r}\right)^t\frac{p_{st}}{\pi_s}=\theta^h\mu_t\,, \tag{3}$$

where

$$\mu_t=\left(\frac{1+\delta}{1+r}\right)^t\frac{p_{st}}{\pi_s},$$

and $\lambda_t\left(c_{st}^h\right)$ is the marginal utility of consumption in period *t*. Thus the main implication is that the marginal utility of consumption has a two-factor structure, consisting of a household-specific component, θ^h, and a time-specific component, μ_t.[3]

Given a specific functional form for the felicity function, such as an isoelastic utility function,

$$\upsilon(c_t)=\frac{1}{1-\rho}c_t^{1-\rho}f(z_t)\,,$$

where $f(z_t)$ is a function allowing for the influence of time-varying taste factors, equation (3) may be expressed, after logarithmic transformation, as[4]

$$\ln c_t^h\;=\;-\rho^{-1}\left(\ln\theta^h\;-\;\ln\;f\left(z_t\right)+\ln\;\mu_t\right),$$

which, after first-differencing over time, yields

$$\Delta\ln c_t^h\;=-\rho^{-1}\left(-\Delta f\left(z_t\right)+\Delta\ln\mu_t\right). \tag{4}$$

Equation (4) implies that the growth rate in household consumption between time *t* - 1 and *t*, after controlling for the influence of time-varying taste factors, is a function only of the growth rate in the aggregate or covariate risk summarized by the term $-\rho^{-1}\left(\Delta\ln\mu_t\right)$.

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[3] Altug and Miller (1990) provide a more detailed discussion of this two-factor structure of the marginal utility of consumption in an equilibrium with a complete set of markets.

[4] Cochrane (1991), Mace (1991), and Townsend (1994, 1995) provide more detailed exposition of the functional forms for preferences.

The version of equation (4) that is more commonly encountered in the empirical literature (e.g., see Ravallion and Chaudhuri 1997; Jacoby and Skoufias 1998) is of the form

$$\Delta \ln c_{htv} = \sum_{tv} \delta_{tv} (D_{tv}) + \beta \Delta \ln y_{htv} + \delta X_{hvt} + \Delta \varepsilon_{htvt} \qquad (5)$$

where $\Delta \ln c_{htv}$ denotes the change in log consumption or the growth rate in total consumption per capita of household *h* in period *t* (i.e., between round *t* and round *t* - 1) in community *v*; $\Delta \ln y_{htv}$ is the growth rate of income; X is a vector of household or household head's characteristics; δ, β, and δ, are parameters to be estimated, $\Delta \varepsilon_{htvt}$ is a household-specific error term capturing changes in the unobservable components of household preferences; and D_{vt} denotes a set of binary variables identifying each community separately by survey round. This set of survey round/community interaction terms is meant to control for the role of aggregate or covariate risk faced by households in the insurance community.

In this specification, the parameter β provides an estimate of the extent to which *idiosyncratic* income changes play a role in explaining the household-specific consumption growth rate. Unlike specific models of intertemporal consumption (such as the permanent income model of consumption, which predicts that with perfect credit markets only unanticipated income changes affect consumption growth [e.g., Deaton 1992]), the idiosyncratic income changes in equation (5) can be anticipated as well as unanticipated.[5] The set of binary terms, D_{vt}, identifying communities by survey round, serves two interrelated functions. First, the terms control for the role of aggregate (or covariate) shocks common to all households within any given community and survey

[5] Other terms used to characterize income changes are "permanent" versus "transitory," which are related to the terms anticipated and unanticipated. However, the set of terms used depends on whether a study adopts a microeconomic model of expectation formation (such as the rational expectations hypothesis) or a statistically-oriented approach to decomposing a time series in income growth. For a paper that attempts to delineate the predictions of various models of intertemporal consumption, see Jacoby and Skoufias (1998).

round, i.e., the term $-\rho^{-1}(\Delta \ln \mu_t)$ in equation (4).[6] Second, given that consumption and income are in logarithms, they also account for potential differences in the round-to-round inflation rate across communities.[7]

Much of the focus of the empirical literature on risk-sharing in developing and developed countries alike has focused on testing the prediction derived under complete risk-sharing, which states that $\beta = 0$ (e.g., see Townsend 1994, Mace 1991, and Jacoby and Skoufias 1998).[8] Although frequently complete risk-sharing is rejected, it is typically observed that the estimated values of β are generally low (or close to zero), which implies that the growth rate of consumption is related to the (contemporaneous) growth rate of income, but certainly less so than what one would expect under an alternative hypothesis (e.g., $\beta = 1$), as implied by complete autarky and the complete lack of any risk-sharing tools. These findings provide strong indications that households engage in risk-management strategies aimed at insulating, at least partially, consumption changes from income changes. As in Amin, Rai, and Topa (2001), the measure of consumption insurance adopted here takes this idea to the next logical step by interpreting higher estimated values of β as signifying a higher covariance between income and consumption changes and thus a higher vulnerability of consumption to income risk.[9]

Undoubtedly, the data requirements associated with the estimation of regression (5) are quite severe. Not only is it necessary to have a panel household survey, but the survey must collect information on both household consumption and income. Moreover, if the coefficient β summarizing the partial covariance between consumption and income

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[6] Note that including the community/round interaction dummies is equivalent to deviating all variables from their respective community/round mean. For more detailed discussion of this equivalence, see Deaton (1997).

[7] When prices and wages are available, one may also want to include these as explanatory variables (first-differenced) in regression equation (6) (e.g., see Dercon and Krishnan 2000).

[8] If consumption and leisure are nonseparable and labor-leisure choices are endogenous, the rejection of the hypothesis that $\beta = 0$ does not necessarily imply the absence of risk-sharing among households (Cochrane 1991).

[9] The same idea is also explored by Schechter (2001) for Bulgaria, and Ligon (2001) for India.

changes is to be estimated with some precision at the household level instead of for the sample as a whole, at least three or four repeated observations per household in the panel will be necessary.[10] To the extent that repeated observations per household in panel survey do not exceed two or three, one may have to settle with estimating the degree of consumption insurance for groups of households with a group defined by some observable (and preferably time-invariant) characteristic.

At this point it is important to relate this measure of consumption insurance to other measures of vulnerability encountered recently in the literature. First, the estimated value of the coefficient β provides a measure of the *degree of consumption insurance,* or the extent to which consumption growth is insured from idiosyncratic income shocks. A measure of vulnerability commonly encountered in the literature is that of *vulnerability to poverty*, typically measured by the probability that the consumption of a household will fall below a predetermined poverty line within a fixed time interval (e.g., see Pritchett, Suryahadi, and Sumarto 2000; Chaudhuri, Jyotsnya, and Suryahadi 2001; Christiaensen and Subbarao 2001). Vulnerability to poverty attempts to predict (ex ante) the probability that a household may become poor during a fixed time interval, whereas the degree of consumption insurance focuses on the extent to which households are successful (ex post) at insulating their consumption from changes in their income opportunities and other shocks. It is possible, though perhaps unlikely, for an apparently nonpoor household to be well insured and yet be vulnerable to poverty.[11] For example, households may avoid taking risky but profitable opportunities or practice income smoothing as a substitute for consumption smoothing (Morduch 1994). In that sense, the degree of income risk may in fact be endogenous. Others may be able to smooth their consumption through coping strategies that deplete their assets, such as selling their livestock (Rosenzweig and Wolpin 1993), withdrawing their children from school when

[10] The higher the number of time observations per household, the lower the variance of the estimated coefficient β.

[11] Along similar lines, it is also possible for a wealthy household to be quite vulnerable to risk and yet not vulnerable to poverty.

there are shortfalls in income (Jacoby and Skoufias 1997), or using assets as a buffer for consumption (Deaton 1992). As a consequence of all these strategies, households may appear to be more insured, when in fact their vulnerability to future poverty may be increasing. Clearly, the extent to which consumption insurance is informative about vulnerability to poverty is a question that can only be addressed empirically.[12] One advantage offered by the approach proposed here is that it offers the opportunity to determine whether and the extent to which lack of insurance is correlated with the probability of a household becoming poor (or vulnerability to poverty).

Another important aspect of the consumption insurance measure is that it is based on the covariance of consumption and income changes and not solely on the variance of consumption or income changes. Thus it does not necessarily follow that households with a higher variance in income (or income growth) or a higher variance of consumption (or consumption growth) will be also less insured. In other words, if the variance of income growth faced by a household increases, this does not necessarily imply that the household will be more vulnerable to risk. In contrast, measures of vulnerability to poverty are to a large extent related or even synonymous with increases in the variance of consumption within a cross-section of households (as in Chaudhuri, Jyotsnya, and Suryahadi 2001) or the variance of consumption growth (as in Pritchett, Suryahadi, and Sumarto 2000; Kamanou and Morduch 2001).[13]

Third, the focus on income risk implicitly assumes that all shocks experienced by a household affect the growth rate of household consumption through their impact on the contemporaneous growth rate on household income. Put differently, the growth rate of

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[12] To a large extent our emphasis on consumption insurance instead of vulnerability to poverty originates from the belief that for any meaningful progress in measuring, the latter one must be willing to adopt a specific model for the intertemporal allocation of consumption and credit constraints faced by households.

[13] Interestingly, none of the vulnerability to poverty measures proposed to date appears to take into consideration the few known facts about the variance of consumption over time. Deaton and Paxson (1994), for example, demonstrate that within any given cohort, the variance of consumption increases over time and this variance may differ across cohorts. This implies that at any given point in time, any attempt to characterize the variance of consumption changes of households must take into consideration the age distribution of the population, since different households are likely to be at different points in their life cycle.

household income is assumed to act as a "sufficient statistic" for all the shocks experienced by the household. Following the same general approach to defining vulnerability, Dercon and Krishnan (2000), for example, use shocks instead of income. Their measure of vulnerability to poverty is basically determined by the coefficients of shock variables (or an index constructed of various shock variables) estimated from a regression equation such as

$$\Delta \ln c_{htv} = \sum_{tv} \delta_{tv}(D_{tv}) + \sum_i \beta_i S(i)_{htv} + \gamma X_{hvt} + \Delta\varepsilon_{hvt}, \qquad (6)$$

where $S(i)$ denotes shocks such as crop damage due to pests, illness, and other. One practical advantage of using income, as opposed to specific shocks as in specification like equation (6), is that as long as there is information available on shocks that might have an impact on the household, it can be used as an instrument for the change in household income so as to account for the role of measurement error in income.[14] In principle, once a consistent and fairly robust measure of consumption insurance based on equation (5) is obtained, one may also want to also construct a vulnerability to poverty measure based on estimates that the consumption of the household may fall below a poverty line as a result of any given change in income.

Another advantage offered from the insurance measure proposed here is that it offers the opportunity to determine exposure to risk arising from idiosyncratic risk and covariate risk, either separately or in combination. While the discussion has so far focused on the coefficient of idiosyncratic income changes (that is, after controlling for covariate risk or community round effects), it is important to note that with minor changes in the specification of equation (5), one may also analyze consumption variability arising from aggregate risk. One option is to simply exclude from the equation to be estimated the set of binary variables, D_{vt}, summarizing covariate risk, as in equation (6b) below:

[14] In fact, this approach is taken in all of the IFPRI papers surveyed here. Details are discussed in the next section of the paper.

$$\Delta \ln c_{htv} = \alpha + \widetilde{\beta}\Delta \ln y_{htv} + \delta X_{hvt} + \Delta \varepsilon_{htvt}. \qquad (6b)$$

In this case, the coefficient, $\widetilde{\beta}$, provides an estimate of consumption variability inclusive of both idiosyncratic and aggregate shocks. To the extent that risk-sharing takes place and covariate risk has a significant role in explaining household consumption changes, then it is expected that $\widetilde{\beta} > \beta$, with the difference, $\gamma = \widetilde{\beta} - \beta$, summarizing the role of covariate risk in the growth rate of consumption.[15]

A related specification, but at the same time with weaker theoretical foundations, is that of equation (7) below (e.g., see Deaton 1997; Ravallion and Chaudhuri 1997):

$$\Delta \ln c_{htv} = \alpha + \beta\Delta \ln y_{hvt} + \gamma\Delta\left(\overline{\ln y_{vt}}\right) + \delta X_{hvt} + \Delta \varepsilon_{hvt} \qquad (7)$$

This specification allows the growth rate in household consumption to be determined by the growth rate in household income as well as the growth rate in average community income, denoted by $\Delta\left(\overline{\ln y_{vt}}\right)$. In a purely autarkic world, where there is no pooling of resources and risk-sharing, the growth rate in the average community income should have no impact on the growth rate of consumption of any one household. Evidence that the growth rate in average community income has a significant role in the growth rate of household consumption (i.e., $\gamma \neq 0$) is consistent with the hypothesis that some risk-sharing is taking place within communities.[16]

One drawback of this approach, however, is its symmetric treatment of positive and negative shocks. The consumption insurance approach implicitly suggests that the distinction between positive and negative shocks is irrelevant. However, the factors that determine whether one can deal with positive shocks (including access to safe assets and savings instruments) compared to dealing with negative shocks (selling assets, receiving

[15] This point is also noted by Deaton (1990).

[16] Deaton (1997) first noted that the coefficient of idiosyncratic income changes in specification (7) will be (mechanically) identical to the coefficient of idiosyncratic income changes in specification (5), where the community/survey round interaction dummies are used instead of the change in village mean income.

transfers, or obtaining credit) may be quite different in general and between households.[17] While credit may be hard to obtain, savings (via livestock or grain stores) is likely to be easier. Thus, interpreting β from equation (5) as a measure of vulnerability—rather than a measure of consumption insurance—could lead to wrong inferences about the vulnerability of households.[18]

Having described the economic framework underlying the measure of consumption insurance proposed here, the next section summarizes and elaborates on the findings reported by the five case studies.

3. Consumption Insurance and Poverty: Summary and Discussion of Findings

The five case studies discussed here cover geographically diverse areas. The data used in the Bangladesh study (Quisumbing 2002a) come from a four-round panel survey of 957 households conducted at four-month intervals between June 1996 and September 1997 in 47 villages in three sites in Bangladesh. Each site was chosen as part of an impact evaluation of program disseminating new agricultural technologies. The Ethiopia case study (Quisumbing 2002b) uses four rounds of the Ethiopian Rural Household Survey (ERHS). The first three rounds of this survey were conducted in 1994/95 while the fourth round was conducted in 1997. The ERHS covers approximately 1,500 households randomly selected within 15 villages all across Ethiopia. The villages themselves were chosen to represent the major farming systems used in Ethiopia.

The Mali case study (Harrower and Hoddinott 2002) uses panel data from 275 households in 10 villages surveyed between 1997 and 1998 for four rounds from Zone Lacustre area, situated in the northern region of the Niger River Valley. The Mexican case study (Skoufias 2002b) uses survey data from the sample of rural households surveyed three times between October 1998 and November 1999 for the purpose of

[17] This draws heavily from Dercon (2002).

[18] Empirically, one can distinguish between positive and negative shocks, although in the present paper, we impose the same coefficient on income changes.

evaluating the Programa Nacional de Educacion, Salud y Alimentacion (PROGRESA), a national cash transfer program conditioned on households investing in their human capital. This survey covers close to 24,000 rural households from 506 villages assigned into treatment and control groups for the purposes of the evaluation. Finally, the data set used in the Russia case study (Skoufias 2002a) is from Phase 2 of the Russian Longitudinal Monitoring Survey (RLMS) for the years 1994, 1995, 1996, 1998, and 2000 (rounds V–IX). The RLMS is a household-based representative survey of Russia collected by the Population Center at the University of North Carolina.[19] It is an unbalanced panel containing repeated observations for more than 2,800 households.

Consumption and Vulnerability to Specific Shocks

All five country studies begin by examining whether the incidence of specific shocks has a significant negative impact on the growth rate of household consumption from round to round. For this purpose, in each country study, equation (6) is estimated by appropriately defining what constitutes an insurance group. The four studies using household-level data from surveys in rural areas (i.e., Bangladesh, Ethiopia, Mali, and Mexico) identify an insurance community by the village in which the household resides. In contrast, the Russia study, which contains households in both urban and rural areas, defines the insurance group as the set of households within a primary sampling unit (PSU).[20]

The details associated with the construction of per capita consumption and per capita income can be found in the individual country studies. Instead, here we focus our discussion on the findings obtained by distinguishing between food and nonfood consumption in the five country studies. The separate investigation of these two

[19] The project description at *www.cpc.unc.edu/rlms* provides complete information about the RLMS survey and its sampling procedure.

[20] In principle, insurance arrangements are easier to organize and implement in small or close-knit communities than in larger groups, where moral hazard, incentive, and information difficulties are more severe.

consumption groups, in addition to total consumption, yielded a rich picture about the interplay between risk-sharing and insurance from shocks.

Table 1 presents the estimated coefficients of the idiosyncratic shocks on the growth rate of monthly per capita food consumption. Table 2 contains the respective coefficients for the growth rate of nonfood consumption. In each country study, the coefficients of the various shock variables were estimated by running a regression with all the shock variables included at once in the regression. In all cases the standard errors of the estimated coefficients were corrected for unknown forms of heteroskedasticity in the error term of the regressions, using the formula of White (1980).

The estimated impact of the various shocks on food consumption does not yield a clear picture. One would expect that shocks of the type examined here, if they are significant, would have a negative effect on food consumption. Surprisingly, only in the urban areas of Russia did the incidence of wage arrears and unemployment appear to affect food consumption negatively. In Ethiopia, better livestock disease outcomes increase food consumption.[21] In most other cases, shocks do not have a significant effect on food consumption. For example, in both Bangladesh and Mali, the loss of livestock appears to have no significant role on the growth rate of food consumption per capita. In Mali and Ethiopia, illness does not affect food consumption. This would suggest that households are able to insulate their food consumption from this type of shock. In fact, in rural Mexico, it appears that household food consumption is completely insured from any of the five idiosyncratic shocks examined in that case study.

Examination of the impact of the same shocks on the growth rate of nonfood expenditures raises some intriguing possibilities. For example, wage arrears and unemployment continue to have a significantly negative impact in urban Russia. Moreover, the (negative) coefficients of these shocks on nonfood consumption are

[21] Note that the shock variables in the Ethiopia study are as defined by Dercon and Krishnan (2000), where a value of 1 indicates the best outcome. Thus, these shocks should be interpreted as positive shocks, and positive coefficients imply that consumption increased as a result of positive shocks.

Table 1—Least squares determinants of change in food consumption per capita

	(1)	(2)	(3)	(4)	(5)
	Bangladesh (rural areas)	**Ethiopia (rural areas)**	**Mali Zone Lacustre (rural areas)**	**Mexico (control sample rural areas)**	**Russia (urban areas)**
Ln (value of livestock losses	0.005				
	(0.69)				
Female illness	-0.002				
	(0.25)				
Male illness	0.011*				
	(1.72)				
Rainfall index (1 is best)		-0.047			
		(0.64)			
Livestock disease index (1 is best)		0.261**			
		(2.23)			
Lack of water or grazing land (1 is best)		0.036			
		(0.38)			
Crop index (1 is best)		-0.035			
		(0.53)			
Days lost due to illness (1 is best)		0.010			
		(0.87)			
Crops were attacked by insects			-0.030		
			(0.60)		
At least one member of household lost productive time due to illness			0.038		
			(1.04)		
Lost livestock due to theft or death			0.034		
			(0.76)		
Land cultivated less than land available			0.023		
			(0.45)		
Lost land?				0.011	
				(0.62)	
Lost harvest?				0.009	
				(0.70)	
Lost animals?				0.007	
				(0.20)	
Lost home/other items?				-0.036	
				(0.68)	
Owed wages					-0.055*
					(1.81)
On forced leave					0.054
					(0.28)
Unemployed					-0.122**
					(3.31)

Notes: Dependent variable is change in log per capita of food consumption. * = Significant at the 10 percent level; ** = significant at the 5 percent level. Absolute value of t-statistics is in parentheses. Standard errors are corrected for heteroscedasticity using the Huber-White method.

slightly larger than for food consumption. This suggests that nonfood expenditures may absorb more of the shock as a way of insulating food consumption from these same shocks. This interpretation is reinforced further by the estimates of the impact of livestock death in Mali and of land loss in Mexico. In both cases these shocks have a negative effect on nonfood consumption and no effect on food consumption.[22]

Some caution is warranted in the interpretation of these results. One plausible explanation for the overall pattern of these findings may be due to the lack of any substantial variation of these shocks within smaller insurance communities. As discussed earlier, the estimates in Tables 1 and 2 are obtained by estimating equation (6), including as regressors community and round interaction effects meant to control for the presence of covariate or aggregate effects in the community. To the extent that these shocks are fairly common among households in the same insurance community, then the coefficient signs of the idiosyncratic shocks variables may be the consequence of strong colinearity with the covariate shocks included in the regression. This possibility is investigated in more detail in the Bangladesh, Ethiopia, and Mexico studies, where the coefficients of the shock variables, including community round shocks, can be contrasted with those obtained when community round shocks are left out of the regression.[23] In the Bangladesh case, there is no perceptible difference between the estimates with or without covariate shocks. For Ethiopia, however, the strong aggregate component of self-reported idiosyncratic shocks is readily apparent. Positive rainfall shocks, which are not significant in the regression that controls for aggregate shocks, are surprisingly negative and significant in regressions for total consumption and food consumption per capita. The livestock shock is no longer significant, while better crop outcomes have a

[22] The relatively higher coefficients of these shocks for nonfood than for food consumption might also be explained in terms of underlying household preferences. Ceteris paribus, insofar as the incidence of these shocks represents a decrease in household income, then the quantity demanded for luxury goods (nonfood) will decrease more than for necessities (such as food that has an income elasticity less than 1).

[23] For Mexico, see Table 2 panels a and c in Skoufias 2002b. Results for Bangladesh and Ethiopia are available from the authors.

Table 2—Least squares determinants of change in nonfood consumption per capita

	(1)	(2)	(3)	(4)	(5)
	Bangladesh (rural areas)	**Ethiopia (rural areas)**	**Mali Zone Lacustre (rural areas)**	**Mexico (control sample rural areas)**	**Russia (urban areas)**
Ln (value of livestock losses	-0.003				
	(0.25)				
Female illness	0.000				
	(0.00)				
Male illness	0.003				
	(0.30)				
Rainfall index (1 is best)		-0.121			
		(1.15)			
Livestock disease index (1 is best)		0.107			
		(0.68)			
Lack of water or grazing land (1 is best)		-0.214			
		(1.50)			
Crop index (1 is best)		-0.003			
		(0.03)			
Days lost due to illness (1 is best)		-0.019			
		(1.14)			
Crops were attacked by insects			0.142		
			(0.93)		
At least one member of household lost productive time due to illness			0.232**		
			(2.30)		
Lost livestock due to theft or death			-0.244**		
			(2.14)		
Land cultivated less than land available			0.042		
			(0.34)		
Lost land?				-0.062	
				(1.89)	
Lost harvest?				0.014	
				(0.63)	
Lost animals?				-0.038	
				(0.65)	
Lost home/other items?				-0.056	
				(0.62)	
Owed wages					-0.098*
					(2.19)
On forced leave					-0.201
					(0.97)
Unemployed					-0.174**
					(3.10)

Notes: Dependent variable is change in log per capita of food consumption. * = Significant at the 10 percent level; ** = significant at the 5 percent level. Absolute value of t-statistics is in parentheses. Standard errors are corrected for heteroscedasticity using the Huber-White method.

significant positive effect on total consumption and nonfood consumption. In the case of Mexico (estimates reported in Table 1), the coefficients of the shock variables are positive, but not significant when covariate shocks are controlled for. The same coefficients turn negative when the village round dummies are excluded from the regressions, suggesting that these concerns about vulnerability to idiosyncratic shocks may have some solid foundations.

A more serious caveat arises from the estimation of the effects of shocks on food and nonfood consumption separately. First, a formulation that allows the changes in consumption of a commodity (group) only to be a function of community-level variables in the presence of complete insurance (when $\beta = 0$) requires that the marginal utility of food is independent of the levels of nonfood consumption, or that preferences are strongly separable (additive)—a strong restriction on the structure of preferences for food and nonfood.[24] In the extreme case of autarky, where the community dummies control for price changes, the coefficients on food and nonfood, β_f and β_{nf}, would be income elasticities. The insignificant coefficients of income changes in the food consumption regression may therefore be more reflective of the low-income elasticity of food rather than the differential ability to protect food and nonfood consumption.

Consumption and Household Income

An alternative test for the hypothesis of complete risk-sharing is whether the growth rate of household food consumption is independent of the growth rate in household income (after controlling for aggregate or covariate shocks). As mentioned in the previous section, this specification presumes that all of the shocks experienced by the household between rounds impact on household consumption solely through the growth of household income. As before, under the null hypothesis of complete insurance idiosyncratic changes in household income should have no role in explaining household-specific consumption growth rates, i.e., $\beta = 0$.

[24] We thank Stefan Dercon for pointing this out.

The estimates of equation (5) for total as well as for food and nonfood consumption per capita are presented in Table 3. Although not reported here, it is important to note that in all five countries, covariate shocks, as proxied by the community survey round terms, were significant determinants of consumption changes in the estimation of equation (5). The estimates obtained using total (food plus nonfood) consumption suggest that, on average, total consumption is not insured from idiosyncratic income changes in Ethiopia, Mali, Mexico, and Russia. The estimates obtained by separating food and nonfood reveal a richer picture. In most instances food consumption appears to be better insured (or have a lower covariance with income) from idiosyncratic changes in income in comparison to nonfood consumption. Whereas nonfood consumption is found to be significantly correlated with idiosyncratic income shocks in all five countries, food consumption appears to be completely insulated for idiosyncratic income shocks in Mali and Ethiopia. Even in Russia, where income changes significantly affect both food and nonfood consumption, the effect appears to be lower for food than for nonfood. These estimates confirm what was already hinted earlier regarding the impact of specific shocks on food and nonfood consumption. Food

Table 3—The impact of changes in log household per capita income on log household per capita consumption: OLS estimates

	Bangladesh (rural areas)	Ethiopia (rural areas)	Mali Zone Lacustre (rural areas)	Mexico (control sample rural areas)	Russia (urban areas)
Total consumption per capita	0.03**	0.02**	0.076**	0.037**	0.182**
	(2.41)	(1.88)	(4.30)	(7.26)	(16.88)
Food consumption per capita	0.03**	0.01	0.018	0.028**	0.176**
	(1.96)	(0.55)	(1.55)	(5.42)	(15.26)
Nonfood consumption per capita	0.06**	0.06**	0.227**	0.062**	0.198**
	(2.76)	(4.08)	(5.24)	(6.89)	(11.71)

Notes: * = Significant at the 10 percent level; ** = significant at the 5 percent level. Absolute value of t-statistics is in parentheses. Standard errors are corrected for heteroscedasticity using the Huber-White method.

consumption is more likely to be covered by informal insurance arrangements than nonfood.[25]

Additional information on the extent to which food and nonfood consumption are differentially covered by risk-sharing arrangements can be obtained from Table 4, where the estimated coefficients of the growth rate in average community income (i.e., of the parameters γ from equation [7]) are reported. The estimates provide strong evidence supporting the role of partial insurance and community risk-sharing in food consumption. Thus changes in the growth rate of average community income appear to have a positive and significant role in the growth rate of food consumption of individual households in all countries except Ethiopia. In contrast, no evidence of risk-sharing is found with respect to nonfood expenditures in Mali, Mexico, and Russia. Thus there are considerable indications that the available options for insuring nonfood consumption are limited in comparison to those for food consumption.

Table 4—Impact of change in mean log village income on log per capita consumption: OLS estimates

	Estimates of γ				
	Bangladesh (rural areas)	**Ethiopia (rural areas)**	**Mali Zone Lacustre (rural areas)**	**Mexico (control sample rural areas)**	**Russia (urban areas)**
Total consumption per capita	0.14**	-0.05*	0.129**	0.077**	0.219**
	(3.60)	(-1.66)	(2.98)	(4.17)	(5.18)
Food consumption per capita	0.25**	-0.04	0.121**	0.116**	0.342**
	(6.41)	(-1.31)	(3.79)	(6.10)	(7.24)
Nonfood consumption per capita	0.21**	-0.01	-0.021	-0.048	-0.023
	(3.28)	(-0.36)	(0.23)	(1.44)	(0.32)

Notes: * = Significant at the 10 percent level; ** = significant at the 5 percent level. Absolute value of t-statistics is in parentheses. Standard errors are corrected for heteroscedasticity using the Huber-White method.

One potential shortcoming of the OLS estimates discussed so far is that they may be biased due to measurement error in the income variable and imputation errors in the calculation of the food consumption of households. By itself, measurement error in the

[25] As already pointed out in footnote 22, the relative differences in the size of the estimated income coefficients for food and nonfood may also be attributed to preferences. Food is typically a necessity with a lower (< 1) income elasticity, while nonfood is a luxury good with a higher (> 1) income elasticity.

income variable gives rise to "attenuation bias" that biases coefficients towards zero. In the cases where the income coefficients are significantly different from zero, one can be reasonably confident that the hypothesis of complete insurance is justifiably rejected and that the significant income coefficients in Table 3 provide a lower bound estimate of the true elasticity of consumption to idiosyncratic income.

However, it is possible that imputation errors in the construction of the food consumption variable may bias the income coefficients upwards (Deaton 1997). This is especially the case for households in rural areas of Mali and Bangladesh. For many of these households, a significant share of income and consumption is accounted for by food that is produced and consumed by the household and neither sold nor bought in the market. A common practice is to impute a value for food produced and consumed at home using local prices for the specific food item produced. Errors in this imputation procedure may be positively correlated with measurement errors in the income variable, and for positive coefficients, this upward bias may work in the opposite direction to the standard downward attenuation bias produced by the measurement errors in the income variable alone (Deaton 1997). Given that the net effect cannot be signed in advance, it is prudent to make an effort to control for these sources of bias in the estimates.

Table 5 presents the income coefficient estimates using instrumental variables for the changes in household income. In each of the country studies, the set of instruments used included the various shocks variables discussed earlier in the analysis.[26] The instrumental variable (IV) estimates presented in Table 5 reveal some substantial differences from the results obtained from the OLS estimates. The coefficients of income changes on food consumption are generally higher, suggesting that the concerns about measurement and imputation errors may have some foundation. Compared to the OLS coefficients, the coefficient of the instrumented income growth variable is higher in all of

[26] In all five country studies, the shock variables used as identifying instruments in the first-stage regressions were significant and negatively correlated with the growth rate of income. Other instruments included changes in income from sources that were not likely to be correlated with crop production. Tests on the excluded instruments rejected the null hypothesis that they were equal to zero.

the regression equations, irrespective of whether one uses total, food, or nonfood consumption. However, the lower coefficients of income in the regression equations for food relative to the equations for nonfood consumption continue to support the earlier interpretation that adjustment in nonfood consumption expenditures appears to act as a means of partially insuring ex-post the consumption of food from the effects of income changes.

Table 5—The impact of changes in log household per capita income on log household per capita consumption

	Instrumental variable estimates				
	Bangladesh (rural areas)	**Ethiopia (rural areas)**	**Mali Zone Lacustre (rural areas)**	**Mexico (control sample rural areas)**	**Russia (urban areas)**
Total consumption per capita	0.17**	0.04	0.396	-0.158	0.344**
	(2.60)	(1.11)	(1.29)	(0.55)	(4.62)
Food consumption per capita	0.09	0.03	0.011	-0.180	0.303**
	(1.48)	(0.61)	(0.05)	(0.59)	(3.64)
Nonfood consumption per capita	0.26**	0.19**	-0.03	0.750	0.478**
	(2.35)	(3.32)	(0.06)	(1.22)	(3.82)

Notes: * = Significant at the 10 percent level; ** = significant at the 5 percent level. Absolute value of t-statistics is in parentheses. Standard errors are corrected for heteroscedasticity using the Huber-White method.

In sum, the instrumental variable estimates presented above suggest that the proposed estimate of household consumption insurance is likely to be subject to opposing and possibly reinforcing biases arising from measurement error in income, imputation errors in the construction of food consumption, and possible endogeneity bias in income. Clearly the extent to which estimates of the consumption insurance measure proposed are consistent will depend critically on the availability of adequate instrumental variables for the changes in household income.

Differences in Household Consumption Insurance by Observable Characteristics

The analysis so far has investigated whether risk-sharing is prevalent among households in the sample of each country. For example, in the results reported in Table 5, the reported coefficients of the idiosyncratic change in income represent conditional

averages of the covariance between consumption and income changes among all the households and, by default, they may mask substantial differences in the extent to which the covariance of income and consumption changes differs among households with certain characteristics or from household to household. In an effort to examine whether there are significant differences in the vulnerability of households, three of the five case studies have also re-estimated a slightly amended version of equation (1),

$$\Delta \ln c_{htv} = \sum_{tv} \delta_{tv} (D_{tv}) + \beta \Delta \ln y_{htv} + \gamma Z + \delta (Z * \Delta \ln y_{htv}) + \gamma X_{htv} + \Delta \varepsilon_{htv}, \qquad (8)$$

where Z is a binary variable identifying households with a particular observed characteristic. In this specification, the sign and size of the parameter, δ, identifies the extent to which there is higher or lower covariation between income and consumption changes in the group of households with this specific characteristic relative to the reference group of households without this characteristic. Along similar lines, the *t*-value associated with δ allows one to test whether this difference is significant.[27]

In Russia, for example, the variable Z identifies the poverty status of the household in Round V (or Round VIII),[28] whether the household is in a rural or urban area, whether the household resides in one of the eight regions covered by the survey, whether there are children between 0 and 6 years of age in the household, whether the household head is retired, whether the household head is a female, the type of occupation of the household head, and whether the household owns any land.[29] It is found that in Round VIII of the survey (the round collected soon after the August 1998 crisis), the set of poor households consisted of households that had a significantly higher covariance between food consumption and income. This suggests that it is the more vulnerable

[27] The Bangladesh and Ethiopia studies did a similar analysis but with a slightly different methodology. In future work, the same analysis will be performed for these two countries.

[28] A household is classified as poor in Round V (or Round VIII) if its per capita consumption expenditures is less that or equal to the 30th percentile of per capita consumption expenditures in Round V.

[29] Although it is possible that some of these characteristics may change over time, they are treated as time invariant and the information of the initial observation of each household is used to assign values for the indicator variable *Z*.

households that become poor at a time of crisis. At the same time, households with younger children were found to be less vulnerable (perhaps as a consequence of the child allowances they receive), while female households were more vulnerable.

The Mali case study includes an even greater number of observable characteristics, but only a handful of them turn out to capture any significant differences in the vulnerability of households to risk. As in the Russia study, the same socioeconomic characteristics appeared to be more or less correlated with higher vulnerability to risk, depending on whether on focused on food consumption or nonfood consumption. Female-headed households, households with young children, households with young and old household heads, and households with more than four members are all found to not be significantly more vulnerable than their respective reference groups. However, households without access to irrigation infrastructure proved to be more vulnerable to risk. In terms of food consumption vulnerability, those households with activities focused around noncrop production (such as pastoralists, fishers, and artisans) and those who were not members of the dominant ethnic group turned out to be relatively more vulnerable to risk.

The Mexico study, taking advantage of the randomized design of the sample was also able to compare the vulnerability to risk between villages covered and not yet covered by PROGRESA (treatment versus control villages). The findings suggested that a poverty alleviation program providing cash transfers conditioned on households investing in their human capital has the potential of combining long-term poverty alleviation with improved opportunities for insuring consumption from income fluctuations.

Identifying Household-Specific Capacity to Insure

To derive a household-specific measure of consumption insurance, three of the country studies (Bangladesh, Ethiopia, and Russia) took the extra step of estimating a household-specific estimate of the covariance between total consumption (and food

consumption separately) and income growth rate over the rounds of the available surveys. Given the acute shortage of degrees of freedom associated with having at most four observations on consumption and income growth rates, household-specific estimates of β were derived using an alternative (but for all practical purposes equivalent) approach to estimating regression equation 1 (see Mace 1991; Townsend 1994). For brevity, we will describe how the household-specific measure of vulnerability was constructed in the Russia study, which contained the greatest number of survey rounds (five).

First, round-specific means by community (PSU) were estimated for the change in the log of total expenditure per capita and the change in the log of income per capita. Second, the household-specific growth rates in total consumption and income were expressed as deviations from the round and community-specific means, respectively. Third, limiting the sample to the households with at least three observations on changes in the log of consumption and income per capita changes one regression for each of the 2,867 households satisfying this restriction was estimated. A household-specific vulnerability measure was then constructed based the different coefficients obtained from the 2,867 household-specific regressions estimated.[30]

As constructed, the household-specific consumption insurance measure reflects the ability of households to insure their total consumption from idiosyncratic income risk. To examine the possible sensitivity of the measure to the exclusion of the aggregate shocks, the Russian case study constructed an alternative measure that is inclusive of both aggregate and idiosyncratic shocks by skipping the first two steps above and simply regressing the household-specific growth rate in consumption on the household-specific growth rate in income.

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[30] It is necessary to acknowledge that the low degrees of freedom associated with each household-specific regression result in very high standard errors for the estimated β or consumption insurance measure of each household. Also, as noted earlier, there remain potential complications due to measurement errors in the income variable. In the absence of a better alternative, it was determined that it was worthwhile to explore this approach in spite of the limitations just noted. To minimize the potential influence of extreme outlier values of household-specific βs less than the 1 percentile and greater than the 99th percentile of the distribution of βs across all households were excluded from the later stages of the analysis.

In terms of the notation used above, the vulnerability measure for household h was constructed, based on the coefficient, β_1^h, derived from the regression (without a constant term),[31]

$$\Delta \ln c_{htv} - \Delta\left(\overline{\ln c_{vt}}\right) = \beta_1^h\left(\Delta \ln y_{htv} - \Delta\left(\overline{\ln y_{vt}}\right)\right) + \Delta\varepsilon_{htv} \ , \tag{9}$$

whereas the household-specific vulnerability measure inclusive of both aggregate and idiosyncratic shocks was based on the coefficient, β_1^h, derived from the regression,

$$\Delta \ln c_{htv} = \beta_2^h\left(\Delta \ln y_{htv}\right) + \Delta\varepsilon_{htv} \, . \tag{10}$$

Table 6 presents coefficients of per capita consumption in a regression of the estimated consumption insurance measures on observed household characteristics (at the

Table 6—The covariates of the degree of household-specific consumption insurance in Russia, Bangladesh, and Ethiopia

	(A) Degree of insurance of total consumption from				(B) Degree of insurance of food consumption from			
	Idiosyncratic shocks		Idiosyncratic and aggregate shocks		Idiosyncratic shocks		Idiosyncratic and aggregate shocks	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Russia								
Ln (total consumption per capita)	-0.046	-2.19**	-0.079	-3.94**	-0.056	-2.37**	-0.085	-3.82**
Nobs	2,867		2,866		2,869		2,867	
F-value/LR chi2	1.59		1.64		1.83		2.17	
Prob > F/Prob > chi2	0.03		0.02		0.01		0.00	
R-squared/Pseudo R-squared	0.01		0.02		0.02		0.02	
Bangladesh								
Ln (total consumption per capita)	0.00	0.05	0.00	1.20	0.00	-2.21**	0.00	0.93
Nobs	919		917		919		917	
F-value/LR chi2	1.11		0.28		0.72		0.07	
Prob > F/Prob > chi2	0.32		1.00		0.83		1.00	
R-squared/Pseudo R-squared	0.02		0.04		0.02		0.04	
Ethiopia								
Ln (total consumption per capita)	0.00	0.48	20.58	0.14	0.00	0.46	0.00	-0.90
Nobs	765		703		765		703	
F-value/LR chi2	0.97		n.c.		4.16		n.c.	
Prob > F/Prob > chi2	0.50		n.c.		0.00		n.c.	
R-squared/Pseudo R-squared	0.01		0.04		0.01		0.03	

Notes: Regressors included the age and education of the household head, whether the household is female-headed, occupational dummies, household size, and demographic characteristics, land and asset holdings, and site or regional dummies. * = Significant at the 10 percent level; ** = significant at the 5 percent level. The t-statistics reported are based on standard errors corrected for heteroscedasticity using the Huber-White method.

[31] Equations (9) and (10) were also estimated with an intercept term. This did not result in any remarkable changes in the estimates reported in Tables 6 and 7.

initial round of observation of each household) (columns 1 and 2 of Table 6), as well as some measures of goodness-of-fit for Russia, Bangladesh, and Ethiopia. For comparison, the same consumption insurance measures were constructed based on food consumption instead of total consumption in equations (9) and (10) above. These corresponding estimates are presented in columns 3 and 4 of Table 6.

As the low R-squared of the regressions reveal, observed household characteristics explain a very small fraction of the variance of the estimated household-specific degree of consumption insurance. For Russia, irrespective of whether consumption insurance is measured based on insurance from idiosyncratic shocks to income (see Skoufias 2002a), the main variables that are significantly correlated with the level of household consumption variability are mainly those identifying the household's region. Except for the variable identifying whether a household has members that are retired, all other household characteristics do not appear to have a significant role in explaining differences in household consumption insurance. Both measures of insurance also appear to be negatively correlated with the total consumption per capita. Thus, ceteris paribus, in a cross-section of households, wealthier (poorer) households are more (less) able to insure. Lastly, practically the same picture emerges if one were to construct an insurance measure based solely on food consumption instead of total consumption (compare estimates in panel B with those in panel A of Table 6).

Results from Bangladesh and Ethiopia are more lackluster (see Quisumbing 2002a and 2002b for details). While the variability of food consumption in Bangladesh (or an inability to insure food consumption from idiosyncratic shocks) is negatively related to per capita consumption, indicating that wealthier households are better able to insure, the consumption insurance measure does not correlate significantly with other observed household characteristics. Only the proportion of adolescent females significantly increases the variability of total consumption. In Ethiopia, the number of male adults increases variability of food consumption with respect to idiosyncratic and aggregate shocks, while the number of females decreases it. However, none of the other covariates—including per capita consumption—is significant.

To further investigate the potential uses of the consumption insurance measures employed here, the Bangladesh, Ethiopia, and Russia studies also examined whether they are significantly associated with the proportion of time a household spends in poverty and the probability that a household is ever poor.[32] The former variable is constructed by simply dividing the number of rounds classified as poor by the total number of rounds; the latter is a binary variable taking the value of 1 if the household is classified as poor in any of the survey rounds. The poverty status of a household in any given round was determined by comparing total per capita consumption in the survey round with the relevant poverty line.[33] The consumption insurance measure presented in Table 7 is the variability of food consumption with respect to income.

In Russia, food consumption variability, defined here by the partial covariance between the growth rate in food consumption and income, has no significant role in explaining the proportion of time a household spends in poverty. This result holds irrespective of whether vulnerability to risk is defined to include or exclude the role of aggregate shocks. However, food consumption variability appears to be positively and significantly correlated with the probability of a household ever becoming poor (even after controlling for the initial level of household consumption per capita). In Ethiopia, food consumption variability, inclusive of aggregate shocks, is positively correlated with the proportion of time spent in poverty as well as the probability of being poor in any round. The effect becomes weaker only when idiosyncratic shocks are considered, underlining the importance of aggregate shocks in Ethiopia. For Bangladesh, however, food consumption variability is not significantly correlated with any of the poverty

[32] It should be noted that a similar approach was adopted in the Bangladesh study, and it yielded no significant correlation between vulnerability and the probability of "ever being poor" and "being always poor."

[33] The Bangladesh poverty line is the lower poverty line constructed using the Cost of Basic Needs Method (World Bank 1998), which differs across regions. The Ethiopia poverty line is that constructed by Dercon and Krishnan (2000), using the Cost of Basic Needs method, converted to 1997 values and to per capita terms for consistency with the other vulnerability studies. The poverty line for the Russia study was the 25th percentile of per capita consumption in Round V.

Table 7—The degree of food consumption insurance and poverty: Russia, Bangladesh, and Ethiopia

	The proportion of time spent in poverty		The probability of being poor in any round		The proportion of time spent in poverty		The probability of being poor in any round	
	1		2		3		4	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Russia								
Degree of food consumption insurance (including aggregate shocks)	-0.209	-0.37	0.060	4.94**				
Degree of food consumption insurance from idiosyncratic shocks					-0.463	0.85	0.035	3.10**
Bangladesh								
Degree of food consumption insurance (including aggregate shocks)	0.00	0.52	0.00	0.33				
Degree of food consumption insurance from idiosyncratic shocks					-0.01	-0.85	-0.04	-1.41
Ethiopia								
Degree of food consumption insurance (including aggregate shocks)	0.01	2.20**	0.01	1.92*				
Degree of food consumption insurance from idiosyncratic shocks					0.04	1.86*	0.03	1.59

Notes: Regressors included the age and education of the household head, whether the household is female-headed, occupational dummies, household size, and demographic characteristics, land and asset holdings, and site or regional dummies. The coefficients in columns 2 and 4 are the marginal effects on the probability of falling into poverty (dF/dx). The poverty status of a household is determined relative to poverty lines described in the text. * = Significant at the 10 percent level; ** = significant at the 5 percent level. The t-statistics reported are based on standard errors corrected for heteroscedasticity using the Huber-White method.

measures. Similar analyses showed that the variability of total consumption is a positive and significant determinant of the proportion of time spent in poverty only for Russia. Given the large budget share spent on food in Ethiopia, variability in food consumption is probably one indicator of vulnerability to poverty in general.

4. Shocks and Family Risk-Coping Mechanisms

Having established that households are only partially able to insure, it is of interest to examine the mechanisms used to cope with idiosyncratic and aggregate shocks. Overall, the results reported in the five case studies revealed that households employed a portfolio of strategies rather than favoring one single coping strategy.

However, differences in country settings and institutional context are immediately apparent in the choice of coping mechanisms. The coping strategies examined included getting (or having) a second paying job (Russia and Mexico), getting involved in informal economic activities (Russia), receiving remittances from friends and relatives (Bangladesh, Mali, Mexico, and Russia), receiving public transfers or participating in public safety net programs (Bangladesh, Ethiopia), getting in debt (Bangladesh, Ethiopia, Mali, Mexico, and Russia), selling assets such as poultry or livestock (Bangladesh, Mali, Mexico, and Russia), and cultivating land (Russia). The Mali study also examined such additional coping strategies as diversification and changes in the composition of food consumption, while the Bangladesh and Ethiopia studies examined whether different categories of households were equally able to use risk-coping mechanisms. Regressions on the use of coping mechanisms in response to the idiosyncratic shocks are presented in Table 8. To the extent possible, the case studies employed techniques that control for the potential role of unobserved household heterogeneity in determining how households respond to shocks, but using the same technique was not possible in all studies because of data differences.

The first two panels of Table 8 present the results from Mali and Russia, which both employ fixed-effects logit. In Russia, households appeared to complement their self-insurance strategies, consisting of adjustments in labor supply, and selling assets of land, with informal risk-sharing strategies that spread risk over time and households. The same general patterns were also observed in Mali, where households made additional adjustments by changing the composition and frequency of food consumption (such as serving less preferred foods more frequently, or serving less food to men, women, or children). Moreover, in Mali, there were significant differences between the coping strategies of asset-poor and asset-rich households.

In the Mexico case study, fixed-effects logit analysis was not possible because information on how households might respond to idiosyncratic shocks is collected in only one round (November 1999) of the survey. The estimated marginal effects of the various

Table 8—Idiosyncratic shocks and household coping mechanisms

	Outmigration	Remittances received	Positive livestock sales	Positive net debt	Aid from family and friends (food gifts)
	Mali[a]: Fixed-effects logit				
Crops were attacked by insects	0.083	0.268	0.272	1.577**	0.554
	(0.25)	(0.70)	(0.83)	(5.76)	(1.40)
At least one member of household lost productive time due to illness	-0.037	0.135	-0.194	-0.679**	0.157
	(0.14)	(0.42)	(0.73)	(3.06)	(0.44)
Lost livestock due to theft or death	0.673**	-0.332	1.102**	1.128**	1.078**
	(2.15)	(0.94)	(3.57)	(4.24)	(2.69)
Land cultivated less than land available	-0.805**	0.326	0.174	-0.006	0.329
	(2.45)	(0.92)	(0.55)	(0.03)	(0.90)
	Russia[b]: Fixed-effects logit				
	Get a second job	**Informal activities**	**Receive transfers**	**Borrow money**	**Sold assets last three months**
Owed wages	0.41**	0.04	-0.03	0.28**	-0.31
	(2.29)	(0.36)	(0.27)	(3.12)	(-1.45)
On forced leave	2.90**	-0.29	0.01	-0.01	-1.54
	(2.68)	(0.54)	(0.02)	(0.05)	(-1.43)
Unemployed	-0.54**	-0.64**	0.17	0.34**	0.32
	(2.32)	(4.94)	(1.47)	(3.26)	(1.60)

	Sold animals?	Sold other/land?	Borrowed?	Received help from government?	Worked more?	Received help from family?
	Mexico[c]: Households in control villages, probit					
Lost land?	0.01**	0.00**	0.00	0.00	0.06	0.01**
	(4.29)	(2.13)	(1.12)	(0.93)	(6.20)	(2.24)
Lost harvest?	0.06**	0.02**	0.10**	0.03**	0.29**	0.08
	(11.18)	(5.15)	(15.97)	(9.35)	(30.19)	(16.17)
Lost animals?	0.06**	0.00**	0.02**	0.00	-0.01	-0.00
	(6.56)	(2.25)	(2.78)	(0.25)	(0.72)	(-1.03)
Lost home/other items?	0.00	0.01**	0.13**	-0.00	0.12**	0.03**
	(0.83)	(3.06)	(7.85)	(-0.24)	(7.54)	(2.81)

	Net debt	Net asset sales	Remittances	Food for Education	Relief
	Bangladesh[d]: Fixed effects				
Ln (value of livestock losses)	-26.12	26.38	-19.34	0.10	0.06
	(1.07)	(0.98)	(0.96)	(0.58)	(1.10)
Female illness	-6.18	-5.54	4.60	0.14	-0.78
	(0.30)	(0.25)	(0.27)	(0.95)	(0.95)
Male illness	25.21	-43.12*	6.06	0.21	0.75
	(1.09)	(1.72)	(0.32)	(1.28)	(1.05)

	Net debt	Transfer receipts	Free distribution	FFW earnings	Women's income
	Ethiopia[c]: Fixed effects				
Rainfall index (1 is best)	-34.14	9.31	0.92	1.57	-0.25
	(1.08)	(0.15)	(0.48)	(1.57)	(0.14)
Livestock disease index (1 is best)	-2.38	-60.39	-1.08	0.47	0.48
	(0.06)	(0.78)	(0.45)	(0.38)	(0.22)
Lack of water or grazing land (1 is best)	-23.40	64.19	-1.40	-1.43	-1.47
	(0.71)	(1.01)	(0.71)	(1.38)	(0.80)
Crop index (1 is best)	-91.35**	231.67**	-3.30**	-2.91**	1.64
	(3.77)	(4.98)	(2.28)	(3.82)	(1.22)
Days lost due to illness	-9.51*	-3.52	0.18	0.29	-0.03
	(-1.68)	(0.32)	(0.53)	(1.63)	(0.11)

(continued)

Table 8 (continued)

Notes: * = Significant at the 10 percent level; ** = significant at the 5 percent level. Absolute value of t-statistics is in parentheses. Standard errors are corrected for heteroscedasticity using the Huber-White method.

[a] All shock variables are included simultaneously in the regression. Additional regressors not reported included time-varying regressors: household size, age composition of household, gender composition of household, and survey round. Z-values reported in parentheses.

[b] All three shock variables are included simultaneously in the regression. Additional regressors included, but not reported: a constant term, binary variables describing the age/gender composition of the household in each round, the round of the survey, and whether the household is headed by a female of working age or a retired male or female. Z-values reported in parentheses.

[c] All shock variables are included at the same time in the regression. Additional regressors included, but not reported: a constant term, variables describing the age and gender composition of the household in each round, the age of the household head, whether the household is headed by a female, the education level of the household head, binary variables for the type of occupation of the head, an index summarizing the asset holdings of the household, the eligibility status of the household for PROGRESA benefits, and binary variables describing whether other government programs operate in the locality (DIF, LICONSA, PROBECAT, Tortilla Solidaridad, Empleo Temporal, Educ.Scholarship). Prior to October 1997. All coefficients reported are in terms of marginal effects on the probability of the respective outcome (dF/dx). Z-values reported in parentheses.

[d] All three shock variables are included simultaneously in the regression. Additional regressors included the age of the household head, whether the household is female-headed, household size, and demographic characteristics. T-statistics in parentheses.

[e] All shock variables are included simultaneously in the regression. Additional regressors included a dummy for a female-headed household, age and age squared of the household head, the number of male and female adults, and the dependence ratio. T-statistics in parentheses.

shock variables on the probability of adopting a specific response are reported in the third panel of Table 8 for households in the control villages that were not included in the PROGRESA conditional subsidy program.[34] Overall the results for households in control villages reveal that no single strategy is used most frequently. Harvest loss, for example, appears to trigger multiple household responses, including the selling of animals and borrowing and receiving help from the government and relatives.[35]

[34] All shock dummy variables were included simultaneously in the probit regression. Estimation using random-effect (at the village level) probit did not lead to any substantive change in the results obtained using simple probit. The case study also included separate estimates for PROGRESA (treatment) villages.

[35] The analysis in Skoufias (2002b) also suggests that there does not appear to be any significant difference in how households in PROGRESA villages respond to these shocks. The only notable difference is that households in PROGRESA villages appear to respond differently than households in control villages when there is shock leading to the loss of animals. Relative to households in control villages, they are less likely to respond by selling animals or borrowing, or working more, and more likely to receive help from relatives. Also, the loss of other household items or the loss of a home is more likely to result in receiving help from the government. There are also indications that the presence of the PROGRESA program induces households to use adjustments in their labor supply less frequently than households in control villages for coping with some shocks.

In the Bangladesh and Ethiopia case studies, in all survey periods, a large number of households used coping mechanisms such as incurring debt, selling assets, receiving transfers from friends or relatives, and participating in public safety net programs. Thus, the lack of variation in terms of entry and exit into programs or types of coping mechanisms made fixed-effects logit estimation inappropriate, as it led to the exclusion of the majority of the sample from estimation. Both fixed- and random-effects estimation procedures were used instead; only the fixed-effects results are reported in the fourth and fifth panels of Table 8.

Based on the fixed-effects results, it appears that household coping mechanisms are not responsive to idiosyncratic shocks in Bangladesh. However, random-effects regressions, which include controls for time-invariant characteristics of households, show that these characteristics are important determinants of the use of risk-smoothing mechanisms. For example, poorer households may not be equally able to make use of private coping mechanisms such as credit. Net debt is higher for households whose heads have secondary or more schooling, as well as those with more nonland assets, possibly because the latter can be used as collateral. Remittances are higher in households whose heads have at least primary schooling and for larger families, and in households with a higher proportion of adult females. This may reflect kin support networks, such as brothers who make remittances to their adult sisters, often in exchange for their inheritance (Subramanian 1998).[36] In contrast to private coping mechanisms, public transfers appear to have a more redistributive impact. Both food for education (FFE) and relief go to households with smaller landholdings; relief also is directed toward households with lower values of nonland assets. There is some indication that public transfers also serve some consumption-smoothing function; FFE receipts increase with a female illness shock and relief receipts increase with livestock losses.

[36] Using data from this survey, Quisumbing and de la Brière (2000) show that current assets owned by women are higher if they have more brothers.

In Ethiopia, the use of private and public risk-smoothing mechanisms appears to decrease in response to a favorable idiosyncratic shock, in this case, favorable crop outcomes. Favorable crop outcomes reduce net debt, receipts from free distribution of food aid, and earnings from food for work (FFW), although they surprisingly increase transfer receipts from friends, family members, and government programs. However, fixed-effects estimates do not reveal whether different categories of households are equally able to use these mechanisms. Similar to the Bangladesh case study, the Ethiopia case study estimated the levels (not changes) in net debt, net asset sales, remittance receipts, and public transfers, taking into account household characteristics, idiosyncratic shocks, and individual heterogeneity.

Results not reported here (Quisumbing 2002b) suggest that idiosyncratic shocks do not appear to significantly affect levels of net debt, but transfer receipts decrease when rainfall and livestock disease outcomes are better. Transfer receipts may also tend to favor wealthier households: receipts are positively correlated with education of the head, land area, and the value of household assets. While receipts from free distribution of food aid decrease with favorable rainfall and livestock disease outcomes, there are indications that free distribution does not necessarily reach the poorest households. Free distribution receipts (a subset of transfer receipts) are higher for households with more education and with larger areas cultivated, and also decrease with the number of male and female adults, consistent with earlier results in Quisumbing (2001).[37] FFW receipts increase with worse livestock disease, crop damage, and illness outcomes, but are unexpected positively affected by good rainfall. Unlike free distribution, FFW appears to be better targeted to poorer households. Female income from various activities, while expectedly correlated with female headship, is also higher for households with larger land areas and nonland assets. Levels of female income also increase with favorable livestock

[37] Jayne et al. (1999) also find a negative relationship between per capita food aid receipts and household size. The negative relationship turns positive when household FFW receipts, rather than per capita receipts, are used as the dependent variable.

disease outcomes, which are expected, since a large portion of women's income is obtained from the sale of livestock and dairy products.

5. Concluding Remarks

This paper has summarized five studies using household panel data from Bangladesh, Ethiopia, Mali, Mexico, and Russia, all examining the extent to which households are able through formal and informal arrangements to insure their consumption from specific economic shocks and fluctuations in their real income.

Building on the recent literature on consumption smoothing and risk-sharing, we attempt to relate a household's degree of consumption insurance (or consumption variability) to its vulnerability to poverty. The consumption insurance measure is defined by the degree to which the growth rate of household food consumption covaries with the growth rate of household income. Among the advantages of the proposed measure of consumption insurance is the opportunity it offers to determine consumption variability arising from idiosyncratic risk and covariate risk, either separately or in combination. It is also independent of the poverty status of a household or the level of the poverty line. Another advantage is that the availability of repeated observations per household allows the construction of a household-specific measure of consumption insurance based on total consumption as well as food consumption. This in turn provides the opportunity to examine in more detail the partial correlation of household consumption insurance with household characteristics as well as the extent to which consumption variability is correlated with the incidence of poverty.

However, some of the disadvantages of this measure are as follows. First, it requires repeated observations (panel data) on households. Second, the survey must collect information on both household consumption and income. Third, it is subject to a variety of biases arising from measurement error in income, imputation error in food consumption, and endogeneity of income.

The empirical estimates of one of the three studies (Russia) provide some tentative confirmation that consumption variability with respect to income changes is negatively associated with the level of household consumption and positively associated with the incidence of poverty. No significant evidence is found on the role of consumption variability and the proportion of time a household spends in poverty. Estimates from Bangladesh suggest that the household-specific variability of food consumption is negatively associated with the level of household consumption, but neither the variability of food nor total consumption is significantly associated with the probability of being poor or the proportion of time spent in poverty. For Ethiopia, neither measure of consumption variability is correlated with household per capita consumption, but the degree of food consumption variability is positively and significantly associated with the proportion of time spent in poverty as well as the probability of being poor.

Is this measure of consumption variability useful in assessing vulnerability to risk? The consumption insurance measure adequately captures sensitivity to risk and income fluctuations. However, it falls short of being a measure of *vulnerability* for a number of reasons.[38] First, it does not allow for differences between positive and negative shocks, nor distinguish between responses to unanticipated risk and anticipated fluctuations. From a policy viewpoint, one would be more concerned with the inability to cope with the consequences of a negative shock rather than a positive shock. Second, the consumption variability measure is not related to the size of income risk faced by the household. It has been pointed out (Dercon 2002) that using the measure of consumption insurance as a measure of vulnerability to risk is consistent only if income risk is identical across households and only if it is exogenous. The results on risk-coping mechanisms—which show that households diversify income sources to cope with risk—make the assumption of exogenous income risk unwarranted.

Have we advanced our understanding of households' ability to cope with risk? Most tests of consumption smoothing allude to the role of community-based insurance

[38] We are grateful to Stefan Dercon for most of the points raised in this paragraph.

mechanisms as underlying observed risk-sharing, but are silent on the particular types of mechanisms used. In examining the various risk-coping strategies used by households, the case studies have shown that households use a portfolio of strategies, but that different types of households may have differential ability to use these strategies. In particular, poorer households may be less able to use mechanisms that rely on initial wealth as collateral. In this regard, public transfer programs may have a more redistributive effect. How useful is each strategy in smoothing consumption fluctuations, and what is the relative importance of each strategy? It would be useful to quantitatively establish the role played by each of these strategies in smoothing consumption, to judge their importance in the household's risk-coping portfolio.[39]

The results of this study provide empirical confirmation of the potential benefits associated with a more effective social protection strategy. Given that households differ in their ability to protect themselves from shocks, it appears that there are significant gains associated with the adoption of a social protection system that not only provides support for the critically poor but also assists households, and communities to better manage risk. As this study suggests, the targeting of social safety net programs, for example, need not be based solely on the current poverty status of the household (ideally measured by consumption per capita), or whether a shock affected a household. Social program targeting can be effectively complemented with indicators of the ability of the household to protect its consumption from such shocks. Taking into consideration these factors and devoting efforts to identify households that are less able to insure their total or food consumption, in particular, may be an important consideration to be introduced in the targeting of the social safety net system of developing countries.

[39] For example, Dercon (2002) suggests that one could establish the extent of consumption fluctuations caused by income shocks from a version of (5). Then, one could investigate the value of the change in livestock holdings, or transfers, than can be directly linked to income shocks via regressions, relative to overall consumption fluctuations.

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