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Consumption Insurance: An Evaluation of Risk-Bearing Systems in Low-Income Economies

Robert M. Townsend

People face substantial, even catastrophic, risk throughout most of the developing countries of the world. In villages in India or the Ivory Coast, with rather low per capita income figures, people face the risk of human illness, sickness or death of plow animals, crop pests and diseases, and erratic monsoon rains. Even in developing countries such as Thailand, with modest per capita incomes on average, farmers in one locality can face fluctuations in net income that are substantial relative to other localities or to the nation as a whole.

The central nature of such risk in developing countries raises three related issues. First, how covariate or insurable are these various risks? If shocks or adverse events are idiosyncratic, peculiar to the individual or household, then local pooling or insurance may be feasible. On the other hand, if shocks are aggregate shocks, common to a population, then insurance can be more limited.

Second, what markets or technologies are available to manage the risk? For example, storage of grain has been used from biblical to contemporary times. Land fragmentation appears to have been a solution both in medieval times (McCloskey, 1976; Townsend, 1993) and in contemporary societies (for India, see Walker and Ryan, 1990); the idea is that holding multiple, spatially separated plots is a way to avoid having all one's eggs in one basket. More generally, real and financial assets can be bought in good times and sold in bad (Deaton, 1989). Finally, there is the implicit insurance provided by networks of family and friends, as Rosenzweig (1988) discusses in the case of India.

■ *Robert M. Townsend is Charles E. Merriam Professor of Economics, University of Chicago, Chicago, Illinois.*

Third, what financial institutions are available to offer implicit and explicit insurance? Possible examples include village-level rice banks, credit unions and local money lenders, or national-level banks, rural credit programs, and insurance companies. Many financial systems can be used for an insurance purpose (Townsend, 1990).

It is always tempting to focus on financial institutions alone. However, the key question really is whether markets and institutional arrangements are *jointly* providing an optimal allocation of risk bearing given the degree of idiosyncratic and covariant risks. If not, can we think of how to alter markets or financial institutions so that there might be an improvement?

This paper describes research and a recent literature that begins to answer some of these questions. But before moving on to details, consider the potentially dramatic effects from improved insurance. Households with access to an improved financial system can use credit and insurance to diversify risk and potentially to raise levels of income, consumption and savings. Conversely, as shown in models by Greenwood and Jovanovic (1990) and Banerjee and Newman (1993), costs of entry or poorly designed financial systems can limit access by the poor, reinforcing low levels of income, consumption and saving for certain groups. Thus a lack of insurance can contribute to inequality in society as a whole. Increasing inequality and its relation to growth are important policy issues in many countries. Townsend (1995b) reviews the theoretical and policy literature.

The paper proceeds as follows. The next section focuses on income fluctuations and sources of data for three sample economies. The following section focuses on full insurance, to get at the basic economics of risk bearing and insurance markets. This is followed with a section on empirical results and interpretation using consumption and income from the three economies. A following section addresses the important question of how consumption is actually smoothed within villages and regions. The last part of the paper focuses on incentive issues, looking at institutions in a manner informed by the mechanism design and contract theory literature.

Some Data on Income Fluctuations

To understand what sort of risk exists and what sort of insurance is possible, one must begin by understanding what income fluctuations commonly occur in developing countries and whether these fluctuations are idiosyncratic or aggregate. The development literature typically portrays risk as covariate, imagining that most people are doing the same thing and experiencing the same weather, for example. However, evidence on actual households from a number of developing countries suggests that the incomes of households in a village or region move together much less than expected. The discussion here will focus on three particular economies, though others will be mentioned.

The first economy (or set of economies, really) consists of three villages in southern India sampled by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The ICRISAT data come from a rather special survey, in which up to 40 households were sampled almost continuously, month to month, in each of the three villages for 10 years. Among other details, the ICRISAT survey includes plot files, which record the details of agricultural production; the census schedule, which records household members and other characteristics; the transactions file, which records all purchases, sales, gifts and some within-household transfers; and some details of labor supply. Researchers are drawn to these data by the level of detail and the fact that they constitute a panel of households. There are drawbacks, of course. Most notably, consumption was not measured directly but was estimated as a residual. There are household and village selection issues as well. The villages chosen had to display certain agroclimatic characteristics and had to be willing to "cooperate" with ICRISAT. Landless laborers were underrepresented and show the highest rates of attrition.

Townsend (1994b) shows within each of the ICRISAT villages, Aurepalle, Shirapur and Kanzara, that particular household incomes vary considerably over time from the village average. This is true whether the household is landless or is a small, medium or large landholder. Apparently, there is considerable scope for insurance.

But what of the presumption of covariate risks? With the ICRISAT data, one can compute the variance-covariance matrices of net income from various sources: of a crop placed in different types of soils (like castor in black soils or in shallow red soils); of various crops (for example, castor, paddy or sorghum mixed with pigeon pea); and of various principal income categories (crops, livestock, trade and handicrafts, and wage income). This analysis shows that risks are high and that diversifying in these various ways would be beneficial. Yet few households diversify. To put it another way, few households hold a market "portfolio" of soils, crops or occupations.[1] In summary, incomes do not comove across households in each of these villages because households earn their income in different ways, subject to different risks, and do not diversify much.[2]

[1]Here and below income data exclude interest, gifts, the buying and selling of financial and real assets, and other effects from risk-bearing strategies apart from plot, crop and occupational diversification. Indeed, though there is some land fragmentation, most of the plots of a given household in Aurepalle village lie close to one another. Still, preliminary analysis of rainfall data from 22 gauges indicates rainfall is not highly correlated across different plots. Rain gauges were placed in the field in collaboration with ICRISAT under the research project in Mueller and Townsend (1993).

[2]Another method of analyzing this data is to fit a factor model to the household incomes, one village at a time. Lim (1992) tries this approach, and finds that there are five "unobserved" factors driving income across households. Further, the coefficients on these factors are not identical across households. Even after accounting for these unobserved factors, Lim attributed 25 percent of the income variance to residual, household-specific, idiosyncratic terms.

The second economy is the set of counties constituting regional economies and the national economy of Thailand, sampled by the Thai Socio-Economic Survey (SES). The SES is highly regarded as yielding more or less reliable estimates of consumption and income, including home-produced goods. There are numerous quality control checks, such as repeat interviews triggered by an inability to balance the monthly accounts of income and expenditures to within 10 percent. Below we focus on consumption of food, clothing, shoes and tobacco, all added together.

The major drawback of the Thai data is that they do not constitute a household panel—no household is known to be sampled more than once during the five survey years: 1975, 1981, 1986, 1988 and 1990. An advantage of the SES is that certain "counties," or amphoes, were sampled repeatedly. Thus to be included in the analysis here, households had to have lived in an amphoe that was sampled at least twice and lived there for 10 or more years. The requirement that people had lived there for some time is needed because Thailand has significant internal migration, especially from rural to urban areas. Limiting the sample to longer-term residents assures that the results are not being driven by changes in population composition. While the 1975–1981 and 1988–1990 pairings retain a large number of matched amphoes (227 and 691 matches, respectively, containing about 8,000 households in each case), the 1981–86 pairing is relatively sparse, with 42 amphoes matched overall and only about 2,000 households. Indeed, the 1988–1990 pairing makes up about half of the total national sample overall, causing some problems in interpretation noted below. (See Table 1 for these and other details.)

The evidence from counties in various regions of Thailand supports the importance of localized change. This evidence compares growth rates in average

Table 1
Number of Sampled Households and Amphoes

	Kingdom	*North*	*Northeast*	*Central*	*South*	*Bangkok*
Number of households in matched amphoes						
1975–81: 1975	8306	2008	2599	1709	986	1004
1981	8501	1784	2469	1637	923	1688
1981–86: 1981	1737	531	322	206	380	298
1986	2266	690	357	319	563	337
1986–88: 1986	7120	1633	1558	1691	1205	1033
1988	1905	431	347	321	403	403
1988–90: 1988	7351	1664	1688	1551	1192	1256
1990	8090	1690	1857	1688	1381	1474
Number of matched amphoes						
1975–81	227	60	56	59	41	11
1981–86	42	12	7	6	13	4
1986–88	128	28	27	28	31	14
1988–90	691	158	193	172	127	41

Note: All households must have resided in current amphoe for 10 or more years.

per capita income of various amphoes in the various regions of Thailand: north, northeast, central, south and greater Bangkok. Thailand is on average a growing economy. In counties in the northeast from 1988–1990, for example, the average annual growth rate of income was 7.44 percent. Still, of the 193 counties for the northeast that are available from the SES data, many experienced substantial *drops* in income, with shortfalls of up to 77 percent per year. Conversely, there are counties for which income virtually doubled in each of those two years (on average). Figure 1 presents histograms for the distribution of income growth across different counties from 1988–1990, first in five separate regions of Thailand, and then an overall measure. The x-axis of the histogram shows the average annual income growth for a county over the relevant time period, with 1.0 corresponding to 100 percent growth. The y-axis shows the fraction of counties in the regional sample with income growth falling into the various cells and categories. Clearly, there is considerable diversity in growth rates across counties in a given region over a given pair of years. This suggests again the potential importance of insurance among these counties.

It is also interesting to examine whether there are common regional components: did income growth in northeast counties from 1988–1990 differ significantly from national average growth over the same period? I set up a model with three sorts of dummy variables: four for date changes, five for the five regions of Thailand, and three for community types distinguished in the SES data (urban, rural or sanitary district). This creates 60 different possibilities.[3] (Details of this analysis are available on request from the author.) The bottom line is that there are a few common components to income growth. An F-test for sets of regression coefficients shows some common fixed effects for the northeast from 1988–1990 and for the south from 1988–1990. But overall, the analysis reinforces the previous conclusion: idiosyncratic shocks are large even across counties in a common region.

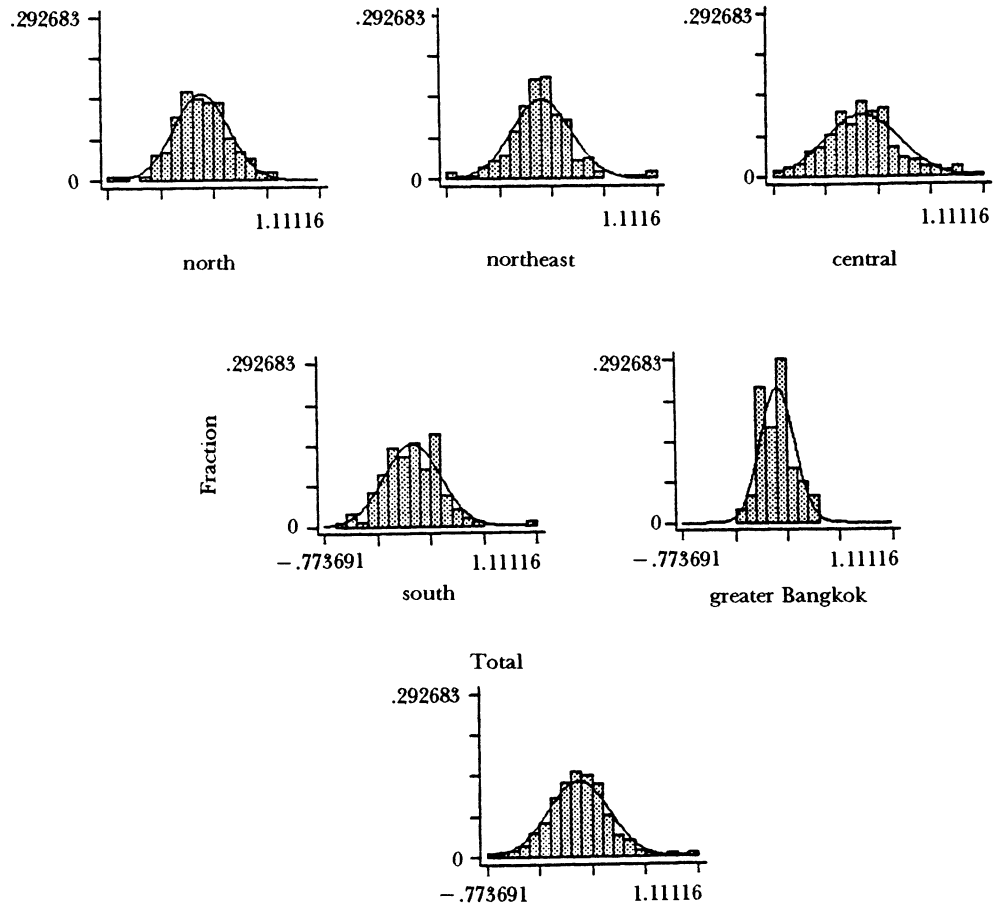
There may also be patterns by occupation group, and this might limit possibilities for within-group insurance. Suppose, for example, that we consider households who report that the principal occupation of the head is farming only. Then we pick up more fixed effects; the northeast, central and greater Bangkok regions have common components for within-region income growth for two of the four pairs of years. Common movement of farm incomes within

[3]Specifically, let

$$\frac{\overline{\ln y_t^a} - \overline{\ln y_\tau^a}}{t-\tau} - \frac{\overline{\overline{\ln_t^a} - \overline{\ln_\tau^a}}}{t-\tau} = b_{\tau,t}^{r,c}\delta_{t,\tau}^{r,c} + \epsilon_{t,\tau}^{a,r,c}$$

where a is an amphoe or county, the single bar denotes the county average, and the double bar is the national average over all counties. The dummy variable $\delta_{t,\tau}^{r,c}$ is equal to one if the amphoe a change in income is formed from the indicated pair of years (t and τ), is in indicated region r (north, northeast, central, south, greater Bangkok), and is of community type c (urban, rural, sanitary district) and $b_{t,\tau}^{r,c}$ is the coefficient on that variable. Variable $\epsilon_{t,\tau}^{a,r,c}$ is the idiosyncratic noise.

Figure 1
Histograms of County Income Growth, 1988–1990



Notes: *X*-axis is county average income growth from 1988–1990 (1.0 = 100%). *Y*-axis is the fraction of counties in the regional sample with income growth in the various cells or categories. See Table 1 for details concerning the number of households and number of counties that underlie the graph.

regions would limit a priori the possibility of within-region insurance among farmers and would make cross-region insurance more important. Still, this pattern of within-region income correlation falls off if the analysis is restricted to rice farmers. Perhaps subsistence farmers in the northeast, relying on rainfall, have erratic idiosyncratic incomes. More strikingly, entrepreneurs (self-employed in industry, trade, handicrafts, and so on) have, with one exception,

no common fixed effects at all. Idiosyncratic shocks among entrepreneurs loom large, as would the possibility for within-group insurance.[4]

The third economy is the set of villages constituting the rural economy of the Côte d'Ivoire, sampled by the World Bank's Living Standards Measurement Section (LSMS). The World Bank has done similar surveys in several countries, and this one is typical of the kind of data that may be available for tests of consumption insurance. Specifically, Côte d'Ivoire data consists of two overlapping household panels, 1985–86 and 1986–87. Clusters or villages were the primary sampling unit, and these were spread throughout the three major geographic divisions of the country. Deaton's (1994) book contains an excellent discussion of the reliability of LSMS consumption and income modules (and of other large surveys like those conducted in Indonesia by RAND).

A similar story about the idiosyncratic variability of income emerges for households in villages in the Côte d'Ivoire. Indeed, the work on Thai counties just reported follows closely Deaton's (1993) earlier work, searching for common components in income. Deaton finds that common components for particular villages explain very little of the variation of household income changes within villages. Households in West Forest villages from 1985–86 experienced something of common village-wide components, as did rural areas in general. But these effects are smaller than Deaton had expected before looking at the data. As he notes, fires in cocoa and coffee growing areas are frequent occurrences, so absence of village-level effects remains a puzzle. If village effects exist, they may be swamped by intravillage variation, from one household to another.

Apparently, the incomes of households in villages and in counties in lower-income countries do not move as much in unison as one might have expected. This finding is striking enough that it naturally raises the question of measurement error. Perhaps the ups and downs of idiosyncratic income movements reflect mainly the ups and downs of poorly measured incomes of households over time and across other households. However, Deaton's back-of-the-envelope calculations suggest that measurement error would have to be extraordinarily large to explain the absence of village effects.

The Theory of Full Insurance

If households are risk averse, and if actuarially fair insurance is available, then households will choose to buy insurance. Moreover, if the risks are largely idiosyncratic, as the empirical evidence argues, then risk-averse households should group together to share all risks. These risks will include the weather, that is, rainfall, temperature, humidity and the like; shocks associated with

[4]The image of highly motivated and individualistic entrepreneurs teaming together to insure one another may seem at odds with intuition, but various of the world's more successful micro enterprise loan programs have insurance components. See Rashid and Townsend (1994) and the discussion below.

incidence of crop disease and human illness; shocks associated with changes in prices outside the group or the local economy; and random factors helping to determine births, deaths, migration, division of extended families and other endogenous demographic states. If risks are fully pooled, then growth in household consumption should track growth in group average consumption, and nothing else. To put it another way, movements in average group consumption represent aggregate risk, and through risk-sharing mechanisms of various sorts, all other shocks are pooled. The amount of risk sharing that actually takes place can thus be compared to this benchmark of full risk sharing.[5]

This suggests an empirical test. For independent variables, use average group consumption, the specific income of each household, and perhaps shocks like unemployment, sickness and so on. Through regression analysis, see how these independent variables affect the dependent variables—individual household consumption. If risk sharing is complete, the coefficient on group consumption will be one, and the coefficient on household income and any other shocks will be zero.

Versions of this approach are testable.[6] In the Côte d'Ivoire and ICRISAT data, household incomes (and some other shocks) are measured directly. In some specifications, village average consumption growth may be taken to be the average over sampled households and run directly as an independent variable. The regression can also be set up so that the dependent variable is the difference in growth between household consumption and village average consumption. Alternatively, one could view village average consumption growth as an unobserved factor, varying either over time, as in the Indian ICRISAT data, or varying cross-sectionally over villages, as in the Côte d'Ivoire LSMS data.[7]

However, for the Thai data, information on particular households is not available. Therefore, instead of comparing the individual household to the village, the approach is to compare various subgroups with a larger aggregate. For example, one can compare the variability of consumption and income in

[5]These ideas are derived from Arrow (1964), Debreu (1959) Diamond (1967), Scheinkman (1984) and Wilson (1968).

[6]This survey on consumption insurance in developing countries is not the place for a detailed review of tests using U.S. data; see Altonji, Hayashi and Kotlikoff (1992), Altug and Miller (1990), Cochrane (1991), and Mace (1991), among others. A related literature on social security inclusive of developing countries is represented by Diamond (1993) and Kotlikoff (1994).

[7]Thus, consider the regression equation

$$\frac{\ln c_t^i - \ln c_\tau^i}{t-\tau} = \beta\left(\frac{\overline{\ln c_\tau^g} - \overline{\ln c_t^g}}{t-\tau}\right) + \phi\left(\frac{\ln y_t^i - \ln y_\tau^i}{t-\tau}\right) + \xi_{t,\tau}^{i,g}$$

where y^i and c^i are household-specific income and consumption and q is the group, the entire village. The theory suggests $\beta = 1$ and $\phi = 0$. (Indeed, ϕ should equal 0 for sickness, unemployment, and so on.)

given amphoes (counties) with the region or with the entire Kingdom. Again, if full risk sharing exists among households in a region (or in the country), it should be true that county average consumption should move with regional average consumption (or national average consumption) and should not move with county average income. Alternatively, one can use dummies for the unobserved time, municipality type and regional factors. The coefficients on such dummies should be significant while coefficients on idiosyncratic, county-specific income shocks should not.[8]

The analysis here has only been sketched in general terms, but it should be emphasized that the framework is a flexible one. A village, for example, is easily modeled as embedded in the larger regional and national economy. Then, average village consumption is determined in a village-wide, balance-of-payments equation containing labor exports, consumption imports, changes in grain stocks or inventory, changes in currency, net sales of financial or real assets, changes in outside indebtedness and so on. Changes in village average consumption reflects only the "residual" aggregate risk that the village had been unable to smooth away. This kind of decomposition is reported below.

Moreover, it is straightforward to extend these regressions in various ways. For example, the framework is easily extended to include leisure, so that household consumption is then determined by group average consumption and group average leisure. It is easy to control for this in the analysis if the data is available, as it is in the ICRISAT sample. The analysis can also easily be extended to incorporate changing demographic terms. Indeed, the basic unit of analysis can be taken to be the individual, not the household, in which case there appears in the regression equation a demographic adjustment term, reflecting how a household's age, sex and member composition changes relative to some group average. Another possible change to the analysis is to use alternative functional forms: one can readily derive forms that use changes of levels rather than changes of logs.

Less obvious, although perhaps more important, are extensions of the models that make explicit incentive and information problems. Effort and idiosyncratic shocks may be unobserved, for example, and full insurance can lead to a moral hazard problem in which households expect to be assisted in bad times and so fail to be diligent or to take care. Still, these alternatives lead to partial insurance, and this might be borne in mind when interpreting the

[8]Now suppose the relevant group is not the village but rather all households in an entire region r. In that case, averaging over all households in some particular county or amphoe a of the region r, and averaging also over all households in the entire region r yields

$$\frac{\overline{\ln c_t^a} - \overline{\ln c_\tau^a}}{t-\tau} = \beta\left(\frac{\overline{\ln c_t^r} - \overline{\ln c_\tau^r}}{t-\tau}\right) + \phi\left(\frac{\overline{\ln y_t^a} - \overline{\ln y_\tau^a}}{t-\tau}\right) + \xi_{t,\tau}^{a,r}.$$

Note that the region in the above derivation could be taken to be the entire country.

empirical results below. We shall return to more explicit limited-information models and tests in a subsequent section.

Empirical Results and Interpretation

A detailed reporting of the empirical evidence on risk sharing in the three ICRISAT villages in India is provided in Townsend (1994b). The remarkable aspect of this analysis is the relatively low influence of present household income on present household consumption: the marginal propensity for a household to consume out of idiosyncratic changes in income was no larger than .14 in any of the three villages.[9] Versions of the permanent income model that permit households to smooth present consumption against income fluctuations by borrowing and lending would make this coefficient close to the village real rate of interest, but reported rates are much higher than this. However, the income coefficients are statistically positive, thus rejecting the hypothesis of full insurance. If one uses particular types of income as independent variables, like labor income, the coefficient can be even higher, reaching .33 in one village, although only .09 in another. The income variables as a group do have a significant impact on a household's present consumption (Townsend, 1994b, Table IX). Still, the hypothesis that the household consumption moves one to one with household income and not with aggregate consumption is also rejected in the data. Clearly, these villages display a considerable amount of risk sharing, though pooling is less than perfect.

The analysis can be extended to explore the sensitivity of consumption to other shocks. Indeed, Townsend (1994b) reports the surprising fact that neither unemployment nor sickness has a significant impact on a household's consumption. However, as it turns out, the poor, the landless laborers, of at least one village, Aurepalle, are significantly less well insured than their village neighbors, the landed farmers.

Table 2 reports on running regression equations for the sample counties or amphoes in the entire kingdom of Thailand, also distinguishing each of the five regions separately. The dependent variable is the change in average amphoe consumption (in log form). Specification 1 within the table uses changes in measured averages as the independent variable in computing changes in the regional average consumption variable (the regional average includes all sampled nonmigrant households in a given amphoe in a given year, not just in amphoes that were sampled in a pair of years. This is important to avoid spurious significance of the average consumption variable). The other independent variable is the change in average log amphoe income. Specification 2 uses

[9] In these regressions, the dependent variable is the change in household consumption relative to the village average. The consumption variable is the all-consumption variable, but for six years only. The regressions reported in Table IX of Townsend (1994b) control as well for average village leisure and additional demographic terms.

Table 2
Thai SES: Four tests for full risk sharing

	Kingdom	*North*	*Northeast*	*Central*	*South*	*Bangkok*
Dependent Variable in regression 1, 2, 3 and 4: Change in average log amphoe consumption						
1) Independent Variables: Measured changes in region and community type average log consumption (see parenthetical caveat in the text) and change in average log amphoe income						
β (coefficient on average consumption)	.7366[a] (.07749)	.5288[a] (.15501)	.8223[a] (1.1162)	.7063[a] .25647)	.4140 (.30968)	.8468[a] (.22570)
$\varnothing$ (marginal propensity to consume income)	.3443[a] (.1722)	.3507[a] (.03519)	.3553[a] (.03572)	.3324[a] (.03399)	.3455[a] (.03726)	.3715[a] (.08502)
F-test for region and community type effects	.0001	.0008	.0001	.0063	.1827	.0004
2) Independent Variables: Dummies for region, year and community type and changes in average log amphoe						
$\varnothing$ (marginal propensity to consume)	.3548[a] (.01790)	.3757[a] (.03378)	.3655[a] (.03671)	.3294[a] (.03487)	.3577[a] (.03844)	.4553[a] (.09456)
F-test for region and community type effects	.0001	.0500	.0001	.6686	.8669	.0430
3) Independent Variable: Changes in average log amphoe income						
$\varnothing$ (marginal propensity to consume income)	.3694[a] (.01770)	.3714[a] (.03538)	.4218[a] (0.0371)	.3408[a] (.03427)	.3529[a] (.03692)	.2936[a] (.08993)
4) Independent Variables: Dummies for year and changes in average log amphoe income						
$\varnothing$ (marginal propensity to consume income)	.35509[a] (.01783)	.35577[a] (.03644)	.36093[a] (.03607)	.33279[a] (.03431)	.34922[a] (.03740)	.43786[a] (.06843)
F-test for kingdom effects	.0001	.0583	.0001	.1514	.6499	.0008

Notes: Standard Error in parentheses
[a]Indicates significance at the 5 percent level.

dummy variables for changes in unobserved community type, time, and regional factors, to proxy for changes in regional consumption and includes also changes in the average amphoe income. Specification 3 drops regional consumption, or its proxy, altogether, and uses only the change in average amphoe income as an independent variable. Finally, specification 4 uses unobserved national factors, to proxy for changes in national average consumption, as if the country as a whole were integrated, along again with changes in the average amphoe income.

Apparent in Table 2 is an overwhelming rejection of full insurance. Consumption in an amphoe does move with income in that amphoe. The idiosyncratic amphoe-specific income coefficients are significant more or less uniformly across regions, and though these are elasticities, the coefficients are not particularly low, from .33 to .37. This is true for all four econometric specifications. An exception is the coefficient on income in Bangkok, which is highest in specification 2, .45, and higher than in other regions in three of the four specifications. We should also note, however, that the aggregate consumption variables, or their unobserved factor counterparts, are also significant in all regions (except the south and the central regions) in most specifications, as shown by the *F*-test rows in Table 2.

More revealing, perhaps, one can sort the data by occupation of the head. When such calculations are carried out, entrepreneurs display income elasticities that are higher than for all households generally (with the exception of the northeast and central regions). Indeed, the income elasticity in the greater Bangkok area now appears even more of an outlier, from .46 to .53, higher than in the other regions. This means, of course, less insurance. The coefficients and significance of regional average consumption variables or fixed effects counterparts tend to go down for entrepreneurs relative to all households. Many of these variables now lose significance altogether. By this standard there is little pooling of risk among entrepreneurs. In contrast, farmers in the north and northeast actually pass some tests for full insurance if the data from the 1988–1990 pairings are excluded from the analysis! The county-specific income terms vary from .08 to .13 and, depending on the specification, may no longer be significant. County income growth does not predict county consumption growth once regional consumption growth is accounted for; the regional average consumption variables themselves often remain significant.

By these standards, then, risk sharing is worse for entrepreneurs than for households as a whole, and with exceptions, worse within the greater Bangkok area than within the other regions. Farmers in the north and northeast appear to do much better.

Thailand has experienced growth with increasing inequality, an important policy issue within the country. Indeed, the Thai (SES) data confirm increasing inequality for SES nonmigrant households. Per capita levels of income and consumption of all areas of the country are less than that of the greater Bangkok area, and for the most part this spread has only increased over time. The

northeast had an income level that was 49 percent of Bangkok's in 1975, and this fell to only 33 percent by 1990. Related, of course, income and consumption growth rates have been higher on average in Bangkok than for most areas of the country for most pairs of years, and relatively high for entrepreneurs. But do households in the Bangkok area and entrepreneurs have greater consumption insurance, as the models of Greenwood and Jovanovic (1990) or Bencivinga and Smith (1991) would predict? Apparently not. In fact, the SES data convey the opposite impression, an inverse correlation, as if consumption insurance, whether indigenous or otherwise, deteriorates with growth. This might suggest that there remains some scope for improvement, working with the major financial institutions of the country. The logic of the models suggests that faster and more uniform growth may be possible with an improved allocation of risk.

A related question: Does insurance deteriorate with distance? One might hypothesize that there would be a fair degree of risk sharing at the village level, less at the regional level, and still less at the national level. Rashid (1990) found this pattern in Pakistani data.[10] Here we first difference and replace the regional average consumption variables, or unobserved factor counterparts, with unobserved factors at the national level, as in specification 4 of Table 2. As it turns out, the results are mixed. Income coefficients tend to be insensitive to this (and alternative) specifications. The significance of fixed effects does vary across specifications, but insurance does not diminish uniformly with distance. A striking exception occurs again when we analyze farm households with the 1988–1990 data excluded. For the north, northeast, and southern regions, income coefficients rise, displaying less insurance at the national level, and for the north, northeast and central regions, fixed effects are less significant, again showing less insurance at the national level.

The question of whether insurance deteriorates with distance seems important. After all, if we reject full insurance, we might conclude that informational problems (moral hazard and adverse selection) are the cause. These problems might be more severe at greater distances, although this is not obvious. It depends on the monitoring technology.

The results for villages in the Côte d'Ivoire from Deaton (1994) are given in his tables. As he emphasizes, marginal propensities to consume vary by region and by date but are significant and positive in all regions and both pairs of years. There are, however, significant fixed effects in the two forest regions for the 1985–86 panel, even though these fixed effects do not appear in income. The similarity of these results with those of Thai counties is striking. One soundly rejects full insurance for households within villages in the Côte d'Ivoire data, but the degree of consumption comovement is not low.

The full-insurance hypothesis does seem to be rejected in most data sets. However, the heavy insurance against idiosyncratic shocks in the ICRISAT

[10] Crucini (1994) has found cross-state and cross-province insurance in the United States and Canada, respectively, is better than across OECD countries.

Indian data has proved surprising enough to provoke a series of responses. Surely the village economies cannot be that close to the risk-sharing economies predicted by theory. Surely the data on household income and consumption are measured with error. Surely there is an econometric explanation of "spurious" results.

This article is not the place for a thorough discussion of the econometrics of measurement error. Interested readers will need to consult the detailed econometric methods and results, in Deaton (1994) and Townsend (1994b), for example, and form their own opinions. The econometric methods and correction techniques are continually being improved. It should be noted, however, that initial and modified methods are being applied to a variety of different data sets and generating results that vary across these different data sets. The fact that the same methods are finding different results is a comfort against the thought that the tests themselves are a source of persistent bias.

Consumption Smoothing Within Villages and Regions: How Do They Do It?

Empirical results in India, the Côte d'Ivoire and Thailand indicate more consumption insurance than might have been anticipated. How is this actually accomplished?

Lim and Townsend (1994) tediously construct measures of changes in farm inventory, real assets, currency and financial assets from the ICRISAT transaction and production files. One surprising finding is that purchases and sales of real capital assets, including livestock and consumer durables, are *not* playing a role in smoothing income fluctuations. On the other hand, crop inventory plays a relatively large role in the monthly and annual data, particularly so in the village of Shirapur. Currency also plays a role, especially in annual data, and particularly so in the village of Kanzara. These results are consistent with the results of Paxson and Chaudhuri (1994), who conclude that buffer stocks are responsible for the observed degree of smoothing. Yet credit plays a role as well, both alone and in combination with currency and crop inventory, particularly so in the village of Aurepalle. This is consistent with coming close to a full allocation of risk bearing.

There seem to be patterns by land class as well. Relatively large landholders tend to use crop inventory while relatively small and landless holders tend to use currency. Still, there seem to be no patterns in the use of credit by landholding class, counter perhaps to the earlier finding that the poor are less well insured.

As noted, villages are embedded in the larger regional and national economy of India, and one wonders whether there is smoothing of village-level aggregate shocks and by what means. The primary device appears to be crop inventory, consistent with a buffer stock model of the village economy, but

currency and credit are nonzero and play somewhat erratic roles. These somewhat complicated village-aggregate patterns deserve to be better modeled.

Related, in fact, is a study on informal risk-sharing arrangements among family members across the ICRISAT villages. Rosenzweig (1988) has found that households seem to marry daughters deliberately out over space. In that way remittances can flow between areas, depending on who is suffering a negative shock. In the Côte d'Ivoire, Grimard (1992) sorted the LSMS data by tribe and has argued that networks among tribes allow greater consumption smoothing than is apparent in the nonsorted data. Given the high level of migration in Thailand, remarked on earlier in this paper, one wonders if remittances from migrants help stabilize consumption against county income fluctuations. Paulson (1994) has pursued this line.

One can also reach beyond existing data sets. Indeed, this author has been fortunate enough to do field research in villages in northern Thailand, as reported in Townsend (1995a). A relatively short questionnaire focuses on the difference between good years and bad years and on whether or how households might have managed to smooth consumption. Various patterns quickly emerge.

In one village, Yang Pieng in amphoe Omgoi, some relatively rich households try to smooth consumption with buffer stocks, and a few relatively poor households try to smooth with increased labor supply. In contrast to these so-called "isolated" households is a group of relatively rich and poor households who borrow and lend from one another and who make use of local village institutions: a rice bank, a housewife fund and a health insurance fund. Indeed, some of these village institutions were discovered to be surprisingly flexible; they appear to have contingencies in their loan contracts and on occasion direct transfers to those in distress, as the pure theory of risk bearing would predict. One might anticipate this latter group of households could achieve something approaching full insurance. The more isolated households may do less well, on the other hand. Access and arrangements may vary among households even within the village.

Another pattern emerges in a comparison of villages in amphoe Maajaam. One village is replete with village institutions and is very "organized." A second village has problems with its institutions and appears less successful in credit and insurance arrangements. A third has virtually no institutions, but instead has a lively within-village credit market (which still leaves out a few relatively isolated households). These facts deserve closer scrutiny. If villages vary on the ground, as in the work of Wade (1988), why is this so? The apparent variation suggests that one should be leery of generalizations about what villages can or cannot do. Not all villages are alike.

A third related pattern is displayed in the village of Ba Pai in amphoe Lee. Ba Pai is the village of the field research that is most integrated into the cash, regional economy. Ironically, it seems to lack internal credit and insurance arrangements of almost any kind, and for episodes of severe illness, at least, some households seem to suffer changes in consumption. This observation then

raises difficult questions. Does insurance in the form of indigenous arrangements deteriorate with growth? Should the link between insurance arrangements and growth be called into question? Are external institutions and markets a partial substitute for some shocks?

One also needs to look at formal credit institutions. To give a sense of the possibilities, let me describe the situation in Thailand. The Bank for Agriculture and Agricultural Cooperatives (BAAC) is the dominant source of rural credit. Notable as well is the Credit Union League of Thailand (CULT) and, related, the Production Credit Groups (PCGs) and rice banks linked to the Community Development Department. These are present in roughly one of every three villages in Thailand. There are also numerous nongovernment organizations promoting various forms of subsidized credit. Townsend (1995b) begins an evaluation of the risk-pooling capacities of these programs.

There has also been a relatively recent surge of interest in micro enterprise programs targeting credit to the poor. The Grameen Bank in Bangladesh is well known for its use of joint liability borrowing groups, making individual borrowers responsible for each other's loans. Grameen gets a 98 percent repayment rate from these poor, high-risk borrowers; Accion International in Latin America, SEWA and MWWF in cities in India, and the BKK, BRI, and BKD in Indonesia have alternative programs.[11] Rashid and Townsend (1994) have critically reviewed many of these programs for the World Bank. It may be that relatively innovative programs are helping to fill the gaps in financial systems, gaps that are pointed out by the empirical results discussed earlier in this paper.

Constrained Optima and Policy Advice

There are probably good reasons why observed village, regional or national economies achieve something less than full insurance. Many insurance systems are destroyed by counterproductive incentives. More often than not, rural credit programs fail (Adams, 1984). Crop insurance, in particular, has a terrible track record (Hazel, Pomerada and Valdes, 1986). Presumably, problems of moral hazard and adverse selection plague informal risk-sharing mechanisms as well.

To understand how various insurance systems may actually work, economists have constructed general equilibrium models that include principal-agent relationships, enforcement and payment mechanisms, and the constraints imposed by private information and incentives. This sort of analysis then prompts two closely related questions. What versions of the principal-agent models are realistic prototypes to use in different settings? What are the institutions (and markets) that we observed in practice relative to those predicted by theory?

[11]Accion- and Grameen-style lending have recently been introduced into Chicago and other U.S. cities.

Recent steps in this area seem to hold great promise. There have been substantial advances in calculating the solutions to multiperiod models with many agents and these sorts of incentive problems (Abreu, Pearce and Stacchetti, 1986; Green, 1987; Spear and Strivastava, 1987; Phelan and Townsend, 1991). Simulations from these models can then be compared with real data. Phelan (1994), for example, has computed mean and variance statistics from versions of these models with realistic lifetimes and has taken these statistics to U.S. PSID data. Phelan's work can explain some of the excess volatility in consumption, particularly in the cross section, though more initial diversity is needed than one might have thought necessary a priori. Particularly striking is the way consumption fans out among cohort groups sorted by age. This finding has become more evident from the work of Deaton and Paxson (1994) using data from the United States, Taiwan and the United Kingdom. The point, however, is that private information models (and other more limited models) take us a step in the direction of otherwise anomalous data.

Closely related is the empirical work of Ligon (1993). Returning to the ICRISAT data, Ligon finds in the work of Rogerson (1985) and the principal-agent model an intertemporal Euler equation that is different from the Euler equation of the permanent income model. As it turns out, the information constrained model fits the micro data better than the permanent income model. A surprising implication of the model, and the data, is that households may be constrained in savings. Beneficial long-term incentives can be engineered when the principal ("social planner" or village committee) has control over household consumption.

This may sound rather theoretical. But the point here is to find out what is really going on, what institutions and markets are like, and that requires both theory and evidence. For example, consider the work of Mueller and Townsend (1993), who focus on a striking sharecropping arrangement in the village of Aurepalle, one of the ICRISAT villages mentioned earlier. Groups of tenants gather together to farm *jointly* the land of a given landowner. The questions are obvious. How can this institution exist in the face of information and incentive problems? How exactly does it work in practice? To begin to answer these questions we are guided by theory. Our survey asks about many of the key elements suggested by versions of the mechanism design and "limited contract enforcement" literature: explicit and implicit contracts, contingencies in land and credit contracts, information sets, costly state verification, monitoring, communication within the group and to outsiders, multiperiod tie-ins, decision making and control over assets, conditions for bargaining and so on.

Of course, one problem with focusing on particular institutions is the danger of missing the larger general equilibrium context. One might discover all kinds of interesting insights about joint sharecropping, for example, but be left wondering if there are alternative ways for farmers to share risks. To pursue the above example further, why form cropping groups at all? More generally, what determines the allocation of land in a village economy? Building on

Holmstrom and Milgrom (1990) and earlier mechanism design models, Prescott (1994) and Prescott and Townsend (1994) are constructing ever more realistic general equilibrium prototypes to address these fundamental issues.

One is using theory in this work to organize one's understanding of the actual environment. One is constructing ideal operating systems, given a solid understanding of the actual environments and constraints. These ideal operating systems, and the benchmarks they suggest, then form the basis one can use to make policy recommendations. The research and measurement described in this paper are loaded with possibilities for the evaluation and design of social programs.

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