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Intra-Regional Risk Sharing in Thailand

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Amphoe or "county" level test within Thailand's five major geographic regions indicate that consumption smoothing across households (risk-sharing that is) is good for farmers in the North and Northeast, but less significant for entrepreneurs or farmers whose primary crop is rice, and less significant for all other occupations in other regions of the country. The results are consistent with the hypothesis that the effectiveness of mechanisms for sharing of risk may diminish as a country grows, with effectiveness lower in regions with high levels and higher growth rates of income.

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Executive Summary

The data used in this study were obtained from TDRI (Thailand Development Research Institute) in Bangkok by permission of the National Statistical Office (NSO). The Thai SES Survey (Socio-Economic Survey) is large with over 10,000 households sampled each of four years, 1975, '81, '86, and '88. The SES data is highly regarded as yielding direct and more or less reliable estimates of consumption and income.

The hypothesis of full risk sharing supposes that households will insure one another against household-specific shocks in order to smooth out potential fluctuations in consumption, but they will do so only up to their ability to smooth as a group. Sporadic crop disease is insurable but fluctuations in regional or national income may not be. Thus, adding up over individuals, changes in county consumption should be related to changes in regional or national consumption (aggregate risk), and not related to changes in county income (idiosyncratic risk). Alternatively, one can derive a relationship in logs so that the corresponding implications hold in annualized growth rates of consumption and income. Statistical tests along these lines are implemented as follows. First, county consumption changes are regressed on county income changes. Second, measured regional (or national) consumption changes are subtracted from the left hand side, avoiding potential econometric problems when an average of the dependant variable is included as a right-hand side variable. Finally, following Deaton, one replaces measured regional (or national) averages with unobserved time and regional fixed effects. All three methods indicate that within-region risk sharing in consumption is good for farmers in the North and Northeast; indeed, full risk-sharing is not rejected. On the other hand, risk-sharing is less evident for other occupations in these regions and for all occupations in all other areas of the country. These results are not inconsistent with the hypothesis that risk sharing is inversely related to levels and growth rates of income. Indeed, marginal propensities to consume out of income are significantly higher in Bangkok and in the Central plains than elsewhere. Sensitivity of these results to alternative categories of consumption, e.g., food only, and alternative measures of income, e.g., income excluding income in-kind, are also reported in the paper.

One wonders if these results are spurious due to the presence or absences of comovements in income. They are not. Procedures are implemented here as follows. There is a search for significant regional or national fixed effects in explaining county level income changes. That is, one is looking for a decomposition of county level income changes into regional (or national) effects--aggregate risk--and residual county-specific changes--idiosyncratic risk. Results to date indicate there are significant time and regional effects in county level income changes in the North, and Northeast, where there is insurance, but these are also present as well in the Central region, where there is not. Intraregional income comovements are particularly striking when attention is restricted to sampled households who indicate their principal occupation is farming (other regions are then also included) but intraregional income comovements are much less striking when attention is restricted to entrepreneurs (few regional effects are then significant). Entrepreneurs also lack insurance, and since risks are idiosyncratic, there would appear to be a gain to pooling these risks. This has not happened in practice.

The importance of this work lies in its efforts to explore the sensitivity of risk-sharing results to other methods and other data sets. In particular the results appear to indicate that risk-sharing systems can be lost as a country grows. This is inconsistent with various growth models. If such results are sustained in this research, then government and nongovernment organizations should either make greater efforts to document and preserve indigenous risk sharing systems or extend implementation of more formal risk sharing systems. Social security, health and disability insurance come to mind as systems which need to be evaluated, especially in view of the impending AIDS epidemic in Thailand. Also, if the logic behind the growth model is correct, improved insurance may increase growth rates and lead to a more equitable distribution of income.

1. Introduction

The hypothesis of full risk sharing may seem an incredible benchmark. Using U.S. data, researchers (Mace (1991), Cochrane (1991), Altonji, Hayashi and Kotlikoff (1992) and Abel and Kotlikoff (1988)) have generally rejected the hypothesis. Altug and Miller (1990) is an exception. Carroll and Summers (1989) also reject full risk sharing in a cross country comparison. Yet this benchmark, although rejected statistically, is surprisingly consistent with observed patterns of consumption in Townsend's (1992) use of the ICRISAT data from three villages in southern India.

Other researchers interested in development and policy issues have considered risk sharing using alternative methods and alternative developing country data sets. Specifically, Rashid (1990) and Deaton (1990a), using somewhat different methods, consider risk sharing across provinces in Pakistan and across villages in the Côte d'Ivoire, respectively. In this paper, I propose to take both the Deaton test and the earlier Mace, Rashid and Townsend tests to Socio-Economic Survey (SES) data from Thailand. There are several reasons for doing this.

First, one can try to determine if the Deaton, Rashid, and Townsend results hold in yet another data set. Though replications of this sort may not be valued much in the profession, substantial movement away from the ICRISAT villages as the primary source of data for low income countries seems warranted.

Second, the Thai SES data is large, with over 10,000 households sampled by the government's National Statistics Office (NSO) in each of four years, 1975, 1981, 1986 and 1988. While the household panels do not overlap, one can take advantage of a time series in consumption and income data which is long by the standards of most other data sets.

Third, unlike the ICRISAT villages, Thailand is on average a growing country, although levels and growth rates of consumption and income are far from uniform. Tables 1 and 2 and Figures 1 and 2 reveal that Bangkok has been on the high end of both consistently. The disparity between Bangkok and the other regions has increased over time, with some amelioration between 1986 and 1988, depending on how income and consumption are measured. The disparity in growth rates and levels suggests a number of hypotheses which would be interesting to test. Are high income, high growth regions such as Bangkok less well insured than relatively poor, slow growth areas such as the Northeast? More generally, who, if anyone, is reasonably well insured and who is not?

The fourth motivation for this paper is an interest in economic policy and applied welfare analysis. The results in this paper can supplement micro-level surveys of Thai villages, such as Townsend (1993), in addition to contributing to more macro policy evaluation of government and non-government credit and insurance programs. The hypothesis of full risk sharing, however implausible a priori, offers a specific benchmark which can be used to make judgements about the efficiency of risk pooling arrangements across households within and across regions. Via statistical tests using consumption and income data, researchers can determine whether specific programs are currently well designed or whether improvements might be possible.

2. Methods and Results from Previous Research on Intra-regional Risk Sharing

The work of Rashid (1990) on Pakistan represents perhaps the first attempt to use data from a source other than ICRISAT to test for intra-regional risk sharing. Generally, Rashid

finds substantial cross household risk sharing at the local level. Since one year of data is not sufficient to control for diverse fixed effects, Rashid judiciously uses wealth data to try to circumvent this problem.

Deaton (1990a) uses overlapping panel data from the Côte d'Ivoire. Specifically the Living Standards Survey samples 454 rural households in 1985 and 1986 and 392 households in 1986 and 1987. Taking first differences to control for fixed effects delivers two separate cross sectional data sets. Deaton tests for village effects in changes in income by region: West Forest, East Forest, and Savannah. For no region do the F-tests for village effects indicate much significance. A similar test for village effects in changes in household consumption by region yields significant unobserved village effects. One interpretation is that these are standins for unmeasured changes in aggregate village consumption.

Village dummy variables remain significant when household specific income changes are included in the regression. Marginal propensities to consume out of current income are significant and not small, however, ranging from .15 to .45. The magnitude of the coefficient on changes in household income remains more or less unaffected by the inclusion or exclusion of village dummy variables in the regression equations. While the magnitude of all of the coefficients is reduced when instrumental variables are used to correct for imputed, and possibly error ridden, values of income produced and consumed at home, they remain quite significant. This then is a clear rejection of the full risk sharing hypothesis in the Côte d'Ivoire data.

3. The Data

The Socio-Economic Surveys were obtained from the Thailand Development Research

Institute (TDRI) with permission from the Thai National Statistics Office. Deaton and Paxson (1990) use the same data. The Thai SES is highly regarded as yielding more or less reliable estimates of consumption and income. Expenditures on infrequently purchased consumer durables (vehicles and furniture, for example) are measured for the twelve months preceding the interview. Expenditures on food, beverages and tobacco are measured for the seven days preceding the interview with a follow up day-before-interview recall session. Consumption of home produced goods is included in expenditures. There are also various quality control checks, such as repeat interviews triggered by the inability to balance household accounts within 10%.

The data include detailed information on sources of income. The empirical work uses the farm, wage, entrepreneurial, property, income-in-kind and owner occupied housing categories. Consumption data are categorized as expenditures on food, shoes, clothing, tobacco and shelter (finer disaggregation is also possible). In addition the surveys include data on remittances, transfers, market insurance and savings (changes in financial assets, in some real assets and in all consumer durables are included for the month preceding the survey). Measures of income typically incorporate these latter categories. Since they can be thought of as smoothing devices, however, they are excluded from measures of "exogenous" income fluctuations in the analysis that follows.

The major drawback of the Thai data is that no household is known to be sampled more than once during the four survey years. An advantage of the SES data is that some relatively small geographic areas, amphoes or "counties", are sampled repeatedly. Thus, if the risk sharing model is correct, and if the number of sampled households in a given amphoe is large enough to yield reliable statistics on average income and consumption in the amphoe, then

aggregating over households in an amphoe delivers risk sharing implications with the amphoe as the basic unit of analysis. These implications can be tested using amphoes which are sampled at least twice during the four years of the survey. Specifically, there are various amphoes in a larger geographic region, e.g. the North, so one can test for intra-regional risk sharing within a geographic region.

Since Thailand is a growing country with significant internal migration, especially from rural to urban areas, consumption and income changes over time for a given amphoe or region may be misleading indicators of movements in consumption and income for people who move. To ensure that changes in the population composition of amphoes between survey years does not affect the analysis, attention is restricted to households who have resided in their current amphoe for at least ten years. This procedure eliminates households who have migrated across amphoes between 1975 and 1988, except for 1986 and 1988 survey households who may have moved 11 to 13 years earlier.[1]

Households are also asked to name their principal occupation, so the data can be sorted into occupational categories: farmers, rice farmers, entrepreneurs and wage earners. The data is also stratified by rural-urban status. Specifically, households are coded as rural (village), semi-rural (sanitary district) or urban (city block). While the number of included households is sometimes small, the analysis treats households which live in the same amphoe but who have different urban-rural status as living in different areas and subject to potentially different co-movements in income and consumption. (Results are not much sensitive to this distinction,

[1] Anna Paulson is studying the relation between risk sharing, migration and remittances in her dissertation. Suffice it to note here that the characteristics of migrants are very different from those of non-migrants.

however.)

The data are summarized in Tables 1 and 2. The first two panels of Table 1 detail average per capita monthly income and consumption in 1975 baht, respectively, for households in matched amphoes. Income is defined to be equal to the sum of wages, entrepreneurial income, profits from farming and income-in-kind (except owner occupied housing). Consumption is made up of monthly expenditures on food, clothing, shoes and tobacco. Panels 3 and 4 of Table 1 document the dispersion in regional income and consumption levels. In 1988, for example, Bangkok's income and consumption is almost double that of the Northeast. The North, Central and Southern regions fall within these two extremes. The Kingdom average per capita income of 858 baht per month in 1988 translates into an annual income of about 10,200 baht or approximately $400 (1975 dollars).

Table 2 presents two measures of approximate growth rates in consumption and income. The first two panels display growth in average consumption and income. Although Bangkok grows while the other regions grow less or decline from 1981 to 1986, the rest of the country tends to grow much faster than Bangkok from 1986 to 1988. The third and fourth panels present averages of log differences in income and consumption. This measure produces much lower growth rates. Again while Bangkok does well on average, the North, Northeast, Central and Southern regions grow faster in income than Bangkok from 1986 to 1988 and the North and South grow faster from 1975-1981 (see also Figure 1). The difference between Bangkok and the rest of the country is partially due to migration. When the sample is restricted to households who have changed amphoes in the last ten years, Bangkok's growth rates again dominate the rest of the country's, even from 1986 to 1988.

Summary statistics for each principal occupation category display similar patterns, with the differences in regional growth rates being greater for farmers than other occupations. These Tables are available upon request.

Table 3 summarizes the numbers of households and amphoes that are included in the analysis, by region and occupational category. To be included in the table, households had to have lived in an amphoe that was sampled at least twice and live there for ten or more years. Overall, there are from 1100 to 2600 households sampled in each of the five principal geographic areas of the country (North, Northeast, Central, South and Bangkok) in each survey year (not in the table). However, when attention is restricted to households which are in amphoes that are sampled at least twice (panel 1), the number of households per region drops to a low of 300, and 1988 is particularly sparse. The second part of panel 1 shows the number of matched amphoes by region and year. The number of matches per region ranges from 4 to 60 with the 1981-86 pairing being especially thin. The rest of Table 3 details the number of matched households and amphoes for each occupational category (farmers, rice farmers, and entrepreneurial households) for which there is usable data.

4. Risk Sharing Implications for Amphoes and a Note on Aggregation

Full risk sharing implications for amphoes (or other geographic units) are derived from the optimal household consumption allocations which are solutions to the planner's problem: maximizing the weighted sum of the utilities of all the households in a geographic area, subject to an aggregate resource constraint, determined by the geographic unit. Specifically, suppose all households have identical constant relative risk aversion preferences:

$$U^i(c^i) = \frac{(c^i)^\gamma}{\gamma} \qquad (1)$$

where γ is the coefficient of relative risk aversion and c is consumption in household i per adult male equivalent.[2] The household is the basic unit and has as its objective maximizing the utility of per capita consumption (measured in adult male equivalents). The first order condition for household i for the planner's problem is:

$$\ln\lambda^i + (\gamma - 1)\ln c_t^i(\varepsilon_1,\ldots,\varepsilon_t) = \ln\mu_t^r(\varepsilon_1,\ldots,\varepsilon_t). \qquad (2)$$

Superscript r denotes the geographic region or type of households over which risk sharing is assumed to hold. It could indicate the whole kingdom, the region, rural households within a region, or rice farming households within a region. The aggregate resource constraint is determined by the sum of resources of households who belong to r, and μ_t is the lagrange multiplier on this constraint. Parameter λ^i is household i's programming weight, and variables t and $\varepsilon_1, \ldots,\varepsilon_t$ index the date and history of shocks.[3]

Averaging (2) over all households i in an amphoe *a* or "county," a finer geographic

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[2] The weights used to create adult male equivalents are the same as those used in the ICRISAT data (Townsend 1992). Males over age 18 are equal to 1, females over 18 are equal to .9, boys between 13 and 18 are equal to .94, girls of the same age are equal to .83, children between 7 and 13 are equal to .67, between 4 and 6 they count as .52, between 1 and 3 as .32, finally babies less than 1 year count as .05 adult male.

[3] Equation 2 ignores a demographic adjustment term due to expressing consumption in terms of adult male equivalents. This adjustment was insignificant in the ICRISAT study (Townsend 1992).

division than r, yields[4]:

$$\frac{1}{N}\sum_{i=1}^{N}[\ln\lambda^i + (\gamma - 1)\ln c_t^i(\varepsilon_1,\ldots,\varepsilon_t)] = \ln\mu_t^r(\varepsilon_1,\ldots,\varepsilon_t) \tag{3}$$

Taking a time difference of (3) for $\tau < t$ delivers:

$$\frac{(\gamma - 1)}{N}\sum_{i=1}^{N}[\ln c_t^i(\varepsilon_1,\ldots,\varepsilon_t) - \ln c_\tau^i(\varepsilon_1,\ldots,\varepsilon_\tau)] = \ln\mu_t^r(\varepsilon_1,\ldots,\varepsilon_t) - \ln\mu_\tau^r(\varepsilon_1,\ldots,\varepsilon_\tau). \tag{4}$$

Note that (4) is independent of household specific effects, the λ^i. Rewriting (4) in average log amphoe, a, notation (and suppressing the shock terms) gives us:

$$(\gamma - 1)[\overline{\ln c_t^a} - \overline{\ln c_\tau^a}] = \ln\mu_t^r - \ln\mu_\tau^r. \tag{5}$$

If full risk sharing holds for households in an entire region, r, following the steps outlined above, (2) can be averaged over all the households in the region to yield:

$$(\gamma - 1)[\overline{\ln c_t^r} - \overline{\ln c_\tau^r}] = \ln\mu_t^r - \ln\mu_\tau^r. \tag{6}$$

Combining (5) and (6) delivers full risk sharing implications for the relationship between amphoe consumption, c^a, and regional consumption, c^r, which suggest regression equations of the form:

$$\frac{\overline{\ln c_t^a} - \overline{\ln c_\tau^a}}{t - \tau} = \beta\left(\frac{\overline{\ln c_t^r} - \overline{\ln c_\tau^r}}{t - \tau}\right) + \phi\left(\frac{\overline{\ln y_t^a} - \overline{\ln y_\tau^a}}{t - \tau}\right) + \xi_{t,\tau}^{a,r} \tag{7}$$

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[4] Most of the empirical work uses amphoe averages as the basic unit of analysis and tests for risk sharing at the regional level. Alternatively, one could use the region as the basic unit of analysis and test for kingdom wide risk sharing.

where y_t^a is the average log income of households in amphoe a at date t, the income counterpart to c_t^a, ξ is an amphoe, region, date t and τ specific error term, which captures measurement error in the dependent variable. Errors are assumed to be independently and identically distributed. The full risk sharing hypothesis predicts that β will be unity and ϕ, the marginal propensity to consume, will be zero. Roughly speaking, growth rates in amphoe consumption should move one to one with regional consumption growth rates and should, in addition, be independent of growth in amphoe income.

Independent variables which are defined at the level of the region are constructed using all of the relevant households, including households in amphoes in a region sampled only once, while amphoe level variables come from households who resided in the amphoes which were sampled in at least two survey years. Because different households are used to create amphoe and regional consumption growth rates, respectively, the average of the dependent variable is not equal to the measured average of the regional independent variable. There is some overlap, however. Concerns about spurious correlation and measurement error in consumption have led Deaton (1990a) to replace measured average consumption growth with unobserved time and region specific fixed effects. Alternatively, one can assume β is equal to one, as suggested by the theory, and subtract changes in regional consumption from the left-hand side of the regression, making the dependent variable the difference between amphoe consumption growth rates and regional consumption growth. When a symmetric measure of income is be used as an explanatory variable, the regression tests whether amphoe consumption grows faster than the regional average when amphoe income is growing faster than the regional average.

If one assumes that households have utility functions of the following form:

$$u(c_t^i) = -\frac{1}{\sigma}\exp[-\sigma(c_t^i)] \tag{8}$$

following the steps outlined above leads to regressions of the form:

$$\frac{\overline{c_t^a} - \overline{c_\tau^a}}{t-\tau} = \beta\left(\frac{\overline{c_t^r} - \overline{c_\tau^r}}{t-\tau}\right) + \phi\left(\frac{\overline{y_t^a} - \overline{y_\tau^a}}{t-\tau}\right) + \xi_{t,\tau}^{a,r} \tag{9}$$

This is the same as equation (7) except that changes in the average log of consumption and income have been replaced with changes in average levels of consumption and income.

5. Econometric Results

The first set of regressions use a Deaton-like procedure to see if deviations from the mean in income and consumption growth rates, from years τ to t of an amphoe a relative to the sample average of all amphoes, have significant region (r), urban-rural community status (c) and year effects. Again, there are three pairs of dates, 1975-1981, 1981-1986, 1986-1988; five regions, North, Northeast, Central, South, Bangkok; and three community types, rural, sanitary district, and urban. Table 4 presents results for regressions of the following form:

$$\frac{\overline{\ln c_t^a} - \overline{\ln c_\tau^a}}{t-\tau} - \frac{\overline{\ln c_t^a} - \overline{\ln c_\tau^a}}{t-\tau} = \theta\delta_{t,\tau}^{r,c} + \varepsilon_{t,\tau}^{a,r,c} \tag{10}$$

and

$$\frac{\overline{\ln y_t^a} - \overline{\ln y_\tau^a}}{t-\tau} - \frac{\overline{\overline{\ln y_t^a} - \overline{\ln y_\tau^a}}}{t-\tau} = \chi\delta_{t,\tau}^{r,c} + \varepsilon_{t,\tau}^{a,r,c} \tag{11}$$

for consumption and income respectively. The dummy variable, δ, is equal to one if the amphoe

a change in consumption (or income) is formed from the indicated years (t and τ) is in the indicated region r and community type c and is zero otherwise. With three date changes, five regions, and three community types there are forty-five dummy variables, altogether. F-tests for the joint significance of various combinations of year, region, and community type effects are reported in Table 4. For example, the first row marked "N: 75-81" is a test for the joint significance of the three dummy variables (urban, sanitary district, rural) for the Northern region in the 1975-81 pairing. The fourth row marked "N" is a test for the joint significance of all dummy variables for the North, regardless of community type and also regardless of the paired years, the 24th row marked U is a test for the joint significance of all urban dummies regardless of region and dates. The table entries indicate whether the test was significant at the 5% level (**) or the 10% level (*).

As is evident from the column headed "All Households" and "Y", income growth rates display significant regional fixed effects in the North, Northeast and Central regions, particularly from 1986 to 1988. The community type distinctions also appear to distinguish income growth rates. In contrast, there are few fixed effects in consumption growth. Fixed effects in consumption are only significant at the 10% level from 1986 to 1988 in the Northeast and the Central region. One can conclude from this exercise that while there are few fixed effects in consumption growth, income growth follows distinct patterns over regions, community types and time. Deaton (1990a) found the opposite result using data from the Côte d'Ivoire but Deaton results are at the level of the village and here they are at the level of the amphoe.

When households are sorted by principal occupation, in the other columns of table 4, different regional patterns in income and consumption growth emerge. For farm households,

the income effects are accentuated as might be anticipated if farmers are growing similar crops and experience similar weather. In addition to the North, Northeast and Central regions, the South and the Bangkok metropolitan area dummies are significant. In addition, there are regional components to consumption growth in the North, Northeast and Central areas. Compared to all farmers, the income of rice farmers has fewer common components in income. We are led to guess that rice farmers include subsistive farmers with diversity in production. But consumption comovements are similar. Entrepreneurial households have far fewer common components in income or consumption growth. Of course, the category entrepreneurs include many diverse occupations. The fixed effects in income growth remain the same when income-in-kind is excluded from the income measure and when wage income is considered separately. On the other hand, fixed effects in consumption growth are increased when consumption includes only food expenditures. Interestingly, when the income measure includes all sources of income, including presumably some sources of smoothing and components, like owner occupied housing, that are also included in consumption, the fixed effects are very similar to those found with the more restricted income measure.

Tables 5A-5G present two estimates of regression equation (7) as well as estimates of the marginal propensity to consume when no measure of fixed effects is included in the regression.[5] The first panel presents tests for full risk sharing using actual measured changes in average regional consumption by community type. The second panel of each table reports the results of Deaton style regressions which use year, region and community type dummy variables for

[5] To conserve on space, attention is restricted to the log form of the regression. The results for the level regressions (equation 9) are quite similar.

measured changes in log average consumption by year, region and community type. In Panel 1 marginal propensities to consume out of changes in income, parameters ϕ, are positive and significant when the data is pooled and when separate regressions are estimated for each region. That is a clear rejection of risk sharing within regions. The coefficient values do vary tremendously by region, however, from a low of .20 in the Northeast to a high of .54 in Bangkok. In any case, marginal propensities to consume out of income, parameters ϕ, are also higher when Deaton's dummy variable techniques are used, although the regional disparity persists.

Tests for the importance of actual measured changes in average regional consumption by community type are significant for the pooled Kingdom regression and the North. Note, however, that the coefficients β are not near unity, unlike the predictions of theory. Similar tests using dummy variables for year, region and community type find significant fixed effects only in the North. This suggests that co-movement of amphoe and regional consumption may be exaggerated when one uses measured averages.

Note that in panel 1 a common coefficient β is imposed on the relevant aggregate consumption movement across diverse amphoe community types and dates, even with a region, whereas in panel 2 the coefficients on the fixed effects variables are free to take on diverse values across community types and dates, and there are multiple dummies.

One of the most striking results is found in Table 5B, looking only at those households who report that their principal occupation is farming. In the Townsend-type regressions (panel 1 in the table), which use measured growth in average consumption by region, year and community type, the coefficient on income growth ϕ is insignificant for the North and the

Northeast while the coefficient on consumption is positive and significant. The results for the Deaton case (panel 2), which uses dummy variables to proxy for fixed region, community and year effects, are very close except for the fixed effect in the Northeast. In contrast the Central, Southern and Bangkok regions have significant income coefficients, and measures of fixed effects are insignificant, regardless of whether the Townsend or the Deaton method is used. It seems rather remarkable that amphoes in the North and the Northeast pass tests of full insurance while the rest of the country fails.

It is important to be circumspect in interpreting the results. The problem with all of these tests is that the theories imply certain outcomes, but that (as always) the outcomes don't imply the theories. In particular, the significance of regional dummies in consumption changes could come from things other than insurance, most obviously from regional differences in prices, as in other work of Deaton. Townsend (1993) tests for measurement error via a Griliches, Hausman procedure, but there is insufficient data to do this here.

Curiously the results are different when the analysis is further restricted to rice farming households. Table 5C. The coefficient on income growth is significant in panel 1 in the North, and neither the coefficient on income growth or the coefficient on average region consumption growth are significant in the Northeast. In the Central region both amphoe income and average growth in consumption for the region and community type, as well as the analogous f-test for fixed effects are significant. For the South, on the other hand, coefficients on income and consumption growth (and dummies for fixed effects) are both insignificant. The sample of rice farmers in the South is small, however, and it is even smaller for Bangkok (see Table 3), so perhaps those results (the last column of Table 5C) should be ignored.

In contrast to farm households, entrepreneurial households display uniformly high coefficients on amphoe income growth. In fact the marginal propensity to consume in the Northeast is .43, second only to Bangkok's which is .67 (see Table 5D, panel 2). Consumption growth is still important in the Northeast, by both the Townsend and the Deaton criteria.

We may tentatively conclude from this analysis that while farmers in the North and the Northeast are reasonably well insured against income fluctuations, the same type of farmers in other parts of the country are not. Rice farmers and entrepreneurs seem underinsured throughout the country. We are left in future research to look for mechanisms which might explain these results and variations by occupation. Farmers, for example, may be linked up to one another via formal credit arrangements from The Bank for Agriculture and Agricultural Cooperatives (BAAC), and via informal regional connections to traders and lenders. But why should the results vary by region? Related perhaps, entrepreneurs and subsistence rice farmers do not have ready access to BAAC loans.

When income-in-kind is excluded from the income measure, following Deaton (1990a), the coefficient on income tends to decline, and there are relatively few fixed regional effects, see Table 5E. The North is an exception; see panel 1. Other restrictions on income, setting it equal to only wages or only farm profits, for example, yield similar results: coefficients on income are small and often insignificant. This seems unsurprising, since when income is less than all income, components or sums of components which might cause consumption to move have been excluded. Still, the coefficients on these restricted measures of income appear to be more significant than coefficients on **all** income in studies using the ICRISAT data (Townsend 1992).

The most unrestricted measure of income, "all income", which includes insurance, proceeds from the sale of assets and other potential smoothing devices delivers high marginal propensities to consume, see Table 5F. This might be expected since this measure of income approaches an accounting identity which determines actual consumption. However, even with this measure of income, the coefficient on average regional consumption growth is significant in the North in panel 1, and both the North and the Northeast show significant fixed effects using the Deaton test in panel 2. This suggests there is a limited but positive amount of intra-regional insurance. On the other hand, the results may be an artifact of measurement error: if consumption is measured more precisely than income then the regression will assign it more significance.

When consumption is restricted to be equal to expenditures on food only, the results are similar to those with less restrictive measures of consumption, see Table 5G. Coefficients on regional aggregate consumption β in panel 1 and f-tests are more significant, though marginal propensities to consume out of income will occasionally increase. If food is a necessity and hence a priority in household smoothing efforts, one would expect results in this direction.

Taken as a whole, however, the extent of insurance in Thailand appears at best intra-regional. When regional average consumption growth is replaced with national averages or with fixed effects at the national level, neither the Townsend nor the Deaton tests find any significant effects.

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Figure 1: Regional Per Capita Monthly Income, 1975 Baht

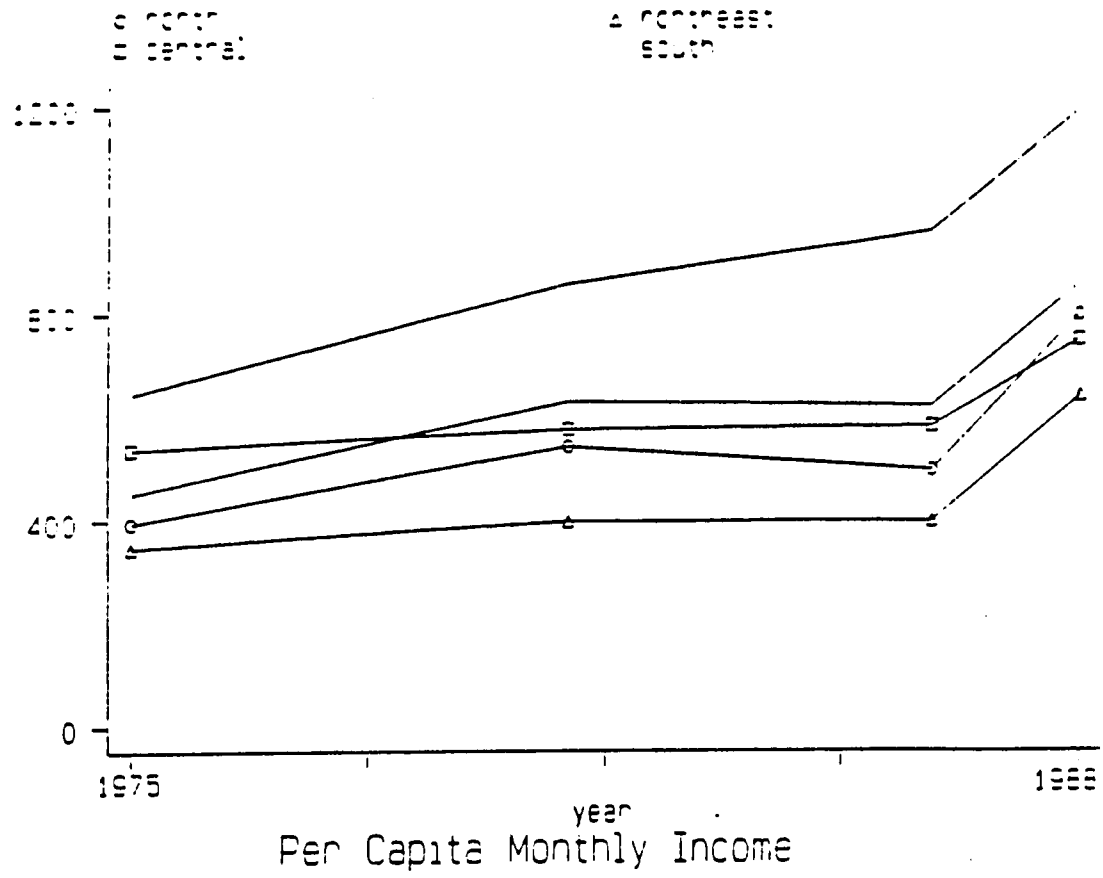

Figure 2: Regional Per Capita Monthly Consumption, 1975 Baht

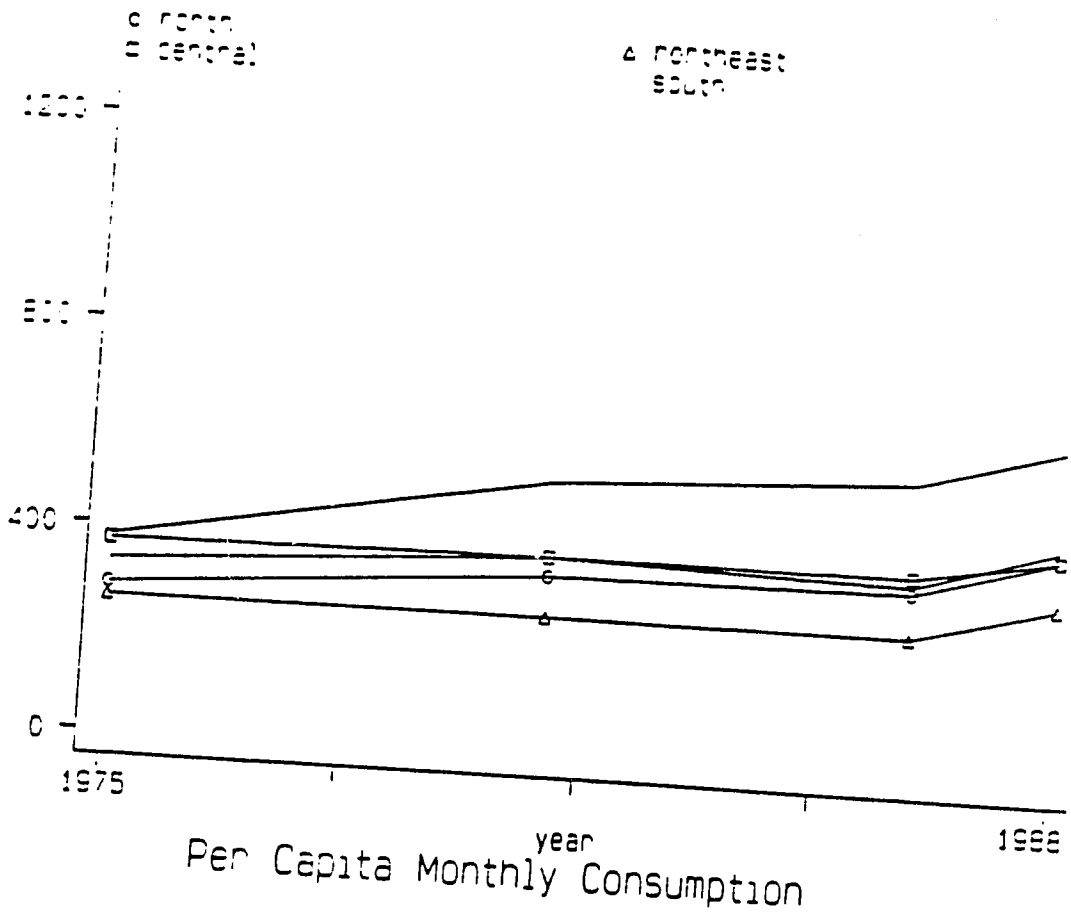

Table 1. Monthly Per Capita Income and Consumption by Region and Comparison With Bangkok						
	Kingdom	North	Northeast	Central	South	Bangkok
1 Average Monthly Per Capital Income (1975 Baht)						
1975	344	394	346	535	450	643
1981	577	540	396	574	628	856
1986	583	496	398	581	621	959
1988	858	799	640	750	859	1196
2 Average Monthly Per Capita Consumption (1975 Baht)						
1975	313	287	262	371	332	378
1981	366	341	262	379	378	523
1986	371	350	263	381	365	562
1988	460	428	335	428	448	640
3 Average Monthly Per Capita Income As a Percentage of Bangkok's						
1975	69 05	61.28	53.81	83.20	69 98	100 00
1981	67 41	63 08	46.26	67.06	73.36	100.00
1986	60 79	51 72	41.50	60.58	64 75	100 00
1988	71 74	66 81	53.51	62.71	71.82	100 00
4 Average Monthly Per Capita Consumption As a Percentage of Bangkok's						
1975	82 80	75.93	69.31	57.70	87.83	100 00
1981	69 98	65.20	50 10	44.28	72.28	100 00
1986	66 01	62.28	46 80	39.73	64.95	100.00
1988	71.88	66.88	52.34	35.79	70.00	100 00

Note Figures are for households residing for 10, or more, years in amphoes which are sampled at least twice. Income is equal to wages, profits from farming, entrepreneurial income and income-in-kind Consumption is made up of expenditures on food, clothing, shoes and tobacco

Table 2 Regional Patterns in Income and Consumption Growth

	Kingdom	North	Northeast	Central	South	Bangkok
1 Annualized Growth in Average Income (in percent)						
1975-81	4.37	5.25	2.25	1.17	5.56	4.77
1981-86	0.21	-1.70	0.10	0.28	-0.22	2.27
1986-88	19.32	23.84	23.75	12.77	16.22	11.04
2 Annualized Growth in Average Consumption (in percent)						
1975-81	2.61	2.87	0	0.36	2.60	5.41
1981-86	0.27	0.52	0.08	0.11	-0.70	1.44
1986-88	10.75	10.06	12.10	5.82	10.24	6.50
3 Annualized Average Change in Log Income (in percent)						
1975-81	2.86	4.46	1.73	1.04	4.52	3.38
1981-86	-1.04	-1.97	0.15	-3.79	-1.32	4.76
1986-88	6.47	8.93	8.41	5.85	5.47	1.21
4 Annualized Average Change in Log Consumption (in percent)						
1975-81	1.62	2.49	0.02	0.59	2.76	6.22
1981-86	-0.16	0.69	-0.62	-2.19	0.63	-1.43
1986-88	0.85	0.07	-2.31	2.18	3.56	-0.16

Panels 1 and 2 measure growth in income and consumption by taking the log difference of average income (or consumption) and dividing by the relevant number of years. Panels 3 and 4 present the average change in log amphoe income (or consumption), again divided by the relevant number of years. Figures are for households residing for ten or more years in amphoes which are sampled at least twice. Income is equal to wages, profits from farming, entrepreneurial income, and income-in-kind. Consumption is made up of expenditures on food, clothing, shoes and tobacco.

Table 3 Number of Sampled Households and Amphoes, by Year, Region and Occupation						
	Kingdom	North	Northeast	Central	South	Bangkok
1 All Households						
# of HH in Matched Amphoes						
1975	8299	2008	2599	1709	986	997
1981	8501	1784	2469	1637	923	1688
1986	7119	1633	1558	1691	1205	1032
1988	1905	431	347	321	403	403
# 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
2 Farm Households						
# of HH in Matched Amphoes						
1975	3948	1044	1586	762	381	175
1981	3590	890	1519	657	375	149
1986	2621	708	899	509	441	64
1988	365	94	86	59	107	19
# of Matched Amphoes						
1975-81	183	52	49	45	35	2
1981-86	29	9	4	4	11	1
1986-88	78	20	16	15	21	6
3 Rice Farming Households						
# of HH in Matched Amphoes						
1975	3634	967	1601	685	211	170
1981	3128	760	1432	568	209	159
1986	2011	562	795	383	208	63
1988	266	94	78	36	48	10
# of Matched Amphoes						
1975-81	162	51	46	40	23	2
1981-86	24	9	3	4	6	2
1986-88	62	19	16	13	12	2
4 Entrepreneurial Households						
# of HH in Matched Amphoes						

Table 3. Number of Sampled Households and Amphoes, by Year, Region and Occupation						
	Kingdom	North	Northeast	Central	South	Bangkok
1975	1627	323	422	324	256	302
1981	1586	296	315	330	216	429
1986	1285	273	185	355	250	222
1988	469	104	86	91	92	96
# of Matched Amphoes						
1975-81	172	44	38	47	34	9
1981-86	35	11	4	5	12	3
1986-88	111	25	21	23	28	14
Note All households must have resided in amphoe for ten or more years						

Table 4 Region, Year and Community Type Patterns in Income and Consumption Growth Rates

** = significant at 5% level, * = significant at 10%

		Different Occupation Groups								Different Measures of Income and Consumption			
	F test for:	All Households		All Farmers		Rice Farmers		Entrepreneurs		All Income	No In Kind	Wages	Food
		Y	C	Y	C	Y	C	Y	C	Y	Y	Y	C
1	N 75-81												
2	N 81-86			**									
3	N 86-88	**		**	**	**	**			**	*		
4	N	**		**	**	**	**			*			
5	NE 75-81											**	
6	NE 81-86												
7	NE 86-88	**	*	**	**	*		*	**	**	**	**	**
8	NE	**		**					**	**	**	**	
9	C 75-81												
10	C 81-86												
11	C 86-88	**	*	**	**	**	**			**	**		**
12	C	**		**	**	**	**			**	**		
13	S 75-81												
14	S 81-86			**									
15	S 86-88			**		*		**	*				
16	S			**									
17	B 75-81			**									
18	B 81-86												
19	B 86-88			**									
20	B			**									
21	U 75-81												
22	U 81-86			**									
23	U 86-88			**	**		**						**
24	U			**	**		**						
25	SD 75-81												
26	SD 81-86												
27	SD 86-88	**			**	*		**	**	**	**	*	*

Table 4 Region, Year and Community Type Patterns in Income and Consumption Growth Rates

** = significant at 5% level, * = significant at 10%

		Different Occupation Groups				Different Measures of Income and Consumption			
	F test for:	All Households	All Farmers	Rice Farmers	Entrepre-neurs	All Income	No In Kind	Wages	Food
28	SD	**			**	**	**		
29	R 75-81							**	
30	R 81-86			*					
31	R 86-88	**	**	** **	** **	**	**	**	
32	R	**	**	** **		**	**	**	
33	75-81							**	
34	81-86		**						
35	86-88	**	** **	** **	** **	**	**	**	**

Notes. This Table presents the results of F-tests for the joint significance of dummy variables from regressions given by equations (10) and (11) in the text. The dependent variables are demeaned income (Y) and consumption (C) growth rates. Where the division is by occupation, consumption is equal to expenditures on food, clothing, shoes and tobacco; and income is equal to wages, profits from farming, entrepreneurial income and income-in-kind. A * indicates that the test is significant at the 10% level. ** indicates significance at the 5% level. N = North, NE = Northeast, C = Central, S = South, B = Bangkok, U = Urban, SD = Sanitary District, R = Rural. Row 31, for example, presents results for the joint significance of all rural dummies for the years 1986 to 1988, regardless of region. Row 32 presents f-tests for all rural dummies regardless of region and year. Each column excludes households who have resided in the amphoe for less than ten years.

All Households Who Have Been in Amphoe Ten or More Years						
Table 5A Two Tests for Full-Risksharing 1) Measured Changes in Average Log Consumption and 2) Dummy Variables which Proxy for Fixed Effects, and estimates of the marginal propensity to consume						
Dependent Variable Change in Average Log Amphoe Consumption						
	Kingdom	North	Northeast	Central	South	Bangkok
1) Independent Variables Measured Changes in Region and Community Type Average Log Consumption (see Equation 7 in the text) and Change in Average Log Amphoe Income						
β (coefficient on consumption)	.3026 (2.639)	.3881 (2.295)	.2094 (.630)	.3346 (.964)	.2615 (.991)	.1376 (.405)
ϕ (marginal propensity to consume)	.3508 (12.699)	.3088 (6.035)	.2018 (3.331)	.3886 (7.054)	.3648 (7.126)	.5350 (3.715)
F test for Region and Community Type Effects	0086	.0239	.5302	.3377	.3248	.6889
2) Independent Variables Dummies for Region, Year and Community Type and Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	.3823 (12.575)	.4721 (6.659)	.3112 (4.610)	.3850 (5.961)	.3704 (6.874)	.5972 (3.900)
F test for Region and Community Type Effects	1033	.0261	.0810	.8575	.9807	.6670
3) Independent Variable Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	.3341 (12.522)	.3129 (5.993)	.2043 (3.391)	.3819 (6.991)	.3840 (8.108)	.5543 (4.142)
Note T-statistics are in parentheses.						

Farm Households Who Have Been in Amphoe Ten or More Years						
Table 5B Two Tests for Full-Risksharing: 1) Measured Changes in Average Log Consumption and 2) Dummy Variables which Proxy for Fixed Effects, and estimates of the marginal propensity to consume						
Dependent Variable: Change in Average Log Amphoe Consumption						
	Kingdom	North	Northeast	Central	South	Bangkok
1) Independent Variables: Measured Changes in Region and Community Type Average Log Consumption (see Equation 7 in the text) and Change in Average Log Amphoe Income						
β (coefficient on consumption)	.6264 (4.146)	1.2921 (4.878)	.5964 (1.987)	.0055 (.008)	.4343 (1.395)	.1346 (.264)
ϕ (marginal propensity to consume)	.1683 (7.022)	.0917 (1.872)	.0756 (1.317)	.2484 (4.796)	.1885 (3.490)	.2669 (3.476)
F test for Region and Community Type Effects	.0001	.0001	.0510	.3201	.1677	.7991
2) Independent Variables: Dummies for Region, Year and Community Type and Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	.1946 (6.567)	.1172 (1.899)	.0794 (1.018)	.2019 (3.251)	.2073 (3.429)	.3643 (5.106)
F test for Region and Community Type Effects	.0070	.0051	.1219	.1282	.8034	.1929
3) Independent Variable: Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	.1810 (7.407)	.0391 (.668)	.1302 (2.528)	.2484 (4.879)	.2147 (4.210)	.2630 (3.713)
Note: T-statistics are in parentheses.						

Rice Farming Households Who Have Been in Amphoe Ten or More Years						
Table 5C. Two Tests for Full-Risksharing: 1) Measured Changes in Average Log Consumption and 2) Dummy Variables which Proxy for Fixed Effects, and estimates of the marginal propensity to consume						
Dependent Variable: Change in Average Log Amphoe Consumption						
	Kingdom	North	Northeast	Central	South	Bangkok
1) Independent Variables: Measured Changes in Region and Community Type Average Log Consumption (see Equation 7 in the text) and Change in Average Log Amphoe Income						
β (coefficient on consumption)	.8765 (4.588)	1.6354 (4.252)	-.2594 (-.631)	1.9153 (4.158)	.5043 (1.423)	-.6335 (-.635)
ϕ (marginal propensity to consume)	.1580 (4.177)	.1540 (2.542)	.1193 (1.461)	.2205 (3.412)	.0201 (.181)	1.2201 (2.831)
F test for Region and Community Type Effects	.0001	.0001	.5307	.0001	.1627	.5600
2) Independent Variables: Dummies for Region, Year and Community Type and Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	.1280 (2.840)	.1619 (1.973)	.1304 (1.089)	.1718 (2.187)	.0192 (.161)	.8851 BIASED
F test for Region and Community Type Effects	.0014	.0009	.6482	.0089	.6173	NA
3) Independent Variable: Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	.1791 (4.587)	.2112 (3.119)	.1148 (1.419)	.2186 (2.978)	.0533 (.482)	1.1191 (2.978)
Note: T-statistics are in parentheses						

Entrepreneurial Households Who Have Been in Amphoe Ten or More Years						
Table 5D Two Tests for Full-Risksharing 1) Measured Changes in Average Log Consumption and 2) Dummy Variables which Proxy for Fixed Effects, and estimates of the marginal propensity to consume						
Dependent Variable Change in Average Log Amphoe Consumption						
	Kingdom	North	Northeast	Central	South	Bangkok
1) Independent Variables Measured Changes in Region and Community Type Average Log Consumption (see Equation 7 in the text) and Change in Average Log Amphoe Income						
β (coefficient on consumption)	.5160 (3.192)	.2617 (.667)	.9991 (3.594)	.8836 (1.528)	.3633 (1.187)	.1053 (.363)
ϕ (marginal propensity to consume)	4011 (11.458)	.3716 (4.934)	.5176 (7.101)	.3269 (2.972)	.3468 (5.462)	.6417 (7.060)
F test for Region and Community Type Effects	.0016	.5067	.0007	.1308	.2390	.8864
2) Independent Variables Dummies for Region, Year and Community Type and Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	4009 (10.564)	.3680 (4.301)	.4319 (6.284)	.3775 (3.127)	.3424 (5.117)	.6724 (6.583)
F test for Region and Community Type Effects	.3972	.9834	.0001	.5830	.9301	.8274
3) Independent Variable Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	.4152 (11.786)	.3708 (4.941)	.5143 (6.463)	.2862 (2.658)	.3721 (6.207)	.6418 (7.188)
Note T-statistics are in parentheses						

Income does not Include Income in Kind, Households Who Have Been in Amphoe Ten or More Years						
Table 5E Two Tests for Full-Risksharing 1) Measured Changes in Average Log Consumption and 2) Dummy Variables which Proxy for Fixed Effects, and estimates of the marginal propensity to consume						
Dependent Variable Change in Average Log Amphoe Consumption						
	Kingdom	North	Northeast	Central	South	Bangkok
1) Independent Variables Measured Changes in Region and Community Type Average Log Consumption (see Equation 7 in the text) and Change in Average Log Amphoe Income						
β (coefficient on consumption)	.3186 (2.606)	.3536 (2.052)	.0688 (.202)	.2318 (.604)	.3255 (1.212)	.3394 (.920)
ϕ (marginal propensity to consume)	.2144 (9.834)	.2619 (5.664)	.1223 (3.088)	.2370 (4.865)	.2868 (6.672)	.3902 (2.406)
F test for Region and Community Type Effects	.0095	.0428	.8407	.5475	.2288	.3659
2) Independent Variables: Dummies for Region, Year and Community Type and Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	.2586 (10.287)	.3169 (5.705)	.1861 (4.259)	.2565 (4.009)	.2952 (6.532)	.4859 (2.661)
F test for Region and Community Type Effects	.1550	.1900	.1309	.5432	.9284	.7154
3) Independent Variable Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	.2231 (10.274)	.2687 (5.736)	.1239 (3.212)	.2337 (4.844)	.3057 (7.609)	.4267 (2.720)
Note: T-statistics are in parentheses.						

Income Equals All Income, Households Who Have Been in Amphoe Ten or More Years						
Table 5F: Two Tests for Full-Risksharing 1) Measured Changes in Average Log Consumption and 2) Dummy Variables which Proxy for Fixed Effects, and estimates of the marginal propensity to consume						
Dependent Variable: Change in Average Log Amphoe Consumption						
	Kingdom	North	Northeast	Central	South	Bangkok
1) Independent Variables: Measured Changes in Region and Community Type Average Log Consumption (see Equation 7 in the text) and Change in Average Log Amphoe Income						
β (coefficient on consumption)	.3115 (2.783)	.3681 (2.280)	.0178 (.056)	.5049 (1.329)	.3090 (1.336)	.0602 (.183)
ϕ (marginal propensity to consume)	.3969 (13.658)	.3646 (7.055)	.3160 (4.964)	.3798 (5.567)	.4871 (9.102)	.6936 (4.200)
F test for Region and Community Type Effects	.0056	.0247	.9551	.1870	.1852	.8562
2) Independent Variables: Dummies for Region, Year and Community Type and Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	.5009 (15.320)	.4899 (7.755)	.5031 (7.447)	.4484 (5.514)	.4874 (8.588)	.7694 (4.431)
F test for Region and Community Type Effects	.0004	.0157	.0008	.1205	.9944	.6072
3) Independent Variable: Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	.4069 (13.992)	.3704 (7.028)	.3166 (5.075)	.3592 (5.384)	.5097 (9.994)	.7045 (4.652)
Note: T-statistics are in parentheses.						

Consumption Equals Food. Households Who Have Been in Amphoe Ten or More Years						
Table 5G Two Tests for Full-Risksharing 1) Measured Changes in Average Log Consumption and 2) Dummy Variables which Proxy for Fixed Effects, and estimates of the marginal propensity to consume						
Dependent Variable Change in Average Log Amphoe Consumption						
	Kingdom	North	Northeast	Central	South	Bangkok
1) Independent Variables Measured Changes in Region and Community Type Average Log Consumption (see Equation 7 in the text) and Change in Average Log Amphoe Income						
β (coefficient on consumption)	4341 (3.980)	.5638 (3.986)	4414 (1.561)	.2332 (.759)	4002 (1.326)	.2652 (.724)
ϕ (marginal propensity to consume)	.3161 (11.550)	.2906 (6.047)	.2315 (3.568)	.3995 (6.987)	.3317 (6.187)	4127 (2.637)
F test for Region and Community Type Effects	.0001	0001	1221	.4500	1884	4752
2) Independent Variables Dummies for Region, Year and Community Type and Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	.3714 (11.893)	.3960 (6.597)	3519 (4.855)	3857 (5.912)	.3456 (6.158)	4696 (2.728)
F test for Region and Community Type Effects	0156	0007	0471	5681	8766	7868
3) Independent Variable Changes in Average Log Amphoe Income						
ϕ (marginal propensity to consume)	3259 (11.728)	2914 (5.654)	.2348 (3.592)	.3917 (6.979)	.3582 (7.168)	4493 (3.059)
Note: T-statistics are in parentheses						