

## Informal Risk Sharing Agreements

So far we simply assumed that a well working insurance market existed. While in industrialized countries this is (most of the time) a valid working hypotheses we must not take this for granted in developing countries.

Reasons:

- political instability
- lack of judicial institutions
- etc.

Following “recent” developments in the theory of repeated games a huge amount of research has been dedicated to the analysis of situations where informal insurance schemes have to substitute for functioning insurance markets.

## Key Questions

- Can we implement the First Best Risk Sharing in the absence of markets / binding contracts?
- What is the structure of such informal risk sharing agreements?
- Which variables influence this structure?
- What are possible policy implications?

## **Kimball (1988): Farmers' Cooperatives as a Behavior toward Risk**

Kimball starts from the observation that medieval farmers had their fields scattered into small distinct pieces.

He challenges the then standard explanation of this structure as being a device for the farmers to insure themselves in the absence of formal insurance markets.

Though “diversification” is a reasonable thing to do if you are risk averse, it comes at a substantial price. Cultivating the fields becomes much more costly by having them scattered into small pieces.

Kimball now claims that sharing the risk in the village community would have been a superior means of providing insurance.

## Kimball's Model

- N identical farmers facing i.i.d. risk concerning their income  $y_t^i$  each period
- income is provided with a non-storable consumption good
- infinitely repeated interaction
- utility has CRRA and is intertemporally additively separable

$$u_t^i = E_t \sum_{s=0}^{\infty} \frac{u(c_{t+s}^i)}{(1 + \delta)^s}$$

The idea is, that a farmer with high income transfers resources to a farmer with low income. As the shocks are independent over time the farmers are able to smooth their consumption.

We know from Borch that in an First Best Risk Sharing Agreement individual consumption is solely determined by aggregate income in a community.

**The Borch condition tells us, that the ratio of marginal utilities has to be constant over all states of the world.** As all agents are identical a simple solution would imply sharing aggregate income equally amongst all members of the community in any one period.

The question is now whether this arrangement is implementable (i.e. self enforcing) in the absence of binding contracts,

Define the autarky payoff, i.e. the one without any transfers ( $y_t^i = c_t^i$ ) as  $V$ . This is the maximal punishment, i.e. the worst possible subgame perfect Nash Equilibrium.

Note that it is most profitable to deviate for a farmer in a state where he has highest possible payoff and the others have low payoff. If deviating does not pay in this situation it will never pay.

Now we solve for the critical discount factor such that deviating from the scheme and foregoing the benefits of future risk sharing does never pay. The sustainability constraint is given by

$$u(\bar{y}^i) + V \leq E_t \sum_{s=0}^{\infty} \frac{u(c_{t+s}^i)}{(1 + \delta)^s}.$$

This now implicitly defines a  $\delta^*$ . For all discount factors above this threshold (i.e. for the future being sufficiently important) the First Best Risk Sharing is implementable.

Kimball furthermore finds that **a larger  $N$  (group size) unambiguously improves the situation** (i.e. the quality of risk sharing). So the optimal group size is infinity. (cf. Genicot and Ray (2002) below)

Summing up Kimball argues that the scattering of the fields cannot be satisfactorily explained by the insurance argument as farmers would have had access to mutual risk sharing agreements of the type described above without incurring the efficiency loss from cultivating only small pieces of land.

Problem 4–3 deals with a simplified version of Kimball’s result.

## Townsend (1994):

### Risk and Insurance in Village India

Townsend analyses an interesting data set for three Indian villages where he has information on income and consumption.

He finds on the one hand that aggregate income is an important determinant of individual consumption but on the other hand consumption varies considerably with individual income.

Whereas the first finding suggests that there is mutual insurance going on the second finding clearly rejects the hypotheses that this risk sharing is First Best.

Further tests:

|                         |                                |
|-------------------------|--------------------------------|
| Deaton (1992)           | Cote d'Ivoire, Ghana, Thailand |
| Udry (1994)             | Northern Nigeria               |
| Grimard (1997)          | Cote d'Ivoire                  |
| Lund & Fafchamps (1997) | Philippines                    |
| Dubois (2000)           | Pakistan                       |



## Coate and Ravallion (1993):

### Reciprocity without commitment

While Kimball focused on the question whether First Best Risk Sharing was in principle implementable, Coate and Ravallion pose another question. What does the Second Best (i.e. given the discount factor) implementable Risk Sharing Agreement look like?

Is this model able to better explain the Data?

They try

- to precisely pin down its structure and
- to identify the situations when divergence from the First Best is largest.

They use Kimball's model with only two farmers and focus on

- symmetric (the transfer from A to B is the same as from B to A if the incomes are inverted) and
- stationary (transfers do not depend on histories but only on the current state) equilibria.

Furthermore they assume CRRA preferences.

## **Results**

As noted above First Best would imply here that the transfer equals exactly half the difference between the two incomes. I.e. consumption is always half of the periods aggregate income.

The transfer in the best implementable scheme equals

- either the First Best transfer (half the difference between the two incomes)
- or the maximal implementable transfer (such that the sustainability constraint just binds).

**In First Best the transfer just depends on the income difference** (that corresponds to consumption only depending on aggregate income) and not on the respective income levels.

**In Second Best this changes.** If the Second Best scheme differs from the First Best scheme this divergence is largest for low income levels.

For low income levels the marginal utility from income is highest, thus incentives to deviate and keep the transfer are highest.

To see that consider the two situations:

**Fix A's income and lower B's income.** Once the constraint binds there is no scope for additional transfers. Hence the divergence grows.

**Fix B's income and increase A's income.** Once the constraint binds there is no scope for additional transfers. Hence the divergence grows again.

Very much in line with Kimball's original finding they find that divergence from First Best increases, too, if the **discount factor**  $\delta$  decreases.

They offer a nice interpretation of that. When there is an increase in mobility in developing countries the probability of future interaction decreases (i.e.  $\delta \downarrow$ ) and the scope for informal risk sharing decreases.

Another intuitive result concerns the structure of the risk. If you allow for correlation in income shocks the value of the risk sharing decreases in the degree of correlation of the income shocks. (I.e. if the scope for mutual insurance shrinks, mutual insurance itself becomes less valuable.)

## Kocherlakota (1996): Implications of Efficient Risk Sharing without Commitment

Kocherlakota now takes the next step and **allows for more general transfer schemes** than Coate and Ravallion.

His focus is on trying to explain Townsend's data better than Coate and Ravallion. Whereas they can explain why both current aggregate and current individual income are important in determining current consumption they can't explain the fact that lagged income also seems to be an explanatory variable for current consumption.

Kocherlakota basically uses the same model as Coate and Ravallion but allows transfers to depend on histories as well (i.e. abandons stationarity).

As Coate and Ravallion he finds that for large income differences the transfer is bounded by the sustainability constraint. But he also finds that there

are intertemporal effects as well.

We can implement a larger transfer in a state with high income difference if we reward the well off household with larger consumption (as compared to a stationary transfer scheme) in the following periods. That is we smooth shocks not only over states but also over time.

This feature helps to explain why lagged income influences current consumption.

Also we find that the richer setting gives scope for improvements.

## Ligon, Thomas, and Worrall (2002): Informal Insurance Arrangements with Limited Commitment

Ligon, Thomas, and Worrall now restrict Kocherlakota's model a bit and give more structure to the problem. This allows them to characterize the Second Best Risk Sharing Arrangement by a simple updating rule.

This simple updating rule uses the fact that in First Best the ratio of marginal utilities should be constant. Now in Second Best the change in this ratio of marginal utilities has to be minimized s.t. the sustainability constraint holds.

In addition they try to calibrate the model on Townsend's data set. Their model does better in explaining these data than the full insurance, the stationary limited commitment or the autarky model.

However there is a problem that the model is not capable of explaining the dynamic properties and the



idiosyncratic shocks over income in one period in the data at once. It can explain either the first or the second observation well.

Ligon, Thomas, and Worrall offer several explanations for that shortcoming.

- assuming CRRA preferences instead of IRRA
- assuming away the possibility of credit market transactions or intertemporal production

Especially the latter point seems to be a fruitful area for future research. There seems to be evidence that shifting ownership on storable assets is used to smooth consumption and improve the scope of informal mutual insurance.

## Attanasio and Rios–Rul (2000): Consumption Smoothing in Island Economies

Attanasio and Rios–Rul analyse the impact of a compulsory public insurance scheme on the performance of an informal mutual insurance scheme.

Their finding seems *prima facie* counter intuitive. Introducing public insurance might have a detrimental effect overall.

Why is that? The public insurance scheme improves the autarky utility level thus making the punishment less severe and thus making an informal mutual insurance scheme harder to sustain.

This has important implications for development policy.

## **Genicot and Ray (2004):**

Genicot and Ray tackle the problem of sub optimal mutual insurance from another angle. They focus on the fact that it is not only that transfers are bounded in Second Best Risk Sharing Agreement but also that the group size is smaller than the previous models would suggest.

While Kimball (1988) finds that the optimal size of the “cooperative” is infinite, Genicot and Ray find that there is always a finite bound on that group size.

They apply the concept of coalition proofness and require that a Risk Sharing Agreement has not only to be robust against deviations by a single individual but also against group deviations.

This is a harder requirement as now the deviating group can set up a Risk Sharing Agreement only amongst its members which is still better than autarky.

Using that they find that optimal group size is always

finite.

They make an additional interesting observation. An **increase in the need for insurance** (either via an increase in risk aversion or via a riskier environment) has non-monotonic consequences for the degree of risk sharing. It can happen that the maximum stable group size decreases.