**Miscellaneous Issues in Agriculture**
*or Are Collectives (and even landlords) Bad?*

**Issues Overview:** Village life encounters – highlights – issues pervasive in economic life. How should entities structure work? In Mao's China, instability in rural institutions confronts us with a range of organizational choices and at least some data on their strengths and weaknesses. Given the overall evaluation of Mao, our natural tendency is to emphasize the drawbacks of communes and teams, but we need to keep in mind that agricultural output more than kept up with population growth, contrary to the expectations of many. We've seen this in the Maoping video and read about it in Li's *Village China*.

The models below (as with *any* model) are *deliberate simplifications* that (in this case) focus on labor inputs. Seeds, fertilizer, pest and weed control, tools, skill, management resources – all are left out, as are implicit (and often explicit) credit flows to cover the gap between irregular income and the need to eat and obtain seeds and so on between harvests.

[*Keep in mind that most of your working life will be spent in teams within large organizations, doing work that is hard to monitor in terms of either individual inputs or outputs.*]

**Incentives: Share Tenancy:**     Here is the core of a formal model, which is *not* specific to agriculture!

In practice, output quantity varies, as does price, though quantities vary at the local level – weather, pests –while prices are regional or national. Furthermore some farmers are more skilled or harder workers than others. Why output is high or low is hard (as economists, "costly") to observe, and even measuring output isn't always easy. So how best organize production? (As to price, the quantity aspect of an overall good [*bad*] harvest will be partially offset by low [*high*] prices.)

Let's analyze a variety of rental and sharecropping alternatives. As a general but still simple (linear) model, parties choose the share of output and rent level (**s, R**). With quantity **Q**, risk **θ**, we then get income $Y = (θQ)s - R$, which is linear in revenue $θQ$. We can think of risk as both a measure of fluctuations in local quantity and in the regional or national market price – both affect agriculture.

For analytic purposes we don't need to specify where risk θ comes from, only that it exists (with mean $μ = 1$). Furthermore, competitive markets mean that as a first approximation the income (in economic jargon, "rent") that accrues to land should be the same independent of organization, ditto that which accrues to labor. So for clarity let's normalize quantity at **Q=100** and the rental income for land and labor income as 50% each so **r = w = 50**. The contract is $Y = s*100*θ - R$. Again in a bad year q is low, in a good year high, with an average value of θ = 1 under some specified probability distribution.

This linear framework allows us to distinguish several common institutional arrangements found in agriculture, as follows:

| | | |
|---|---|---|
| for an owner-farmer: | **s** = 1, **R** = 0 | (owner supplies all inputs, gets all output) |
| for rent tenant: | **s** = 1, **R** > 0 | (fixed rent paid but gets all output) |
| for share tenant: | **s** < 1, **R** ≤ 0 | (shares output, owner may supply inputs) |
| for a laborer: | **s** = 0, **R** < 0 | (no output share, fixed "wage"). |

Why, though, might a would-be farmer ever agree to a share-type agreement? Similarly, what's in it for the landlord? Finally, how does this analysis help us understand the Chinese countryside, before, during and after Mao? To guide you, fill in the following table.

**Farm Organization**

| Type | Labor | Risk | Wealth Needs | Investment Incentive | Contract Length |
|---|---|---|---|---|---|
| Laborer | weak | v low | low | – | – |
| Share Tenant | good | some | some | low | – |
| Rent Tenant | strong | high | high | varies ==> | better if long |
| Owner | good-strong | some | (have) | strong | – |
| Landlord | ?irrelevant | v low | (have lots) | varies ==> | better if short |

- What incentives do the parties have for varying the quantity (quality) of labor, for working hard?

- How does risk vary, compare for example what happens when $\theta = 0.5$ and $\theta = 1.5$.

- What incentives are there to invest in (or at least care for) land? Consider for example an investment of 100 that raises the normal yield to 150.

- What wealth is required? How might that (and skill, and labor availability) evolve over the life cycle of a farm family?

- Are there any other distinctions, e.g., investing with one-time *versus* long-run contracting?

Note that physical issues are important but separate from this model - subtropical and particularly tropical ecosystems tend to have finely subdivided plots of land, and farmers may not have "rights" to contiguous plots. That diversifies risk when crops vary to match variable soil types (in tropical ecosystems microclimates can differ over short distances), and may likewise lessen the hit from local pest infestations, variations in weather, and external shifts in demand, while spreading the workload when the harvest and planting season (e.g. for rice) differ in timing from that of other crops (e.g., mulberry and silkworms). So you may want to rent out one of your two plots to get a different type of plot, or you may want to "rent in" to cut down on travel time, which can add up to a non-trivial 8% of the day (1/12th of output). Likewise you may want to rent out or rent in land as you marry, as your children are toddlers demanding parental time and then young adults contributing to farm tasks, and then marry out as your own physical vigor lessens. Labor supply and tolerance for risk shift in predictable patterns.

This is a "first pass" analysis. In the real world contracts are mixed – the landowner (Communist Party!) may specify what is planted ("grain") while fixed costs (seed, fertilizer) are split. Cash flow varies across the agricultural cycle in a monetized system, so credit markets matter (though in China they may occur through implicit rather than explicit financial transactions). Empirically, it's not unusual to find rural households who are simultaneously landlords and tenants (e.g, because families have swapped who works a specific piece of land), and may both hire in and hire out labor at different points of the year. (In pre-1960s US "summer vacation" wasn't for the benefit of children, but for the needs of the farm.)

Our simple linear model doesn't capture all these related aspects; it is a however a useful starting point…


**Incentives: Teams** – Theory and Empirical
- large teams are unstable; huge efforts can be called forth but are hard to maintain
- small teams can work well with experience and leadership
- leadership requires stability and acceptable goals or ideals
- labor surplus (lack of outside opportunities) makes directing efforts to joint projects easier

Query: how important are pecuniary incentives?


A simple team model:

Output is directly proportional to effort, but effort is personally costly. With one person, what is the relationship between effort and team income? (Let your effort increase by 10% – then output increases by 10%, and income by 10%…)
- with 10 people? – how does your income change if you increase effort by 10%
- with 100 people? – ditto!
- with 1000 people.

What implicit assumptions are there in the link between effort and income in this example? Think!!

When is a "team" not a team? In weeding a field, output is cumulative, more man-hours, woman-hours and child-hours means more weeds pulled. How about in football? – does the score improve if only one person plays harder? In consulting a weak member can undo the work of the entire group, but the bias may be the opposite: the "rain maker" is more important than the rest of the group added together, as long as in the aggregate they exhibit some modicum of competence.

**Hierarchies** – Information Flows. We can reconfigure the above problem as one of information.

- the span of control (subordinates per supervisor) is limited by the ability to observe and process information - in US corporations the span is a dozen or fewer people in white-collar jobs.

- when the number of workers is large, limited span means hierarchy. the big boss may have a dozen "reports" and each of them a dozen. with 144 subordinates the information flowing up to the big boss gets summarized and averaged. add another layer and the big boss is tracking 1,554 workers. and just as information is lost as it moves from foreman to shift manager to plant manager to production VP to manufacturing-purchasing EVP to CEO, so to the general directive of the CEO gets expanded and reinterpreted to provide concrete guidance to those doing the nitty-gritty of actual work.

- over time an organization can standardize work and subdivide routine, repetitive tasks, thereby increasing specialization and improving coordination and thereby efficiency. but that has a downside: instability and change become the enemy of effective bureaucracy, be it structural shifts in demand, in input markets or products – or of quirky CEOs (and Mao was more than quirky).

- even in a stable environment exceptions arise. hierarchies thus require "fixers" to handle exceptions to the routine, and are not robust to changes in technology and needs. comedies about companies (or the army) often feature a sergeant or equivalent who swaps favors to get things done and save the day … in a manner that at a deeper level is fundamentally dishonest, adding to the comic tension. to rephrase: in a bureaucracy a certain amount of corruption isn't just tolerated, it's necessary.

- so while we didn't discuss hierarchies in class, they are implicit in any discussion of teams – and as with the Great Leap Forward, they can run amok. but as the economy marketized and decentralized, the boundary between bending rules to make the system work, and bending the rules to make the system for you shifted. working in the gray area became immensely profitable, which was not the case as long as it was internal to the bureaucracy.

**To Sum:**

- ***risk*** *may* matter, but its role is hard to evaluate and may be overstated

- ***pecuniary incentives*** (piece wages) are strong but aren't everywhere applicable. agriculture entails a tremendous variety of tasks, and needs flexibility from day to day in the tasks to be performed. "get to work" is ambiguous, unlike in a factory or firm with a narrow job description.

- ***monitoring*** by a boss may not work, but with ***experience*** and ***continuity*** team-based production can and does work – after all, most of the US economy depends on team-based effort. Monitoring alone does not solve the problem of how the team ought to manage the mix of skills and work habits, but skilled management can help in matching tasks and individuals on a fluid basis. Incentives include a big sense of esprit d'corps – in OECD economies team-level pecuniary incentives are unusual.

- ***self-employment*** provides strong incentives but no ***economies of scale,*** one benefit of collectivization (be it teams or communes).[1] of course a commune may be an extreme solution to problems where some less drastic form of local government is adequate. but before Mao there was no reliable mechanism for local government to collect and redistribute resources. taxes, such as they were, were for the benefit of the empire - even if good rulers then would remit some back for local uses.

- ***on-going contracts*** provide different incentives than ***one-time*** contracts

  - empirically validating this is difficult: ***informal*** practices likely provide substantial security of tenure in China, even though ***formal*** property rights to land rest solely with the State.   (of course on paper there is security of tenure for 30 years or so, but the local government is also the local court...) historically property rights were multi-layered and subject to local tradition. so there may be less change than meets the eye. good anthropology is needed to sort all that out (the Buck family, of Pearl Buck fame, did some of that).[2]

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[1] Outside contractors are a potential substitute for internal production – in the North American midwest steam tractors would go from farm to farm, starting in Kansas and ending in Manitoba.

[2] See Scott, James C. *The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia*. Yale University Press, 1976.  There is an extensive empirical literature on tenancy in Japan and in the Philippines – Keijiro Otsuka is a prominent contributor to that research paradigm.

- as we will see, land rights impede migration because of the need to be a "member" of the village (and at least on paper to farm contracted land) to maintain the rights to land, which are valuable but as a first approximation cannot be sold. this is effectively an "option" to maintain a right for such time that markets extend to rural land. but along with labor (again, on paper) it does require paying the grain tax, and the State's quota is high enough that it's hard for a migrant worker to simply buy the requisite grain. someone has to stay on the farm.

**Conclusion** – Information Economics and Incentives

- in general neither inputs (effort / skill) nor outputs (quantity / quality) are readily observable

- monitoring is hard, either in teams or in standardized tasks.

- problems are fundamentally unsolvable. strong incentives don't work well, risk and side effects complicate "simple" schemes.

- management isn't and never will be a science! – but we can see things that *don't* work...

<u>**Challenge for later in the term:**</u>
**In what ways does this analysis carry through when applied to the "dual-track" reforms of SOEs (State-Owned Enterprises) that we study later this term?**

Contract for good "i": output $Q_{io}$ with government as part of "the plan" with inputs $C_{ii}$ given under "the plan"

If efficient, squeeze out extra output $\Delta q_{io}$ with inputs $\Delta c_{ii}$ and market prices $p_{io}$, $p_{ii}$.

When consumer goods are newly permitted there is "pent up" demand so prices can be high … while you may be able to obtain inputs close to old plan prices that don't reflect new-found scarcity. Also firms tend to hoard goods – under "the plan" everyone had an incentive to build up inventories of inputs. Since those were squirreled away under "the plan" their marginal cost is nil!

In that case profits are … $Q_{io} - C_{ii} + p_{io}\Delta q_{io} - 0 \cdot \Delta c_{ii}$ and … boom goes the economy.

In the background is gaming the system. Through happenstance some producers initially face unfavorable prices or costs, and so don't benefit from boosting output (indeed, they lose!). Since failing to meet the plan has unpleasant consequences, such producers only do the minimum work needed to (barely) meet their target of $Q_{io}$. (After a character in Dickens, this is called the "Micawber Effect" after the impecunious Mr. Micawber in ***David Copperfield***: … six pence short on rent is disaster, six pence to the good – well, six pence isn't worth much.) Of course, some firms face high prices for their output and low prices for their inputs, and excel. But under the plan senior managers or government officials face the temptation to bump up goals; this is know as the "ratchet effect." Workers and sub-managers are caught between Scylla of Micawber and the ratchet of Charybdis, damned if they do well and damned if they don't.

*Note that under "the plan" there will be prices $P_{ii}$ and $P_{io}$ for book-keeping purposes. Since these aren't "real" prices there's no reason to worry about whether an enterprise makes a paper loss or a paper profit; prices merely help keep track of what is going on. In the background there is thus an entity called a "bank" that "lends" money when a firm has a deficit and collects "deposits" when a firm has a surplus. It is a mistake to think that this has anything to do with what we call a "bank" or that a "deficit" or "surplus" are the same as "profit" since they do not guide decision-making. Meeting the physical target of "the plan" was (almost) all that mattered.*

*A W&L example of the "ratchet" in a downward direction: what happens the next year to an IFC allocation if an organization doesn't use up their budget by the end of Spring?*