

Department of Economics

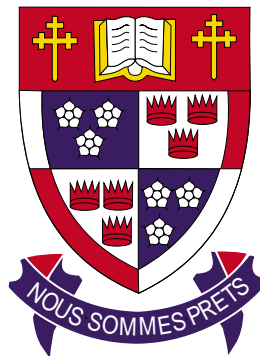
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Open Fields, Risk, and Land
Divisibility

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Abstract

Why were open fields pervasive in the middle ages? Our findings support the general contention that behavior towards risk explains the persistence of open fields, but we reject the mechanism of diversification via scattered landholdings. Simulation analysis is used to estimate the relative efficiency of alternative forms of insurance available to peasant households. We find that, for the vast majority of peasants, self-insurance through land accumulation was a superior risk management/wealth accumulation strategy, but only if land could be transacted in small parcels. Scattering existed because it transformed land into a divisible saving instrument.

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1. INTRODUCTION

Before the eighteenth century, the majority of grain produced in North Western Europe was grown on open fields: scattered plots of unfenced land, most often subject to communal decision-making. A relatively small proportion of grain was produced on enclosed holdings: consolidated blocks of fenced land under the exclusive control of individual peasant households. Explaining the origin, persistence, and final dissolution of open field agriculture is the subject of one of the great debates in European economic history. The literature may be usefully split into two strands. One strand concerns the timing of enclosure.¹ The other strand attempts to resolve the puzzles of open fields: Why did they persist and how can this persistence be reconciled with their perceived inefficiency?² These strands overlap. Our central question is: why did peasants scatter their land in the middle ages?

McCloskey set the focus for the current literature in a long series of papers.³ Rejecting traditional rationales for open fields—e.g., egalitarian preferences, partible inheritance, ploughing technology, etc.—McCloskey hypothesizes that peasants suffered the inefficiencies of open fields in return for insurance via diversification of land types.

Our findings support the general contention that behavior towards risk explains the persistence of open fields, but we reject McCloskey's diversification hypothesis. Simulation analysis is used to evaluate the relative efficiency of alternative forms of

¹ Allen (1994, p. 98) reports that in England, open fields comprised over 50 percent of farmland in 1500, 29 percent in 1700, and 5 percent in 1914.

² McCloskey originally argued that the cost of open fields was large—perhaps 10 percent of output. Recent work by Clark (1998a) implies a much smaller productivity advantage for enclosed holdings but does not resolve the puzzle of open fields in the middle ages.

insurance available to peasant households in the middle ages. Our central finding is that, for most peasants, saving through land was a superior risk-management/wealth accumulation strategy, but only if land could be transacted in small parcels. Scattering existed because it transformed land into a liquid saving instrument.

2. THE DEBATE

The modern debate over open fields and risk begins with McCloskey and Fenoaltea.⁴ McCloskey argues that scattering diversified each individual peasant household's portfolio of land holdings, lowering the variance of harvests, and thereby lowering the consumption risk associated with disastrous harvests. But diversification also lowered the mean harvest. McCloskey views this lower mean as equivalent to an insurance premium. Fenoaltea asserts that grain storage on consolidated holdings was a cheaper form of insurance than scattering. In consequence he views the decision to scatter as independent of insurance considerations.⁵ Another potential source of insurance was income pooling, as explored in Kimball's research on the formation and function of farmers' cooperatives. From Kimball (1988, p. 231), "It is...*possible* that some crucial obstacle can be found that prevented effective sharing arrangements in virtually all of Medieval England, but at a minimum, an explanation for the failure of cooperative insurance must be added to the explanation by those who claim that the scattering of plots in the Open Field System persisted as a mode of insurance" (Kimball 1988, p. 231).

³ McCloskey (1972, 1975a, 1975b, 1976, 1977, 1979a, 1979b, 1980, 1989, 1991).

⁴ See McCloskey *op.sit* and Fenoaltea (1976, 1977, 1988).

⁵ Fenoaltea also denies that scattering lowered mean output in the middle ages, arguing instead that open fields existed because of cost savings in the allocation of labor.

A curious feature of this debate is that the participants appear to demand a corner solution in which one insurance strategy dominates all others. McCloskey argues that peasants insured by diversifying their portfolio of land holdings. Fenoaltea argues that they insured through saving. Kimball's analysis implies that that they should have joined an insurance pool. These positions seem strange from a modern perspective where agents simultaneously diversify their assets, save for a rainy day, and pool risk through the purchase of insurance. One of the issues we address is the potential benefit of utilizing a portfolio of strategies.

3. OUR SIMULATION STRATEGY

Simulation analysis offers an efficient method for examining the questions of the debate. Given estimates for the distribution of harvests under open and enclosed fields, we simulate the outcomes peasants would have experienced conditional on alternative methods of insurance. Simulation analysis allows us to rank alternative insurance strategies and to explore the robustness of their relative ranking to changes in critical parameters.

McCloskey has given us a unit of account with which we can compare insurance strategies—the “Probability Of Disaster” (POD), where disaster is defined as “debt, hunger, disease or, in the limit, death by starvation” (McCloskey 1976, p. 131). We assume, following McCloskey, that the set of potential harvest realizations is described by a (truncated) normal distribution. The parameters describing this distribution are initially taken from McCloskey (1976), as is the level of disaster. The distribution

describes a peasant holding of 20 acres of land—the representative medieval landholder that both McCloskey and Fenoaltea credit with determining the layout of village fields.

The simulation works as follows: each period agents realize an output draw from a specified distribution; the output draw is compared to subsistence; if an agent realizes a deficit outcome he experiences disaster. After the consumption of all agents has been calculated the process is repeated for the next year. To this basic algorithm we add various consumption-smoothing strategies. Given a distribution of harvests and an insurance strategy we compute the number of disasters per year in a population of peasants—the number of disasters divided by the population of agents yields the POD. We also calculate levels of consumption associated with alternative insurance strategies and target PODs.

We benchmark the algorithm by fixing the number of years in the simulation at 50 and generating McCloskey’s calculated PODs—7.5 percent on scattered land and 10.8 percent on consolidated land. The simulation converges to these probabilities with 75 agents; with 200 agents fluctuations in the simulated PODs approach zero. We set the default number of agents at 300. The simulated results over 50 years with 300 agents are presented in Table 1.

Table 1: McCloskey’s Results Relative to Simulated Values.

	Avg. Income	Standard Deviation	Probability of Disaster	Frequency of Disaster
McCloskey				
<i>Consolidated</i>	110	48.4	10.8%	9.3 years
<i>Scattered</i>	100	34.7	7.5%	13.4 years
Simulated				
<i>Consolidated</i>	110	48.4	10.9%	9.2 years
<i>Scattered</i>	100	34.7	7.7%	13.0 years

4. SIMULATING THE OPEN FIELD DEBATE

We illustrate our simulation approach with reference to the debate.⁶ Two results emerge. First, conditional on using central parameter estimates, diversification fails as an explanation of scattering. Second, parameter values, for which we have only approximate estimates, critically determine the relative ranking of alternative strategies.

A. Storage versus Diversification

Let peasants save a fraction, $s(k_t)$, of their total stock of stored grain, k_t , (which includes the current harvest).⁷ Let the stock of grain depreciate at an annual rate of δ_s (which we set to 10 percent).⁸ The peasant's problem is therefore,

$$\text{Max} \sum_{t=0}^T \beta^t U(C_t(k_t))$$

subject to,

$$k_t \leq (1 - \delta_s)k_{t-1} + y_t - c_{t-1}$$

$$k_t \geq 0$$

$$c_t \geq d$$

with the solution taking the form of

⁶ In the simulations below we use the variance and subsistence parameters from McCloskey. For the difference in mean output between scattered and enclosed holdings we use new estimates by Clark (1998a)—i.e., instead of a difference in mean outputs of 10 percent, we use 4 percent.

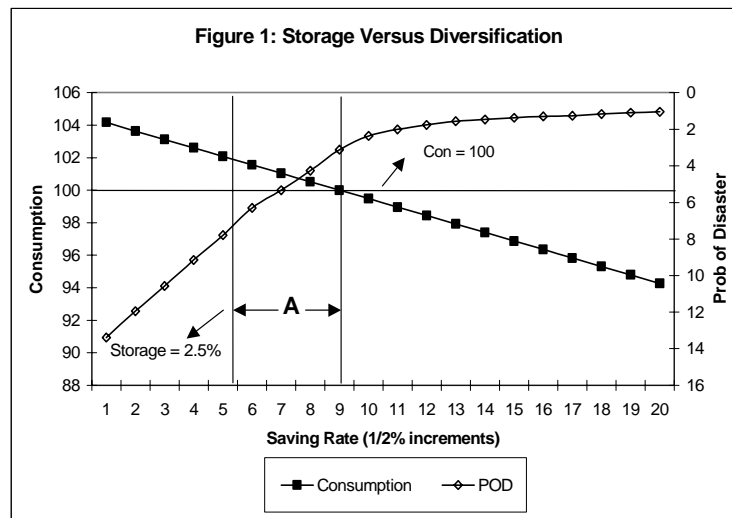
⁷ Our storage simulation works as follows: An agent draws an output realization; last periods savings depreciate and are added to this periods output; a subsistence consumption bundle is subtracted; the agent is checked for having experienced disaster.

$$c_t = [1-s(k_t)]y_t$$

$$c_t^* = \text{Max}[d, (1-s(k_t))y_t]$$

where β is the time rate of discount, y_t is the current harvest, c_{t-1} is consumption last period, c_t is current consumption, d is subsistence consumption, $s(k_t)$ is the saving rate on wealth.

Since we are only interested in an ordinal ranking of insurance schemes we do not specify a utility function to solve for the optimal $s(k_t)^*$. Instead we simulate a peasant's POD and average consumption for a range of saving rates. Both POD and consumption are decreasing in savings; both are plotted in Figure 1.



To the right of the first interior vertical line, the POD for storage is less than that of scattering (i.e., less than 7.4 percent); above the horizontal line mean output for storage is

⁸ There is general agreement on the physical rate of depreciation from storage: peasants could expect to lose about 10 percent of their carryover to rats, mold, and rain.

higher than under scattering (i.e., greater than 100). Thus, over range A, peasants who store are both safer and richer than those who diversify their landholdings. To replicate the POD on open fields we calculate that peasants would need to save around 2.5 percent of their wealth each period and would enjoy an average consumption of 102. Storage on enclosed holdings dominates diversification.

B. Pooling versus Diversification

Let r_i be a peasant's net contribution, from current income, to a village pool which redistributes to those experiencing a disaster harvest.⁹ Also let pooling entail costs. Redistribution pools are public goods typified by problems of moral hazard and adverse selection. In addition, pooling with heterogeneous agents involves cross subsidies, which are costly to wealthier participants. While Kimball does not measure pooling costs he does offer a rationale for their being modest.¹⁰ We model pooling costs by requiring that a portion of the pool's revenues be expended in its maintenance. Pooling costs can be thought of as the opportunity cost of time spent by peasants in visiting their neighbors, the cost of monitoring other peasants' income and labor inputs, administration costs for collecting and dispersing payments, etc. We do not allow the pool to carryover through

⁹ This pooling scheme differs from Kimball's. Peasants contribute to the pool and maintenance costs are subtracted. Only peasants below "d" draw from the pool, bringing them up to "d." Any remaining pool resources are remitted back to contributors. Kimball investigated full income sharing arrangements. Our scheme corresponds more closely to medieval pooling practices and is efficient with respect to POD.

¹⁰ Also see Offer (1997). The central point is that monitoring and enforcement of obligations are often by-products of socializing, a highly valued activity.

time, and thus all unused pool resources are rebated back to peasants on an equal share basis. The peasant's problem is,

$$\text{Max} \sum_{t=0}^T \beta^t U(C_t(p_t))$$

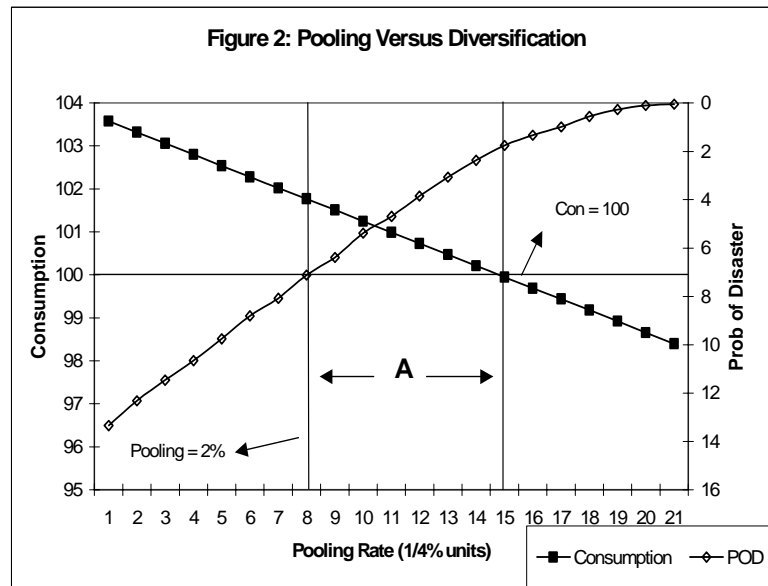
subject to,

$$p_t = \left[\sum_{t=0}^{50} y_t * r_t \right] (1 - \delta_p)$$

$$c_t^* = \max[d, y_t(1 - r_t)]$$

where p_t is the value of the pool at time t , δ_p is the maintenance cost/depreciation rate for contributions to the pool,¹¹ and the other variables are defined as above.

In Figure 2 we plot the POD and average consumption for a peasant following a pooling strategy.



As with storage, the POD on scattered fields serves as our benchmark, and as with storage pooling dominates diversification over range A. To achieve a POD of 7.4 percent a peasant would need to pool just under 2 percent (net) of their income, enjoying an average consumption of 102 units.

The implication of our pooling simulation for the choice of scattering versus enclosure is complicated by additional considerations. Two cost related arguments suggest that peasants who choose to participate in pooling arrangements might also choose to scatter their land. The arguments are based on the advantages of scattering in combating the problem of moral hazard.

If peasants are free to choose the technology of farming (what to plant, when to plant, etc.), and there is a difference between the risk profiles of those choices, pooling will involve moral hazard. Peasants, knowing that they are protected from downside risk by membership in an insurance pool, have an incentive to choose a risky crop profile. At the same time, they would be reluctant to join an insurance pool that included peasants like themselves. Thus an equilibrium with income sharing may not be supported. A primary reason that open fields are considered inefficient is that they required costly communal decision making.¹² However, in the context of trying to avoid the Nash outcome described above, communal decision making can be seen as an efficient way to arrive at consensus concerning the types of behavior that will be supported in an income pooling arrangement.

¹¹ We set $\delta_p = 0.2$ —i.e., we assume that 20 percent of contributions to the pool are used up in pool maintenance.

Another cost minimizing attribute of open fields is the provision of inexpensive monitoring of agents who belong to the pool. The stability of the pool is enhanced when members are able to ascertain each other's income and labor effort. If the cost of this information is too high the survival of the pool is jeopardized. In open fields peasants can directly observe the crop size and the labor effort of peasants working adjacent plots. Peasants hidden from each other by enclosed holdings monitor at higher cost.¹³

What exactly are the relative costs of pooling on open rather than enclosed fields? Are they large enough to justify scattering? The fact that we cannot answer these types of questions is indicative of a larger set of empirical difficulties characterizing the debate.

5. THEORY AHEAD OF MEASUREMENT

The above simulations imply that peasants should not have scattered their land but instead pooled and/or stored grain on consolidated holdings. Yet data for the middle ages show that scattering was the predominant form of landholding, while evidence of significant harvest carryover is lacking¹⁴ and the extent of pooling is largely unknown.¹⁵ Importantly, the measured superiority of storage and pooling relative to diversification depends fundamentally on the simulation's parameters: mean harvests on open versus enclosed fields, variances in harvests on open versus enclosed fields, level of disaster,

¹² McCloskey (1975a, pp. 75-87).

¹³ Townsend (1993) puts forward a related argument. Problems of moral hazard in pooling arrangements are reduced under scattering as shocks common to all pool members are revealed.

¹⁴ McCloskey and Nash (1984) survey manorial accounts and conclude that substantial carryover in grain inventories was rare.

¹⁵ See Richardson (1999) for evidence of pooling.

and cost of pooling. With appropriate selection of parameter estimates within current confidence intervals, we can support any ranking of the three insurance mechanisms.

Consider, for example, a sample of estimates for the inefficiency of open fields. Our simulations indicate that, all else equal, if open fields approach the efficiency of enclosed fields—i.e., the difference in mean harvests between open and enclosed fields is between 1 and 2 percent—scattering dominates storage or pooling on consolidated holdings. Clark's (1998a) estimates of rent premiums for enclosed plots in the seventeenth and eighteenth centuries imply that the difference in mean outputs between open and enclosed fields (after adjusting for the cost of enclosure—fencing, surveying, land improvements, etc.) may have been as small as 1 percent, with a maximum efficiency gain of 3 or 4 percent. Allen directly measures the impact of enclosure on productivity for late eighteenth and nineteenth century farms. He reports a wide range of outcomes—from a negative impact to a greater than 10 percent productivity advantage—depending on soil type, location, and output choice.¹⁶ Direct estimates of productivity by landholding type is not possible for the middle ages, but Allen (1992) finds that rents on open fields were less than half that on enclosed holdings in fifteenth century.¹⁷ This rent premium is comparable to 19th century estimates used by McCloskey to infer a 10 percent productivity advantage for consolidated land. Finally, McCloskey (1991, p. 347) cites fourteenth century probate records on arable demesne land from Clark (1988, p. 281)

¹⁶ See Allen (1994: 115-17) for a summary of his findings.

¹⁷ Note that the rent difference is for scattered versus consolidated land used for pasture. In Allen's sample there were no observations in the fifteenth century of enclosure for arable production.

showing that “In 11 cases (mainly in Wiltshire) the rents on acreage outside the open fields of a village were 128 percent on average above those inside.”

Another example concerns the estimated variance of harvests. Given an absence of data on peasant production, McCloskey is forced to base her estimate of the difference in variances between scattered versus enclosed peasant holdings on observations of demesne outputs on closely situated manors. A bias in this procedure is that, while it provides an estimate of variations in harvests due to productivity shocks to land, it ignores productivity shocks to labor. Dyer (1989, p. 234) lists the following principal causes of ill fortune: “illness, accidents, premature death of bread-winners, fire, robbery, pillage in war, natural disasters and bad weather.” Illness, accidents, and premature death of breadwinners significantly reduce output on a peasant’s customary holding but have minimal impact on demesne production. Including this consideration increases both variances proportionally relative to the case of productivity shocks only to land. Further, Bekar (2001) finds that McCloskey overestimated the efficiency of scattering in shedding harvest risk—i.e., the difference between the variances of harvests on open fields and enclosed fields was smaller than measured by McCloskey.

In sum, while theory allows us to discriminate between insurance strategies, we do not yet have the required empirical inputs. Given the wide confidence interval for many of the parameters and the number of possible parameter combinations, we conclude that the open field debate cannot be resolved in this setting.

6. *OUR HYPOTHESIS FOR SCATTERING*

What is clearly needed is an explanation of scattering that is robust over the existing range of parameter estimates. Another empirical constraint is that the explanation be consistent with peasant budget studies indicating 20-acre households rarely, if ever, starved.¹⁸ We therefore only consider insurance strategies that produce a $POD \approx 0$. Below we argue that saving through land necessitated scattered holdings. We then show that self-insurance through land accumulation satisfies the empirical constraints set out above.

The connection between scattering and using land as a savings instrument is the requirement that an asset must be divisible in order to be a useful store of value. While the cultivation of enclosed land required a minimum configuration of 10-15 acres,¹⁹ open field land was valuable in units as small as a partial acre. Consider the response to a bad output draw for households using land as a buffer stock. Peasants holding less than 10 acres under a regime of enclosure would be forced to sell all of their land and become pure wage earners. Peasants holding 20 acres would need to sell half their land. Scattered holdings, on the other hand, allowed marginal adjustments in landholdings/savings in response to negative harvest shocks and enabled all landholders (not just larger landholders) access to saving through land. Thus if peasants found that land had sufficient advantages as a savings instrument, they would choose open fields over

¹⁸ Dyer (1989, pp.110-117). Also note the Wrigley and Schofield (1981) paradox: for the early modern period in England, crisis years in grain production are poorly correlated with crisis years in mortality. Starvation in general appears to have been uncommon.

¹⁹ Natural economies of scale imply a prohibitive cost of fencing for small plots—a major obstacle to enclosing small holdings. See the discussion in McCloskey (1975b: 144-45) and Clark (1988).

enclosure, even if this choice entailed a substantial productivity cost. In this context, the lower mean output on open fields can be viewed as a liquidity premium.

A. Theoretical Consistency: Simulating the Land Market

We simulate liquidity in the land market by varying the minimum parcel size that peasants may purchase and sell (or lease). In each period peasants draw an output realization (a function of their current landholdings). A household drawing less than subsistence, with land to sell, converts land into grain. Peasants experience disaster when they realize a harvest output below subsistence and have no land to sell. Peasants in a surplus year use a portion of their surplus to purchase parcels of land. The results of the simulation are presented in Table 2.

Table 2: Efficiency of Land Accumulation in Small Parcels²⁰

<i>Savings Rate on surplus</i>	10%		15%		20%		25%		30%	
	POD %	Avg. Cons.	POD %	Avg. Cons.	POD %	Avg. Cons.	POD %	Avg. Cons.	POD %	Avg. Cons.
<i>Parcel Size</i>										
1/10 acre	0.03	100	0	102	0	108	0	113	0	119
1/4 acre	1.0	92	0.4	98	0.07	101	0.03	106	0.02	111
1/2 acre	4.4	87	4.2	87	3.2	90	2.37	94	1.2	99
3/4 acre	9.2	83	9.2	83	9.1	83	8.4	84	6.6	87
1 acre	16	77	16	77	16	77	16	77	15.4	78
2 acres	39	60	39	60	39	60	39	60	39	60

A strong result emerges: increasing liquidity in the land market dramatically increases both the safety and standard of living of peasants. The intuition for this result is straightforward. When land parcels are held in larger units a peasant in a surplus year often cannot afford extra land that could cushion consumption against a bad output draw (per unit of land) in the future. Worse still, to avoid immediate starvation in a deficit year the peasant is forced to sell so much land that future harvests are severely compromised. Only when open fields allow land transactions in very small units does land become a worthwhile store of value.

²⁰ The parameters of the simulation are as follows: Mean output = 100, variance = 48.4. As in our previous simulations, surplus refers to output above “disaster.” Table 2 makes it clear that saving rates higher than 10 percent are motivated by wealth accumulation rather than insurance—i.e., as saving rates increase, POD remains at zero while consumption increases. Maximum average consumption of 150 occurs when peasants save 80 percent of surplus. There is evidence that some peasants, but clearly not all peasants, did accumulate land at very rapid rates (for example see Jones on Leighton Buzzard). Modeling the choice of saving rate, which entails detailed specification of peasant utility functions, is peripheral to the objectives of this paper.

Table 3 demonstrates, for reasonable parameter estimates, the superiority of saving through land relative to storage and pooling. Also note that this ranking remains unchanged even when diversification of land via scattering yields no insurance benefit.²¹

Table 3: Efficiency of Land Accumulation (Reasonable)²²

	Savings/Pooling Rate ²³	Probability of Disaster (%)	Average Consumption
<i>Land (scattered)</i>	20%	0.00	107
<i>Pool (enclosed)</i>	6.5%	0.00	97
<i>Store (enclosed)</i>	20%	0.80	83

We next test the robustness of the land accumulation strategy by biasing the parameters in the simulation against its acceptance. Thus we use McCloskey's estimate of a large difference in mean outputs on enclosed and scattered land, we use Bekar's (2001) estimate of a small difference in variances between scattered and consolidated holdings, the cost of pooling is set equal to zero, and we assume significant transaction costs in the land market. As Table 4 demonstrates, scattering and saving through land remains a superior strategy relative to storing or pooling on enclosed farms.

²¹ When we run the simulations with no difference in variances between scattered and consolidated holdings the only change is that average consumption for the "Land" strategy falls to 106.

²² Mean output on enclosed = 104, mean output on open = 100. Variance on enclosed = 49.6, variance on open = 45.1. Cost of pooling = 20%. Transaction costs in land = 5%, i.e., a 5% surcharge, representing resources used up in making the transaction, is added to the purchase price of land (the buyer is modeled as paying this charge). Note that when we increase transaction costs in land up to 45%, self-insurance through land accumulation remains the best risk management strategy.

²³ For the storage algorithm savings is out of wealth, for land algorithm it is out of surplus.

Table 4: Efficiency of Land Accumulation (Robustness)²⁴

	Savings/ Pooling Rate	Probability of Disaster (%)	Average Consumption
<i>Land (scattered)</i>	20%	0	107
<i>Pool (enclosed)</i>	3%	0	106
<i>Store (enclosed)</i>	20%	0.5	88

B. Historical Consistency: The Nature of the Land Market

There is ample evidence that peasants used land as a savings instrument.²⁵ Schofield (1997, p. 5) finds that in thirteenth century Hinderclay, land market activity is significantly correlated with years of dearth,²⁶ “Comparison of fluctuation of land transfers and the local, regional and national grain price data...indicates that the Hinderclay land market was harvest sensitive.” In good years, peasants leased/purchased land, in bad years they leased out/sold land. Campbell (1984, p. 113) argues that “consecutive years of harvest failure reduced the peasantry to such a state that they were obliged to sell land in order to buy food, and that only a fortuitous run of good harvests put them in a position to recoup their losses.” In late thirteenth and early fourteenth century Halesowen, Razi (1980, p. 37) finds that “Lean years are reflected in the court

²⁴ Mean output on enclosed = 110, mean output on open = 100. Variance of output on enclosed = 45.1, on open = 41.9. Cost of pooling = 0%. Transaction costs in land = 10%.

²⁵ In addition to the historians we quote also see Dyer (1989, pp. 123-127), Jordan (1996, pp. 102-6), and Duby (1968, pp. 254-57). Note that there were many reasons to buy or sell land that were not directly related to consumption smoothing. For example, land could be sold if the family had no heir or did not have the resources to carry out cultivation, land could be transferred within the family to establish bequests or enable consolidation, and land could be sold to finance dowries.

rolls by a rise in the number of pleas of debt, of inter-peasant land transactions and of illegal gleaners. The reason for the rapid quickening of the inter-peasant land market during periods of economic crises is that smallholders and to a lesser extent half yardlanders had to sub-let and to sell land either to remit debts or to pay rents and fines and to buy food, seed corn and livestock.”

Most evidence on early land markets comes from court rolls and private charters. Williamson (1984, p. 41) finds that in Gressenhall, on a total of 107 holdings, “In 1283-84...there were 103 land transactions recorded in the courts...The year was not an unusual one in either the number or the nature of land transfers.” This type of activity was typical of all three manors she studied in Norfolk. Regarding Berkshire in the fourteenth and fifteenth centuries Faith (p. 119) notes “The impression given by a study of late-medieval peasant land transfers is that of the speed with which land changed hands and the scale on which it did so.” This sort of activity in local land markets characterizes much of medieval England. Further, there are reasons to believe that charters and court rolls underestimate the actual level of activity in the land market. Many transfers of freehold land went unrecorded. In some cases the lord may not have been concerned with small-scale land transfers, or with the transfer of land that had no customary services attached. And on those lands with traditional controls there was an incentive for peasants to evade traditional channels of transfer. This is also true of leasing arrangements, “Unquestionably, leasing was an important way of adjusting the size of a

²⁶ Schofield (1997) notes that Campbell (1984) found the same relationship in Coltishall, Smith (1984) in Redgrave, and Clarke (1985) in Chesterton.

holding, one ignored by surviving extents because of its peripheral importance to the lord of the manor.”²⁷

Our argument relies on an abundance of land transactions in very small parcels. Such transactions dominated the medieval land market. In fourteenth century Arlesey Bury “The market in arable land was mostly small-scale. About three-quarters of the total number of parcels transferred were smaller than 10 acres and half were smaller than 2 1/2 acres.”²⁸ In Leighton Buzzard “Between 1393 and 1398 the court rolls recorded 128 transfers, of which 89 were outside the family and 33 were within. Three-quarters of the transfers which made up the land market (the 89) included arable land, and most (50 out of 64) were smaller than 3 acres.”²⁹ In Norfolk in the thirteenth century the “Sedgeford rolls show an average of over twenty-two transactions a year involving the sale, purchase, exchange, or grant of parcels of land that seldom exceeded 2 acres...”³⁰ “In Gressenhall in 1282-83, the average size of transferred land on 103 transfers was less than 1/2 acres.”³¹

When we eliminate transfers to heirs and concentrate on inter-family transactions the size of parcels exchanged falls even more. In thirteenth century Martham, “The amounts of land involved were small: apart from two transfers of over 2 acres each to heirs and an exchange of 1 1/2 acres, the land involved was never more than 1/2 acre and in most cases was expressed in perches. Indeed, one exchange was only 15 feet square,

²⁷ Williamson (1984 p. 54).

²⁸ Jones (1984, p. 215).

²⁹ *Ibid.*, p. 238.

³⁰ Williamson, *op. cit* p. 94.

and ten sales were of 10 perches or less.”³² Schofield (1997, p. 4) finds that, “most parcels of land transferred in the land market were very small...the average area of land transferred was no more than a single acre. In fact, the median and modal holding size of half an acre comes closest to reflecting the reality of the extent of plots of land typically dealt with in the Hinderclay land market.”

A similar pattern characterizes transactions in demesne land, an important source of land that lay “outside” the traditional peasant land market. From Seavoy (1986, p. 78), “Most of the earliest leases of demesne land were of single cultivation units that were 0.3 hectares (1 acre) or less. Even the largest leased area did not exceed 1.0 hectare (2 acres)” He further argues (p. 79) that these leases/purchases were undertaken in order to help insure oneself against subsistence crises—“The usual leasee was a villein or cottager who wanted a larger margin of subsistence food safety...The initial demesne leases followed the same pattern as the earliest recorded sales of peasant cultivation units. These land transfers date from the end of the twelfth century and they were common occurrences by 1250.”

B. Resolving a Contradiction and Puzzle

Our simulations clearly link scattering and insurance. But Fenoaltea (1976, 1988) criticizes the linkage of scattering with insurance by pointing to an inconsistency with the observation of higher rents paid for enclosed land. Why would tenants receiving the benefit from diversified holdings pay a lower rent than peasants working high risk

³¹ *Ibid.*, p. 41.

³² *Ibid.*, p. 76.

enclosed holdings? Or alternatively, why would landlords, who do not benefit from diversification, charge lower rents for scattered land?³³ Our analysis resolves this contradiction by making the landlord, rather than the tenant, the beneficiary of scattering. Open fields allowed the landlord to experience both a lower POD and higher consumption through the use of land as a saving instrument. In return the landlord was willing to accept a lower rent for scattered land. Tenants paid a lower rent because scattered land was less productive.

The observation that small parcels of land rented for more than large parcels (per unit land) poses a puzzle in English agricultural history,³⁴ especially if economies of scale existed in the cultivation of largeholdings.³⁵ Viewing land as a buffer stock yields a potential explanation. Consider a peasant in a good year. Let him put some of his surplus into renting land. In anticipation of the possibility of poor harvests in the future, in which the size of the negative income shock is unknown, he should be willing to pay a higher rent for smaller parcels because they better facilitate marginal adjustments to the size of holdings in the future.

³³ McCloskey (1991, pp. 347-8) states the problem as follows: "... the rent that the lord could get depended on what the tenant favored. If the tenant in the long-run favored meadow lands, those would rent higher; if he favored lands close to the village, they also would rent higher. ... if the tenant favored scattered holdings, then scattered holdings too would rent higher."

³⁴ See Clark (1998, pp. 87-8).

³⁵ Allen (1992, p 86), Allen (1998).

7. A PORTFOLIO OF INSURANCE INSTRUMENTS

In the analysis so far we have allowed our agents to hold only one insurance instrument. We now loosen this constraint and consider a combination of strategies. Although land accumulation dominates pooling and storage in terms of maximizing average consumption for a minimal POD, there are other considerations that could induce peasants to pool and store.

Customary law and the traditions of the manor *required* various forms of pooling.³⁶ Further, the Church offered a large religious reward for informal pooling, while mandating formal pooling through tithing, a portion of which was re-distributed to the poor.³⁷ Also, pooling may have been a very efficient method of smoothing small, non-catastrophic shocks to consumption.

Grain storage becomes attractive when we consider correlated shocks. While pooling is effective for small idiosyncratic shocks, it tends to break down in the face of large shocks, especially large aggregate shocks.³⁸ Pooling relies on spreading risk across agents. Thus adding spatial correlation to the shocks—i.e., making the shocks to all agents more uniform—renders pooling less efficient. In the extreme case in which agents are identical and all experience exactly the same shock, pooling offers no insurance benefit. Medieval peasants experienced shocks that were correlated both spatially and temporally,³⁹ and therefore saving was required. But what form of saving? Saving only through land was problematic given an expectation of large aggregate shocks. As whole

³⁶ See Seavoy's (1986, especially pp. 59-69) discussion of harvest sharing arrangements.

³⁷ Reed and Bekar (2001).

³⁸ Kimball (1988).

villages attempted to convert land into grain, land markets could thin and the liquidity of land as an asset could diminish. In this environment, stored grain would be an appealing savings instrument.

In sum, peasants would hold a portfolio of insurance mechanisms. They would save through land (and therefore scatter their land) for insurance against disaster and for wealth accumulation. They would pool in response to Church and community demands. They would also want to store grain in anticipation of a sequence of aggregate shocks. Peasants that accumulated land, shared a modest portion of their harvests with neighbors, and put minor amounts of grain away for a (village-wide) rainy day, could reasonably expect to be fully insured against all but the most severe, widespread, and prolonged of harvest crises.

8. CONCLUDING REMARKS

We have argued that holding small parcels of scattered land in open fields enabled saving through land, that saving through land was the most effective insurance strategy against disaster available to the majority of peasants in the middle ages, and that saving through land allowed peasants to accumulate wealth. We now briefly consider the larger issue of how the analysis might contribute to an understanding of long run economic growth and social change.

When McCloskey began writing on open fields and enclosure, the historical context was quite different from what it is today. At that time, it was plausible to hypothesize that productivity gains associated with enclosure gave rise to an agricultural

³⁹ See Titow (1972).

revolution, which in turn led to the industrial revolution. The end result was modern economic growth. What do we think now? Enclosure resulted in little productivity growth;⁴⁰ enclosure was an insignificant part of the agricultural revolution;⁴¹ the agricultural revolution was much more modest than previously thought,⁴² with a diminished connection to the industrial revolution;⁴³ the economic growth associated with the industrial revolution is itself controversial.⁴⁴ Thus, from today's perspective, the payoff to understanding why peasants scattered their land appears low in terms of explaining long-term growth. Has the open field debate been about solving an old puzzle that is now largely irrelevant? Our analysis suggests important implications for re-distribution and social change.

Earlier writers on enclosure made equity their central concern and viewed the enclosure movement as “a plain enough case of class robbery.”⁴⁵ More recently Allen (1992) has argued that enclosure allowed landlords to usurp surplus from tenants by raising rents to market levels.⁴⁶ He concludes (p. 21) that “most English men and women would have been better off had the landlords' revolution [enclosure and farm amalgamation] never occurred.” In contrast, McCloskey (1975b) and Clark (1998a)

⁴⁰ Allen (1992, 1994, 1998), Clark(1998a).

⁴¹ Allen (1992, 1994).

⁴² Clark (1998b), Allen (1998)

⁴³ Allen (1992, 1994).

⁴⁴ See the summary in Mokyr (1998).

⁴⁵ Thompson (1963, p. 218) quoted in McCloskey (1975b, pp. 142-3). See also the discussion in McCloskey (1975a, pp. 73-5).

⁴⁶ Note that Allen's sample consists of enclosures in the south midlands. He finds significant income redistribution from enclosure only in pasture and light arable districts.

contend that the re-distributional effects from enclosure were negligible. McCloskey (pp. 142-151) considers the issue of whether small holders were paid the market value of their land when they were required to sell in consequence of parliamentary enclosure. She concludes that they probably were sufficiently compensated, especially if they sold in anticipation of enclosure. Clark (pp. 97-99) considers Allen's claim that enclosure resulted in a re-distribution from tenant to landlord, but finds no evidence for this in his sample of charity data. Clark also looks at the value of common rights lost by the poor and concludes that the value of these rights was very small—"Enclosure at worst would cause only the most marginal reduction in the economic conditions of the rural poor." (p. 99).

Our analysis of open fields suggests that parliamentary enclosures resulted in significant re-distribution. McCloskey and Clark have not found it because they have been looking in the wrong places. A core implication of our analysis is that there was an asymmetry in the valuation of land between smallholders and potential largeholder buyers. Largeholders, with diversified portfolios of assets and easy access to credit markets, valued additional land only for its contribution to agricultural production. Smallholders valued holding land for its contribution to production and also for the additional benefits of insurance⁴⁷ and the opportunity to accumulate wealth.⁴⁸ Without

Enclosure on heavy arable farms resulted in no change in distribution—i.e., rent increases matched increases in Ricardian surplus.

⁴⁷ Two insurance benefits are applicable: self-insurance through land accumulation and participation in specific village pools for which land ownership was a membership requirement (See Seavoy's discussion of harvest and labor sharing arrangements in Chapter 2).

⁴⁸ Clark (1988) finds that in the thirteenth century, investments in land earned a 10 percent return that was close to risk free. We are not aware of any other asset available to

land, smallholders were reduced to wage laborers or worse,⁴⁹ their households were exposed to increased threat of malnutrition, and the possibility of economic and social mobility was blocked. Thus, in many instances, the reservation price for smallholders to sell *all* of their land would be greater than the price largeholders would be willing to pay, even if there existed economies of scale in large-scale production. But the essence of parliamentary enclosures was involuntary exchange: enclosure was imposed with a majority of smallholders opposed. Their now undersized parcels of land were not economical to farm in an enclosed village. Smallholders were forced to sell, with the selling price determined by competition between largeholders. The reservation price of the smallholders was made irrelevant. The extent of the resulting re-distribution was determined by the size of “compensating variation,” the amount a smallholder would have required in compensation to voluntarily give up access to self-insurance and wealth accumulation. It is measured (albeit imperfectly) by consumer surplus, not price or total revenue. It is summed over more than half the landholding population of a typical village. It can reasonably be expected to have been large.⁵⁰

small holders that would yield earnings of this magnitude. Stored grain, for example, decreased in volume by 10 percent per year and was high risk, its value depending on aggregate village harvests. Another alternative was livestock, but ownership required grazing rights, which in turn required landholdings. Displaced farm laborers in the nineteenth century faced severe difficulties in accumulating wealth—see footnote 49 below, also see the discussion of living conditions for the working poor in Mokyr (1998).

⁴⁹ From Allen (1992, p. 19), “... the agricultural revolution was producing paupers—not proletarians.”

⁵⁰ This expectation is reinforced by recent work on “endowment effects.” See Kahneman and Tversky (1979), and Kahneman, Knetsch, and Thaler, (1991).

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