Land Speculation as an Obstacle to Ideal Allocation of Land

By

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DISSERTATION

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TABLE OF CONTENTS

MAJOR OUTLINE OF DISSERTATION

	Page
Introduction	1
PART ONE: The Problem of Mal-allocated Land	44
Chapter I: Unused Land	44
Chapter II: Tenanted Land	118
Chapter III: Large Holdings and Small	171
PART TWO: Analysis of the Problem	304
Chapter IV: Land Speculation as an Obstacle to Ideal Land Allocation	304
Chapter V: Objections to the Hypothesis	358
Chapter VI: Conclusion -- Summary Formulation of the Hypothesis in Theoretical Form	437

DETAILED OUTLINE OF CHAPTERS

	Page
Acknowledgments	i
Table of Contents	ii
Introduction	1
I. Summary of Study	1
II. Basic Assumptions	6
III. Definition of the term "land"	8
IV. Criterion of best use or "ideal allocation" of land	10
A. Diverse Criteria now Used	10
B. The Criterion of "ideal allocation": the equimarginal principle	11
C. Use of the equimarginal criterion in this study	37
PART ONE: The Problem of Mal-allocated Land	
Chapter I: Unused Land	44
I. Introduction to Part I	44
II. Introduction to Chapter I	45
III. Unused Lands in some Relatively Static and Underdeveloped Areas	48
IV. Unused Lands in the United States	56
A. Frontiers of cultivation	59
B. Frontiers of more intensive farming--irrigation as an example	63
C. Urban Frontiers	67

	Page
V. The Social Costs of Unused Land	99
A. and B. The unrealized income of the land itself; and the costs of subdividing and providing basic public works for land otherwise submarginal	99
C. The reduced marginal productivities of labor and capital, including reduced investment and employment	104
D. Costs of scattered settlement	105
E. Increased Economic instability	106
VI. Conclusion	116
Chapter II: Tenanted Land	118
I. Introduction	118
A. Introduction to Chapters II and III .	118
B. Introduction to Chapter II	120
II. The Extent of Farm Tenancy	121
A. Relative values of leased and owner-operated land -- leased land on the average more valuable	122
B. Recent trend of farm tenancy	133
C. Probable future trend of farm tenancy	137
III. The Cost of Tenancy Relationships	142
A. The evidence	142
B. The Landlord-Tenant relationship.....	146
IV. The Function of Tenancy	162
V. Summary	166
VI. Appendix	168

	Page
Chapter III: Large Holdings and Small	171
I. Introduction	171
II. Five Indications that the Marginal Productivity of Land Tends to be Lower on Larger Farm Holdings	178
A. The range of farm sizes is immense ..	178
B. Larger farm holdings tend to be much less intensively manned, improved and equipped per dollar of land value	201
C. The smaller the farm as a rule the more economies of scale it has to gain by adding land	226
D. Economies in financing land titles, at odds with operating economies, draw some owner-operations above and others below optimal operating sizes	265
E. Direct indications of contrasting marginal productivities	285
F. Summary	292
III. The Trend of Concentration of Farm Land in the United States	293
A. Basic Data	293
B. The Drift Away from Medium Sized Farms	297
IV. Conclusion to Part I	302
PART II: Analysis of the Problem	
Chapter IV: Land Speculation as an Obstacle to Ideal Land Allocation	304
I. Preliminary Approach to Hypothesis	304
II. The Meaning of "Land Speculation"	308

Page

III. Differences among Speculators 325

IV. Why Differences Persist 330

V. The Mechanics of Mal-allocation 343

VI. The especial Importance of Anticipated Rising Rents 354

VII. Concluding 357

Chapter V: Objections to the Hypothesis 358

Objection I: Rent is independent of management.. 358

Objection II: The hypothesis depends on the assumption of small numbers 362

Objection III: Tenancy solves the problem 373

Objection IV: The hypothesis ignores risk 374
Rephrased 375
Alternative land policies 381

Objection V: Problem not peculiar to land 390

A. Land depreciates 394

B. Land is a labor product 397

Objection VI: Hypothesis overlooks need for conservation 400

Objection VII: Hypothesis overlooks many other important factors 405

A. Differences in opinion 405

B. Problems of land assembly 418

C. Legal barriers to free exchange 420

Objection VIII: Hypothesis implicitly rejects existing distribution of purchasing power 433

Objection IX: Hypothesis ignores popular habits of thought 435

Page

Chapter VI: Conclusion -- Summary Formulation of Hypothesis in Theoretical Form 437

Explanation of System used for Notes and Bibliography 461

Notes 463

Bibliography 489

LIST OF FIGURES

Page

Introduction

1. Complementary costs, average per acre (ACC) and marginal (MCC) 25
2. Gross products, average per acre (AGP) and marginal (MGP) 26
3. Marginal net product (MNP) derived by subtracting marginal complementary costs (MCC) from marginal gross product (MGP) 26
4. Relationship of rent per acre, or average net product of land, to the marginal net product of land 35

Chapter I

1. Urban land: demand and two kinds of supply.. 101

Chapter II (no figures)

Chapter III

1. Elements of the Lorenz Concentration Ratio.. 179
2. Marginal and average net products of land as related to cost and output per acre 231
3. Relations between the average and marginal products of land and labor 239
4. Hypothetical marginal and average products of land as they would be if the marginal product were higher on larger farms 250

Chapter IV

1. Present Value of $3, at 4% and 6% 347
2. Present Value of $3 at 6%, and of $2 at 4% 352

Chapter V

1. Rent imputed by Japanese and Caucasian farmers 359

Chapter VI

1. Annual marginal product of land; and annual cost of holding land at 10% and 2% 439

LIST OF TABLES

Page

Introduction (no tables)

Chapter I

1. Unused land in the Levant 52
2. Age and development of American irrigation projects in 1920 65
3. Vacant land in several American cities 72-4

Chapter II

1. Acre values of tenant and owner farms; and land values compared to building values on all U.S. farms, 1900-1950 126
2. Values per acre of land in counties with high and low tenancy, by census regions, 1920 129
3. Average farm sizes for different tenure groups, in acres, 1925-1950 135
4. Certain improvements on tenant and owner farms.. 145
5. Values of land plus buildings in the census' West North Central region, by subregions with high and low tenancy, 1950 168

Chapter III

1. Lorenz Concentration Ratios for income and farm land 174
2. Lorenz Concentration Ratios for distribution of farm acreage 180
3. Average values per acre, land and improvements (other than buildings), 1940 185
4. All Tenant plantations, 325 selected counties in 11 southern states, 1910 187
5. Averages for all commercial family-operated farms, 1944 188
6. Per cent of arable to total area in farms in various size holdings, England, 1895 189
7. Acre values and plantation sizes for a sample of large plantations, 1936 192
8. Population and quality of land by regions, Rumania, 1941 194
9. Lorenz Concentration Ratios, distribution of ownership of rented farms, U.S., 1900 and 1920 196
10. Average land values per acre, U.S., by acreage of farm, 1900 198

Page

11. Labor cost per acre, by size of farm, for 238 accounting farms in Northwest Illinois, 1946 204
12. Farm size & labor force, England, 1908..... 205
13. Proportions of labor to acreage on farms ranked by gross sales 207
14. Land, buildings, and implements & machinery: average values per acre; by size of farm, 1940 211
15. Capital intensity and average acreage per farm for different tenure groups 212
16. Horses kept per 100 acres, and per cent of arable land, by acres in farms, England, 1885 213
17. Per cent of acreage, and of various capital items in farms ranked by gross sales..... 214
18. Capital intensity of 333 Willamette Valley farms, ranked by value of real estate, 1938. 216
19. Implements and machinery per farm and per acre by region 217
20. Per cent of farms in different size groups which are tenant farms 266
21. Size of landlord's home farm, by number of tenants per plantation, 11 southern states, 1910 269
22. Rented farms, no. of holders and no. of rented farms by size groups variously defined, 1900 272
23. Splitting of title-holding units ranked by acreage, valley floor of Kern, Madera and Tulare Counties, California 273
24. Per cent of rented farms decreasing in fertility, by number of rented farms owned, North Central States, 1920 275
25. Lorenz Concentration Ratios for title-holding units compared to operating units 277
26. Per cent of male farm landholders by occupations, and by size of holdings (whether operated or leased) 279
27. Percentages of American and foreign-resident landlords having holdings of different sizes, 1900 282
28. Land available for crops and land used for crops, by acreage in holding, 1940 286
29. LCR for acreage in farm operations, U.S., 1900-1950 294
30. Acre values of all farms, and all farms over 1,000 acres, and their ratio, 1900-1950 296
31. Number of farms, acres, and acres per farm, by size brackets 1920 and 1950 299

Page

Chapter IV

1. Present value of $100, due at end of selected years, at 2% and at 4% 345

Chapter V (no tables)

Chapter VI (no tables)

INTRODUCTION

I. Summary of study

Where man has joined economic forces with nature under the organizing genius of the market he has met, along with some notable successes, some sharp disappointments. To be sure the market has outperformed some other institutions for organizing the land economy, but still its performance seems often to fall short of standards to which we might reasonably aspire.

This is a study of the imperfect union of land with man that the market achieves in a free or partly free economy like our own. Formally it is addressed to this question: do market forces tend to allocate land to its most productive use? It concludes that some do, according to traditional theory, but others not contemplated in traditional theory obstruct the beneficent forces from achieving ideal allocation. The major obstructive force is the difference among interest rates, explicit or implicit, accounted by different individuals. The net result of the forces is a land market performance rather short of perfection.

The original reason for the study was the writer's suspicion that the land market tends to function imperfectly, quite apart from any monopoly elements such as one usually has in mind when speaking of "imperfect markets." This

suspicion was aroused both by direct observation of land use and deduction from the principles of capitalization. As to the first, one need not look far to find anomalies and problems such as idle lands amid crowded lands; holdings below optimal size amid holdings much larger than necessary to achieve economies of large-scale operation; lands abused by tenants; premature subdivision and scattered settlement. As to the deduction, the suspicion arose originally from the simple fact that different individuals in the same land market have access to funds at different interest rates. As the major annual cost of holding land is generally interest on the price of the title, it may well follow that individuals paying or imputing lower interest rates tend to add land to their enterprises until the last unit yields them a smaller increase that the last unit must yield to enterprises paying or imputing higher interest rates. If so, some land would be put to uses less productive than others from which it would be preempted.

Although its original motivation and its conclusion both suggest the desirability of considering the many proposals for improving present land policies, the present study stops short of entertaining any of these proposals, other than to list some of them briefly in Section Four of Chapter Five for the purpose of establishing their reality as alternatives to present policies. As understanding must precede intelligent action, this study undertakes only to develop a

conceptual framework for evaluating the performance of the market as it is, and, by applying the conceptual framework to that purpose, to suggest whether it would later be worth while to use it for analyzing reform proposals.

But the orientation of this study, and the writer's willingness ultimately to entertain alternatives to present policies is worth emphasizing now to obviate later misunderstandings. This is not an evaluation of how successfully individuals adjust themselves to the alternatives the market offers them. Rather, it is an evaluation of the market itself as an allocating agent. It seeks to penetrate the veil of prevailing institutional arrangements and policies to ultimate economic realities, and evaluate the institutions in terms of those ultimates. In the background always stands the thought that there are alternative policies to choose from.

Thus the study strikes some unfamiliar notes, as much economic analysis today proceeds on the assumption that prevailing institutions and policies are "given" and themselves constitute ultimate economic realities. For example, several leading economists have rationalized farm tenancy on the grounds that it represents the best adjustment for the individuals concerned, within the framework of existing land prices. No doubt it often does--its very existence seems to tell us that, unless we assume widespread ignoring of self-interest. But in the present study we

cannot rest content with this answer. The study asks, "Is a land market that draws men and land into a relationship as inhibiting to production as tenancy tending to allocate land to its most productive use?" This point is developed further in Chapter II, Section IV, "The Function of Tenancy."

The plan of study is first to describe some major land problems from direct observations, and second to adapt some of the tools of economic theory to analyze forces controlling the land market, relate the problems to theory and, through theory, to each other.

The study has two major parts.

Part I, "The problem of malallocated land," consists of three chapters surveying three basic and interrelated land problems common in market economies. These are: unused land; tenanted land; and land operated in holdings of non-optimal sizes. In this survey there inevitably appears some analysis, but this analysis is strictly subordinate to the survey, and only foreshadows the fuller analysis of Part II.

Most, but by no means all the data surveyed are from agriculture. This particular industry is selected only because of easier access to relevant data in it, and not because the theoretical analysis applies more closely to agriculture than to other industries. This point is elaborated in the introduction to Chapter 2. Most, but again not all the data are from the United States. Let it

be understood, the study does not concern agriculture as such, nor the United States as such, but land as such. Therefore the writer has not hesitated to introduce data, where available and relevant, from other countries and other industries, or to suggest that his conclusions might have some bearing in other countries and industries as well.

Part II, "Analysis of the Problem," takes up the hypothesis that individuals accounting lower interest rates tend to add land to their enterprises until the last unit yields them a smaller increase than the last unit must yield to individuals accounting higher rates. The word "accounting" is taken to include situations where interest is paid out explicitly on borrowed funds, as well as situations where implicit interest is merely imputed on funds owned by the individual. The first chapter of Part II, Chapter Four develops this hypothesis, and Chapter Five takes up objections to it, and modifies it somewhat. The final chapter draws together and summarizes the analysis, indicating its application to the three land problems of Part I. It concludes, in answer to the original question posed by the study, that, as previously stated, some market forces do tend to direct land to its most productive use, according to traditional theory, but others not contemplated in traditional theory obstruct ideal allocation. The major obstructive force is the difference among interest rates, explicit or implicit, accounted by different individuals.

The net result of the forces is a land market performance quite short of perfection.

This net result probably falls short, also, of attainable approximations to perfection. As mentioned, this study concludes without developing any reform program, such as would be necessary to know if anything better is within our reach. Thus the study ends as it begins, in a critical vein. But the author's purposes are not primarily negative. He has developed his analysis in the hope that it may prove useful in the more important enterprise of devising means to improve on present policies.

II. Basic Assumptions

Inasmuch as every study must begin and end, the author has indulged himself the luxury of certain assumptions, which he will not defend. Many of these must go unspoken, but certain ones should be explicit:

A. Only the land market is under scrutiny here. Let ceteris paribus rule. For the present study we take as given, for example, tariffs and other trade barriers. The question is, how do landholders respond to the price and cost stimuli that a market economy relies on to guide their decisions? We deplore the confusion of issues introduced by one writer who, on hearing the Junkers indicted as unworthy cultivators of the German soil, countered that they could only have raised grain in any event, which in the absence of protection they should not have done. We would

instead judge the Junkers' efficiency as land managers in terms of the price system within which they operated.

B. The privilege of holding title to part of a nation's limited land resources is a public trust, and properly the object of public scrutiny and concern. The justification of a land policy must be its effectiveness in promoting the highest use of resources. "Private property" and "vested interests" are means to that end, not ends in themselves.

C. It is desirable to maximize the net product of given land resources. We do not share the monopolistic philosophy which counsels solving the problems of each industry by retiring resources to lower output and raise price. Our philosophy is the classical one of facilitating output and income payments in all industry, whereby few need suffer lower relative prices, save as some can lower unit costs by greater volume. As to aggregate demand, there seems no reason to fear that a better allocation of land would fail to increase demand by as much as output: to allocate land more economically is to make it more accessible to its complements, labor and capital. It is tantamount to opening a new frontier, offering new investment opportunities to balance any increased savings, and new employment opportunities to increase wage payments and consumption.

Nor do we share the philosophy that a fall of land prices, that might ensue from improving land allocation and thus increasing the effective supply of land, is a loss to

the economy. We would echo R. H. Tawney: "A society is rich when material goods are cheap and . . . human beings dear."

III. Definition of the term "land"

The word "land" in this study means the natural attributes of the earth, including site (extension plus location). Some distinctive features of this resource are these:

A. It is not produced by man. The activities of men may wittingly or unwittingly affect its productive capacity, just as they may affect the productive capacity of labor and capital, but land, the physical entity, is nature's contribution, with no cost of production.

B. It is not reproduceable. So-called "made land" is, of course, only an underwater site whose improvement has called for, in addition to the usual expenses, considerable fill. The location, extension and substructure remain nature's contribution.

Subdivision and attendant public improvements are sometimes said to "produce" land. It is true they increase the supply of land for those uses which require the improvements, but they take it from other uses. In our terminology they are only means of transferring land between uses. They do not affect total supply, unless in the special sense that better allocation of an existing supply has effects similar to increasing the supply.

Man's contribution to the fertility of soil is not "land", but an improvement. The practical problem of distinguishing the human from the natural contribution to farm value is more than negligible. But the fact that farm land prices vary so much less within soil groups and natural regions than among different ones attests to the identifiability of nature's contribution and the limits of man's influence.

C. Land is uniquely located relative to its environs, immobile in space.

D. The site is never consumed in production, although its value may rise or fall due to economic or climatic changes. Its substructure is ordinarily permanent too, although nature over the eons will certainly change it by vulcanism and erosion, and man may accelerate the erosion. Topography, also, is usually enduring, again with a few outstanding exceptions.

Some economists have taken the exceptions for the rule, and treated the land as simply another form of capital. We will treat of it ordinarily as a permanent resource. This means that our analysis and conclusions do not apply strictly to those natural resources that are consumed in production, such as virgin timber and minerals. We devote a few special words to them in Chapter Five.

As land has these unique qualities, the price of land is likewise unique: no cost of production affects it,

nor any threat of reproduction; it is based solely on anticipated future yields, and these extend into the indefinite future.

Let it be understood that land, measured by price, is not primarily an agricultural resource. In 1954 the estimated market price of land and improvements in all American cities over 30,000 was about $250 billions; but the price of all farm real estate in 1950, near the peak, was only $75 billions.[1] Let it also be understood that the ratio of land to improvement value does not become small even in the centers of cities. On Manhattan Island the ratio of land to improvement values is almost 3 to 2,[2] higher than in many farm areas.

IV. Criterion of "ideal allocation" of land

A. Diverse criteria now used

On originally looking into the subject of this study the author assumed that there must be among professional economists some general agreement as to what constitutes the most productive use of land. But there is not. Among criteria there are the widest divergences, ranging from the doctrine that maximum output per acre is ideal, regardless of cost, to the opposite doctrine that minimum costs per acre are ideal, regardless of output. These, and many between, and others on unrelated standards, are all seriously advanced or more generally assumed by some one. Obviously no amount of agreement as to facts can bring harmony

among those holding such incompatible concepts. The first step in this evaluation of how ideally the market allocates land must be to establish a standard of excellence by which to judge it.

B. The criterion of "ideal allocation": the equimarginal principle

1. The equimarginal principle

As the criterion of "ideal allocation" we take the simple and by now traditional equimarginal principle. This principle derives directly from the axiom that given resources will be allocated so as to maximize their aggregate net output when it is impossible to increase their aggregate net output by reallocating any of them. The increased output achieved by shifting a small unit to a new use is called the marginal product of that unit in that use, and the marginal product divided by the unit is the marginal productivity, or rate of change of output with respect to the resource. According to the equimarginal principle, in order to maximize aggregate net output from the resource its marginal productivities must be equal in all different uses to which it is applied (in the stage of diminishing returns), since if they were not equal the market could increase aggregate net output by shifting some of the resource from uses with low marginal productivities to uses with high ones.

George Stigler put it this way:

> A difference between alternative cost and the value of the marginal product in any firm or industry is proof of inefficiency, and the magnitude of the difference is a clue to the extent of the inefficiency.[3]

Some would prefer definitions of "efficiency" other than Stigler's, which is actual output from given resources as a percentage of maximum possible output from those resources. But if we substitute his meaning in place of the word it is clear he has in mind the same equimarginal ideal we have expressed. We present his statement here to indicate that our criterion is also that used by a recognized master of economic theory.

The words "marginal productivity" need not necessarily appear in all applications of the equimarginal principle. For the principle is nothing more than an elaboration of a statement so self-evident that it may be likened to an axiom of geometry, the statement that given resources will be allocated so as to maximize their aggregate net output when it is impossible to increase their aggregate net output by reallocating any of them. The elaboration in terms of marginal productivity is useful for many purposes, but the principle may be understood and sometimes applied without the elaboration. A violation of the principle is indicated simply by showing that net output could be increased by reallocating the resource. No explicit reference to marginal productivity is necessary. It is obvious that the marginal productivity of the shifted resource must then have been

higher in its new use than its original use, else shifting it would not have increased aggregate net output.

The words "different uses" are to be interpreted broadly. The equimarginal principle is satisfied only when marginal productivities are equal, not only among different "uses" in the narrow sense of "crops", say, but also among different enterprises and tenures. Shifting land from one "use" to another might mean shifting a marginal acre from, say, a wheat farm to a neighboring truck farm. But it may also mean shifting the acre from one wheat farm to another wheat farm. Finally it may mean simply shifting title from one person to another while crop and operator both remain the same. That would occur if a tenant bought out his landlord, and might materially affect the net output from the land.

In designating some lands as "underused" one runs the risk of imposing his own arbitrary standards of excellence or intensity where they do not apply. Some of our less imaginative European visitors have been guilty of this, criticizing American farmers, miners and lumbermen for failing to follow intensive European-type practises that are uneconomical within our structure of costs and prices. But the equimarginal principle avoids this error. "Underused" land is that held by enterprise A which, if transferred to B, would increase net output more by joining B than it would reduce output by leaving A. In this there is no imposition of arbitrary standards on a sinful world. The

author accepts the principle of consumer sovereignty. He criticizes the land market only insofar as it fails to allocate land so as, in the aggregate, to yield its utmost, net of costs, of that assortment of worldly goods desired by ultimate consumers.

But is the marginal product of just one factor, land, a sufficient criterion for judging the relative efficiency of different enterprises? No, it is not--and that is not what we use it for. It is quite possible that firm 5 might be more efficient, in an overall evaluation of the firm, than firm 13, and yet the marginal product of land alone might be higher for firm 13. And it is normally true that the marginal products of complementary inputs vary inversely, according to the well known principle of variable proportions. If farm G has many men per acre, and farm H few, the marginal product of land will probably be higher on farm G: but the marginal product of labor will probably be higher on farm H. These facts do not contradict but support each other. This point is formalized in Stigler's Theory of Price,[4] and below, Chapter Three, Section II, B, 2, a.

Taking the marginal product of just one input, land, is a means of focussing analysis on exactly the matter of interest, not excluding relevant facts about other inputs but marshalling these facts to bear on the question at hand. Thus the marginal product of land, as we will show more fully in a moment, is much affected by the marginal products,

intensity and cost of other inputs, its complements. To know the marginal product of land we must take all these other factors into account. Indeed, much of what we know of the marginal product of land we know only indirectly, by inference from what we know more directly about the complementary factors of land. So we are by no means ignoring other inputs. It is a question of how these are taken into account, and to what purpose. Our purpose is to evaluate the functioning of the land market as an allocating agent, and for this end the marginal product of land, as used in the equimarginal principle, is a sufficient concept.

2. Meaning of the "marginal product" of land

The "marginal product" of a small unit of land, we have said, is the increased output achieved by adding it to an enterprise. But this brief definition still leaves some vital details to the imagination. Not all economists would fill in each detail the same. Worse, many skeptics question that the concept has much substantive content in real affairs. It therefore falls on us to round out the marginal product concept as we will use it, particularly in relation to land.

a. Unit of measurement the dollar

The marginal product is probably most often measured in physical units, and these then translated into dollars. There may be good reasons for this practise in some studies, but there is none in this one. We will

measure the marginal product directly in its dollar values. As we are dealing with production economics and not price economics we will throughout the study assume that individual sellers have no influence on price. This is not to be taken as indicating that the author believes that the economy is perfectly competitive. On the contrary, he believes the present study may contribute something toward an understanding of how industrial concentration develops. But as the present purpose is to analyze phenomena that occur independently from monopolistic motives we will for the present dispense with this much of the intellectual apparatus of price theory.

b. Adaptability of complements

i. Form and location of complements

Leading exponents of marginal analysis generally insist, in defining the marginal product, that complementary resources be allowed to adapt their form to the increased quantity of the variable input.[5] In this usage we concur. The marginal product of a unit of land added to an enterprise is not the immediate increase of output, but the increase after the complements have adjusted to the new proportions and scale of operations (meaning in both instances output per unit of time, of course). Better yet, it is the increased output of the larger over the smaller enterprise if both are originally planned with their respective amounts of land.

When the variable input is land, not only the form but the location of complementary resources changes, as they must move to the new land. For this reason it may require more mental effort to conceive of the marginal product of land than the marginal product of labor or equipment. But once the marginal concept is firmly in mind there is no difficulty.

One should be wary of a natural misconception of the marginal product of land. It would be easy, especially in some farm operations, to fall into the error of identifying the marginal product of an additional acre with the crop harvested from that particular acre. But the marginal product is the increase of output of the whole enterprise, which is the crop harvested from the new acre minus reduced output on the original acres. Output from these falls as complementary factors move off them to the new acre. The amount of the fall, incidentally, will equal the sum of the marginal products of the complements transferred.

ii. Quantity of complements

Does one allow changes in the quantities of complementary inputs in defining the marginal product of land? It is hard to find just what convention would dictate on this score, as so many theorists have not thought the detail worth explicit mention. This is understandable since, as we will see, the detail does not as a rule materially change the result as long as the increase of inputs is very

small. But we will be dealing with changes over a wide range, as well as with small ones, so we cannot pass the matter over.

To avoid any ambiguity we will, as many economists have done implicitly, and a few explicitly, distinguish two concepts: "marginal product" and "marginal net product." "Marginal product" is a ceteris paribus concept: other quantities are held strictly equal. "Marginal net product" is a mutatis mutandis concept: other quantities are changed appropriately, and the increased cost subtracted. "Appropriately" means until their marginal products equal their marginal costs. Thus, to find the marginal net product of an additional acre we add with it labor and capital, simultaneously of course adapting their forms to the new acreage, until the marginal products of labor and capital each equal their respective marginal costs; then we subtract the costs of these increased complements from the gross increase of output, and have the marginal net product of the acre.

Now which of these two concepts have we in mind when judging the excellence of market allocation of land by the equimarginal principle? In the event of conflict, the marginal net product is the ultimate criterion, containing as it does no artificial limitations on the individual's freedom to economize. But ordinarily there is no conflict since, in a given situation, the marginal product equals the marginal net product, just so the inputs are very small.

Marshall long ago pointed this out, and Stigler in 1941 elaborated on the theme in his Production and Distribution Theories.[6] Let us lay out the essential reasoning.

If one adds to an enterprise an acre of land, with the complementary labor and capital fixed in quantity but adaptable in form and location, the marginal product of the acre is the gross output harvested from it minus the cost of the labor and capital used on that acre. The cost of the labor and capital is, of course, the reduced output from the original acres that results from their being withdrawn. That is the sum of the marginal products of the labor and capital.

Now how does the "marginal net product" differ from that? Instead of drawing the labor and capital from other lands on the same enterprise one draws them from other enterprises. That is the only difference between the two concepts: the labor and capital, whose costs must be deducted, come from different enterprises.

It clearly follows that marginal product and marginal net product are equal so long as labor and capital from outside the enterprise are not available at less cost than the marginal productivity of labor and capital within the enterprise, and labor and capital within the enterprise do not have better alternatives outside it. These conditions imply also that inputs of land be very small, as large inputs affect the marginal productivities of labor and capital within the enterprise.

Now it is generally true that labor and capital from outside an enterprise are not available to it at costs less than the marginal productivity of those already employed there. That is not to say they do not exist, but they are not available to the enterprise, for one reason or another. If they were they would have been hired already. By the same reasoning, labor and capital within an enterprise do not generally have what the people involved consider better opportunities outside it. We say "what the people involved consider" because in the opinion of outside observers they may be mistaken or uninformed. Many of these outside observers are economists, who are more likely to read this than are the people involved. I hope the economists will understand, they may be quite right, but that only the opinions of the people involved are relevant to the present point, and these opinions are not likely to change in result of adding a small unit of land.

It follows, then, that marginal product and marginal net product are in practise generally equal, provided inputs of land are small. It is generally possible to plan various sized enterprises differing from each other by only a small acreage. Therefore in using the equimarginal principle we need not ordinarily trouble to specify whether the quantity of labor and capital is held fixed or let vary. To do so religigusly would be, in fact, rather misleading, inasmuch as the results would differ little. As mentioned, when a choice

must be made, marginal net product is the more adequate concept; but as a rule they are interchangeable.

c. Schedules of marginal productivity and marginal net productivity: ceteris paribus vs. mutatis mutandis

After what has passed one may wonder if it is worth troubling to distinguish marginal product and marginal net product at all. Probably it would not be were we always interested in them only at a point. But also very useful are entire schedules on which these points lie. Such schedules may be developed by simple reasoning from known data on costs and output per unit of land on enterprises of varying scale and intensity, and are vital tools of inference for bringing these facts to bear on the question whether land is equimarginally allocated among such enterprises. Over even a moderate range of acreage the two schedules will diverge considerably. To obviate any confusion it would be well to go over how one may construct these schedules, how they relate to each other, and how one may use them in conjunction with the equimarginal principle.

i. The marginal product schedule, with ceteris paribus

This schedule is developed on the assumption that all inputs but land remain fixed. It is useful in awakening the minds of young economists and in demonstrating the effect of varying proportions on the marginal product of land, although even for this purpose it is less than perfect since,

as Chamberlin has pointed out, when one factor is allowed to vary absolutely it is not just proportions that vary, but also in some degree scale. This schedule is familiar to all economists and need not detain us here.

What points on a schedule of marginal productivity also equal the marginal net productivity? Whatever point or points at which the marginal costs of complements hired externally equal their respective marginal products within the enterprise. For if these complements are available more cheaply outside, the marginal net product will of course be higher; while if cheaper inside, the marginal net product will again be higher, since its definition allows the entrepreneur to dispense with whatever labor and capital he can that are not earning their keep.

Just where these points of equality are, and how many, depends on the assumptions made in drawing the curve. In general it would require some unlikely assumptions to produce equality throughout the schedule, and we will not make such assumptions.

ii. The marginal net product schedule, with <u>mutatis mutandis</u>

This schedule is developed on the assumption that all inputs are variable. The marginal net product is the increased gross output from an additional unit of land with appropriate complementary inputs joined and minus the costs of the complementary inputs. On the schedule, as each

additional acre is added, it is added to a larger base, not only of land but also of complementary inputs. It is this shifting base that particularly distinguishes this schedule.

One might at first sight think to distinguish the two schedules by calling the marginal product "short run," the other "long run." But this would be misleading. In defining the marginal product we have had to allow time for the enterprise to adjust the form, organization, and location of complementary inputs to the new land. In terms of time, there is no difference between the marginal and the marginal net products. Therefore we distinguish the two instead with "ceteris paribus" and "mutatis mutandis": the marginal product schedule is ceteris paribus because all inputs but land remain constant in quantity; the marginal net product schedule is mutatis mutandis because other inputs change appropriately in response to changes in land.

This schedule of marginal net productivity is a most valuable analytic tool for analyzing economies of scale, particularly as they affect the marginal productivity of land. While the marginal product schedule illustrates a simple principle in artificial form, the marginal net product schedule illustrates the same principle in much more realistic form and, free as it is from restrictive assumptions, brings theory to the threshold of reality.

Regrettably, one finds little precedent for the use of marginal net product schedules. The marginal net product

concept is used by a few: Marshall (who called it "net product"), Pigou (who does not really define it), and Lerner (who uses it only briefly) are examples. But in their works, and works of Hicks, Stigler, Chamberlin, Carlson, Samuelson, the Robinsons, Black, Heady, Boulding, Weintraub, Machlup, Edgeworth, Robertson and Bain, the author has unearthed no schedule of marginal net productivity. There is no inherent difficulty in the concept but, as it is unfamiliar, it will pay to spell it out, together with the method of deriving it from available data.

Marginal net product schedules may be derived by simple reasoning from data on output per acre and costs per acre for different sized farms, which are available, albeit inadequate. Let us trace the reasoning, and see the general shape of the schedules that typical data produce.

Studies of economies on scale of farm operations generally indicate that as acreage increases (with more or less homogeneous land) operating costs per acre fall very rapidly at first and then level out. This is because certain inputs of capital and labor are imperfectly divisible below some moderate sizes, while as to land "If some definite size is taken as the smallest unit, it is done so, not because of any limited divisibility of land, but because of the limited divisibility of its complementary factors."[7] With this knowledge we construct a schedule we will call "Average Complementary Costs"--"average" meaning "per acre"

of course. The word "complementary" indicates that these are the costs of the complementary factors to land only, and not of the land itself. Naturally we do not want to subtract the cost of an input itself in computing any productivity of that input.[8] From this schedule, designated "ACC", we immediately infer the marginal complementary costs, or "MCC" (Fig. 1). Note, a, that MCC are very low early in the schedule, and, b, that they rise, even while ACC are still falling.

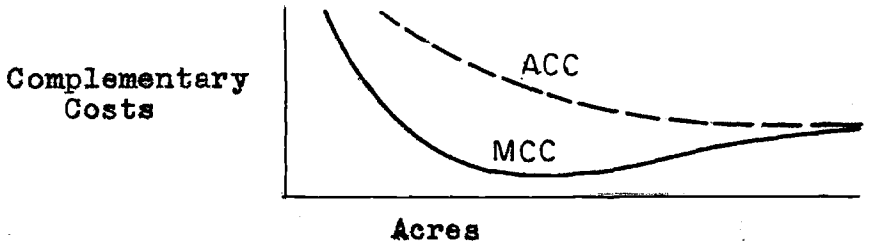

Fig. 1: Complementary costs, average per acre (ACC) and marginal (MCC)

This gives half of what we need to construct the schedule of marginal net productivity. The other half is marginal gross product, which we derive from known data on output per acre. Heady has observed that "Extension of the number of acres operated with one machine unit eventually results in lower acre yields."[9] Perhaps there is also an initial stage of increasing acre yields, as larger acreages permit of more advanced techniques and more specialized machines that more than compensate for reduced intensity--probably this is true in some operations and not others.

We will, at any rate, assume a brief stage of mildly increasing acre output.

Thus in a general way we know the shape of a typical schedule of output per acre, which we will designate "average gross product" (AGP). From it we immediately infer the marginal gross product (MGP) (Fig. 2).

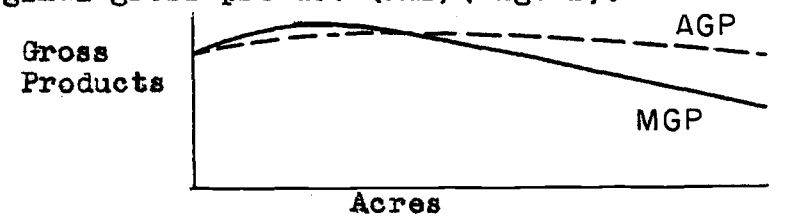

Fig. 2: Gross products, average per acre (AGP) and marginal (MGP)

The marginal net product (MNP) is now simply marginal gross product (MGP) minus marginal complementary costs (MCC) (Fig. 3a & b).

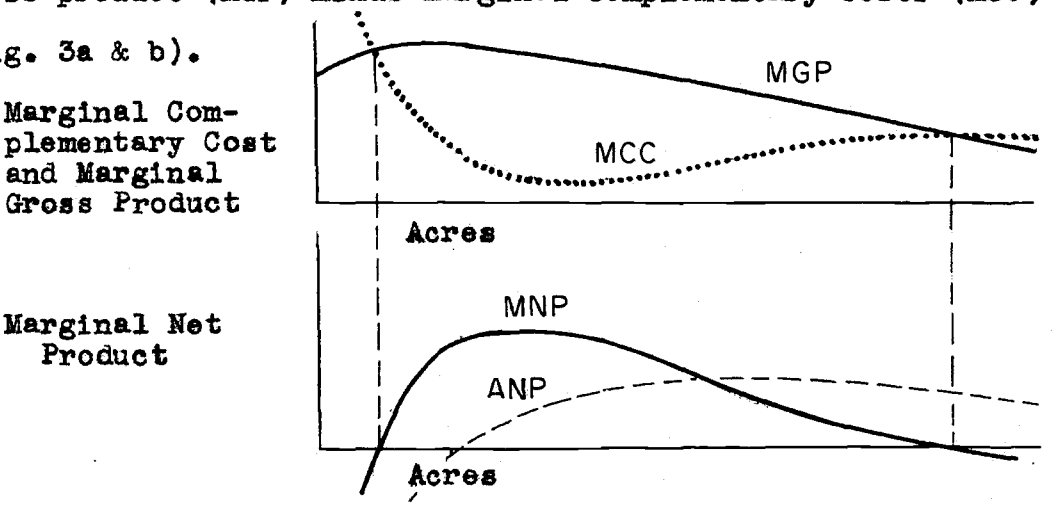

Fig. 3a & b: Marginal net product (MNP) derived by subtracting marginal complementary costs (MCC) from marginal gross product (MGP)

Note that MNP becomes zero while AGP is still higher than ACC.

Alternatively, we might compute the schedule of average net product (or economic rent of land per acre) as the difference of average gross product and average complementary costs. Then from that we could immediately infer the marginal net product schedule. For one who prefers to think in terms of economic rent of land, this latter procedure is more desirable.

As is customary in production economics, the cost and output figures given are the best that the entrepreneur or entrepreneurs in question would achieve with the conditions at their disposal--best, of course, in relation to each other, for all costs are undertaken in order to achieve output. Note also that the word is "would" achieve--not "could." We take human beings as they are. An exceptional individual might keep continually high gross output and low cost over a tremendous range, as some do. And many, many more could if they would. But it is a general rule that the marginal satisfaction from assets tends to diminish as more are acquired, while at the same time, as Black observed, "as a manager brings more and more management to bear on an enterprise, he must exert himself more and more to do it. The first managerial effort comes forth easily; the last, only at great sacrifice of comfort and leisure."[10] These are major factors tending to diminish returns to scale, and must not be assumed away.

A useful feature of the schedule of marginal net productivity is that every point on it is also the marginal productivity, for that particular mixture of land with its complements. For at each point one assumes that complements have been added until each of their marginal products equals its marginal cost. A curve of plain marginal productivity, recall, is not equally versatile, and does not represent the marginal net productivity, for it involves no such assumption, and the marginal products of the complements keep rising in the enterprise as more land is added.

A regrettable feature of the schedule is its unfamiliarity. The author would apologize for imposing a new concept on a profession already bending low under its overloaded pack of "tools." But actually this is only a new combination of accepted techniques. The mutatis mutandis concept is now the common property of economists; and the device of varying one input and then letting others catch up to it is taken directly from Boulding's Economic Analysis.[11] The novelty is not in basic conception or principle, but only in departing from what are becoming stereotyped textbook forms which are inadequate to bring the full power of marginal analysis to bear on the present subject.

The marginal net product schedule developed out of the needs of the present subject and is used only because it is exactly fitted to it. It solves the problem of what unit to choose on the abscissa when all inputs are varied

and marginal productivities are under investigation. It opens new possibilities in the analysis of economies of scale as they relate to the marginal productivities of particular inputs. It offers a technique for resolving the tortured questions "What size enterprises achieve most efficient use of resources," and "what economic forces encourage and what obstruct the achievement?" It resolves the questions into the simple ones, where are marginal productivities higher, and what keeps them from equality? It permits answering the first question from simple data on costs and output per acre. It also integrates marginal productivity analysis with traditional economic rent concepts (a matter discussed below) and permits definition of a socially optimum scale of operations without reference to the cost of land--something that is necessary when the system of pricing land is itself the thing under scrutiny, and cannot be assumed to be an adequate index of social alternatives.

To sum up these observations on the marginal product concept: the marginal product, as the term is used in the equimarginal principle, is the increased output yielded by increasing the input of land by one small unit, where the marginal costs of complementary factors outside the firm equal their marginal products inside the firm. In these circumstances the marginal product equals the marginal net product. In other circumstances, marginal net product is the more proper concept to use with the equimarginal

principle. Schedules of marginal net productivity are deduced from observed data on intensity and output as functions of scale, and are invaluable tools for analyzing economies of scale.

d. Some incompletely resolved problems in defining the marginal product

Few general definitions can be used in particular situations without some additional labor. We have defined the marginal product down to that degree of detail necessary to pursue this study, and would leave further details to the common sense of the reader. We would mention, however, two unresolved problems, in order to assure the reader that their neglect is a matter of choice and not oversight.

i. Differing time distributions of net output

It may sometimes occur that on enterprise A, after the complete adaptation of complements specified in our definitions, the marginal productivity of land would be higher per year than on enterprise B; but B would adapt more quickly, or has already adapted, so that, for a period of years, marginal productivity would be higher on B. Would a perfect market assign the land to A or B? In practise this is not likely to be a serious problem. First, the enterprise on which the ultimate marginal productivity would be higher would generally be under greater pressure to adjust quickly, probably being more crowded with underutilized complementary factors. Second, where there is a

conflict the ultimately higher marginal productivity will in most instances be the more desirable, since the influence of a few years can hardly offset the influence of a large number of later years, except at very high discount rates. Third, an ideal market would often find means of leaving land with the speedier adapting enterprise until the other was ready.

But more generally there is a problem of reconciling different time distributions of planned output. An enterprise may sacrifice current yields in order to accumulate capacity to increase future yields. In general we would handle this problem simply by treating the accumulation of capacity to yield future incomes as a form of capital accumulation. The increase of capital is part of "output" in the year of accumulation. Its value is found by discounting anticipated future yields at the interest rate used by the particular enterprise. Only a part of future yields can be attributed to present sacrifices of the current incomes. It is only this part that should be discounted to figure the present value of the capital accumulation.

We have occasion in the following pages to criticize some farmers for poor "conservation practises." This is not to be taken as identical with criticizing them for having too much current output. Some conservation practises increase both current and future output. It is quite possible to have low current output without conserving land well, either for present or future use. In other words, "production" and

"conservation" are by no means antonyms. Only sometimes is there a conflict between the two. Where there is, it is reconciled, as we have indicated, by treating positive conservation practises as capital accumulation in the year undertaken; and failure to prevent depletion as negative capital accumulation, or depletion, in the year suffered.

Criticizing farms for following poor conservation practises, therefore, is to criticize them for not taking as full advantage as they might of economical opportunities to increase future yields by increasing current expenses, or reducing current salable output. "Economical" means that, in the opinion of those expert in this field, the values of the future increased incomes from conservation practises, discounted at appropriate interest rates, would exceed their present costs--costs, that is, to some farmer with more incentive than the present operator to take advantage of these opportunities.

ii. Difficulty of establishing a homogeneous unit of land

Most of our analytical techniques assume a homogeneous unit of land. Of course there is none, for land or for labor or capital either. The easiest solution is to devise common sense substitutes for homogeneity. The problem is probably easier with land than with other inputs.

There are two general solutions. One is to take area as the measure of land. This is quite all right so long as

one selects areas within which land quality is quite uniform. It is often forced on us by the fact that so many data are collected in this way. The second is to measure land by its value, or some other expression of its productive potential. Due to the primitive state of the art of land valuation this is also far from satisfactory, but about the best that one can hope for until such time as those with the money and power to collect information see fit to improve on their methods of evaluation and land classification.

3. The equimarginal criterion and the economic rent criterion

Ely and Wehrwein have written that "rent acts as the 'sorter' and 'arranger' of this pattern (of land use)."[12] Certainly this is the traditional criterion: that use is best which yields the highest economic rent. This has also the advantage of being more welcome to those who, for reasons good or bad, have not reconciled themselves to the use of calculus in economic analysis. Why then should we depart from it?

First, as a matter of exposition, the equimarginal principle is very simple, clear, and irrefutable. The rent criterion is based on the same thinking, at root, but involves more mental steps. Too, the term "rent" has come to have so many meanings other than "the net income imputable to land" that it is well to dispense with it.

Second, the two principles are equivalent so long as scale of enterprise is no issue. As long ago as 1906 S. J. Chapman demonstrated that rent, residually determined, is the same as the marginal product of land.[13] But Chapman's demonstration depended on the assumption of constant returns to scale. Where returns to scale are not constant, we will see, the marginal product differs from economic rent. And in this study we want to deal with situations where returns are other than constant.

For the convenience of having a point of reference, let us define the acreage at which average net product, or rent per acre, is a maximum as the "ultimate optimal acreage." This is sufficiently analogous to the usual concept of a "long run optimal scale" so as to need no special explanation here--and we have already explained our reasons for eschewing the phrase "long run." This point is also the one where returns are constant, where marginal net product equals average net product or rent per acre. It is at this point that the rent criterion and the marginal product criterion are identical. But in comparing enterprises below the optimum with those above it the simple concept of land rent, while it points to the truth and nothing but the truth, does not reveal the whole truth.

Economic rent per acre is output per acre minus complementary costs per acre. Both above and below the optimum scale this difference becomes less, so economic rent per

acre falls. But, this apparent symmetry masks an important difference. For moving below optimum scale both output and complementary costs per acre become larger; above it, smaller. Doubtless an acre added to a smaller, more intensive enterprise would increase output more than on a larger, less intensive one, even though rent per acre was the same on each. Thus it would be an error to think that land was necessarily ideally allocated between two enterprises just because economic rent per acre was the same on each.

Putting it another way, below optimum scale rent per acre is rising, while above the optimum it is falling. Rent per acre is the same as average net product of land--a close relative of marginal net product of land. From the fixed relationship that always obtains between an average and the corresponding marginal schedule, we know that when the average is rising the marginal is above it; when falling, below it. Therefore just below optimum scale, or maximum average net product per acre, the marginal net product is higher than it is above optimum scale (Fig. 4).

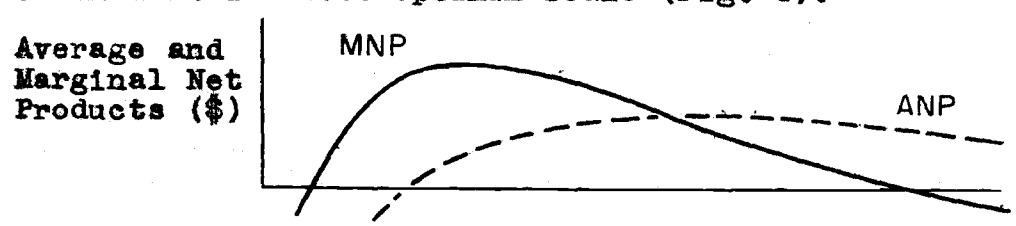

Fig. 4: Relationship of rent per acre, or average net product of land, to the marginal net product of land

This figure shows the relationship that obtains between rent and marginal net product of land as an enterprise passes through different scales. Note that to the right of the optimum scale (or maximum ANP) the marginal net product falls very low, even while ANP is still well above zero. On the other hand, to the left of the maximum ANP, marginal net product is higher than ANP.

4. The opportunity cost of holding land

We have written thus far as though it were self evident that the opportunity cost of holding land is the marginal product of the land in its best alternative use. And this does seem self-evident. But many persons write as though the alternative cost of land were actually the best alternative use of the funds tied up in holding title--i.e. interest on the price of the title. And, in fact, to the individual this <u>is</u> the cost of holding land. In a market where there was only one interest rate the opportunity cost of the funds tied up in the title would be the same as the opportunity cost of the land. But actually as we know funds are available to different individuals at different interest rates, so that the interest burden to some individuals may be less than the best alternative use of the land, and to others the interest burden may be more. Where there is a conflict between the two alternative costs, clearly the ultimate social criterion is the alternative use of the land itself. If the interest cost is different from this, then

there must be some conflict between the individual's incentives and the social welfare.

We will not now analyze this point further, for it is in fact the main theoretical burden of this thesis. Here we would only warn of the possible confusion, and state our position.

C. Use of the equimarginal criterion in this study

The office of the equimarginal criterion in this study is to test the excellence of land use by comparing one use directly with feasible alternatives. Herodotus wrote: ". . . pure gold is not recognized by itself; but when we test it along with baser ore, we perceive which is the better."[14] In like manner full use of land is not recognized by itself, but when we test it along with a baser use we perceive which is the better. We compare the marginal product of land in its present use with the marginal product in the best alternative use to determine if the present use is the best. When we find lands in uses such that their marginal productivity is less than it would be in feasible alternative uses, we conclude that the land of lower marginal productivity is "underused," and the market has not succeeded in allocating it to its best use.

The first three chapters, or Part I, survey three general types of situations in which land seems not to be allocated very strictly by the equimarginal criterion.

Chapter One takes up the problem of "unused land." It is not held to be a problem that land beyond the limits of settlement lies unused--there is no implication in the chapter, that is, that all land should be used. On the contrary, a full use of the better lands would probably result in less total use of land. It is rather a question of which lands should be used. When good lands are held unused in the midst of other lands used very intensively, and when much of the unused land is better located and more productive than much of the used land, then it seems clear that the marginal productivity of the land now unused, i.e. with marginal productivity equal to zero, would be higher in some alternative use, and therefore that the market is not allocating these lands in accordance with the equimarginal principle.

In the strict logic of marginal analysis "unused land" might be thought to include land "used," in the obvious sense of the word, but in such ways that its marginal net product was zero or less--that is, land for which the increased complementary costs of using it equalled or exceeded the increased gross product. But the nature of the surveys from which our data come is such that "unused land" refers only to land from which there is no output. The more subtle problem of land for which marginal complementary costs equal marginal gross product is reserved for Chapter Three, where it is treated as part of a more general problem.

On the other hand, not all lands called "unused" in Chapter One are absolutely without any output or complementary costs. To use available data one must go along with whatever definitions the surveying agencies use. Obviously where things are classified by kind, rather than ordered by degree, there are many borderline cases. Examples are downtown lots "improved" only with a billboard or condemned tenement, or fertile fields "complemented" only with an occasional pack of foxhounds. Some of these inevitably find their way into the "unused" category--some, also, into the used. This problem is elaborated in Chapter One itself.

It is of little consequence whether these lands are "unused" in some absolute sense. The point is that they are either that or so close to it that their marginal products are very low relative to what they might be in some other use from which they are preempted. It is this contrast that makes the fact of disuse meaningful.

Chapter Two deals with tenanted land. Here, as elsewhere in the study, a questionable use of land is judged by comparing it to an alternative and asking if land, shifted from the present use to the alternative, would increase net output more in the new use than it reduced it by forsaking the old.

In Chapter Two the questionable use is tenancy; the alternative is owner-operation. The equimarginal criterion of ideal allocation remains unsatisfied, as we said, so long

as it remains possible to increase net output by shifting land from one tenure to another. This is the most subtle concept of shifting "uses" of land, and it is important to understand it. Crop and operator may remain the same, but the "use" is different, in this sense of the word, if the tenure conditions change.

The chapter indicates that there are unrequited costs and many frustrations in the landlord-tenant relationship, such that the market could increase net output from given land resources by shifting title from absentee landlords to tenant operators, making these latter owner-operators. This conclusion is taken to indicate that the market is not allocating land by the equimarginal criterion.

Some readers may protest that the above statement makes no mention of marginal productivity. But recall that, as mentioned when we first introduced the equimarginal criterion, it requires no explicit reference to marginal productivity to show a violation of the equimarginal criterion, but only the simple reasoning of the preceding paragraph. But as some readers may disagree, and as it is possible to deduce quickly from the preceding paragraph that the marginal productivity of land must be higher on owner-operated farms, we will do so.

If the net output of the lands in a tenant farm would be higher if the tenant were the owner, then it follows that the net output per acre, or average net product of land,

would also be higher, since the number of acres remains unchanged. Now we have already seen that, when enterprises are of optimal scale, marginal net product of land equals average net product of land. So in that case clearly marginal net productivity would be higher on the owner operated farm.

If the farm in question were not of optimal scale the marginal net product would not equal the average net product exactly; but the two schedules would shift up and down together, so that if, at a given acreage, average net product of land is higher on the owner-operated farm, marginal net product must be higher also, unless the shapes of the curves also change in some unlikely ways.

And even should these unlikely changes of shape occur, it would still remain true that, for the average net product to be higher on the owner-operated farm, the marginal net productivity must also be higher throughout most of its range, since a high average is built up from a succession of high marginal increments. And the market's failure to allocate land to owner-operated farms within the range where marginal productivity remained high would still indicate a failure to allocate land equimarginally.

The chapter also indicates higher marginal productivity of land on owner farms over another line of reasoning. We have seen, in defining the marginal productivity of land, that it varies inversely with the cost of its complementary factors. The evidence of Chapter Two indicates that on

tenant farms there are extra costs involved in applying labor and capital, costs which are obviated when tenants become their own landlords. It follows directly that the marginal productivity of land must be higher on owner operated farms.

One might well inquire at this point whether it is necessary to go to as much trouble as we have to introduce and develop the equimarginal criterion for the additional clarity it provides in this chapter. The answer would probably be no. The conclusion of this chapter could have been stated in terms simply of land rent or net product of land. However, the equimarginal criterion is as good as any here--at root they all involve the same basic reasoning. And the equimarginal criterion is very useful in Chapter One, and essential to Chapter Three, which could hardly have been written without it. It is valuable to use it in all three chapters, to show their essential unity and pave the way for a simplified and generalized hypothesis and conclusion.

Chapter Three concerns land in holdings of non-optimal size. This chapter contrasts the marginal productivity of land on large, lightly used holdings with that on small, intensive holdings. It develops the contrast by inference from available data on the availability of labor and capital on the different farms, and also from studies of economies of scale. The tools of inference are the schedules of marginal productivity and marginal net productivity developed in this introduction. Chapter Three concludes

that the marginal productivity of land tends to be higher on small, intensive farms than on large, tightly used ones, and therefore that the market has not achieved an equimarginal allocation of land between these two general classes of farms.

Chapters Four and Five treat of time economics, and can be read without reference to the equimarginal principle, just so one understands what is meant by the rent of land. These chapters may be linked with the equimarginal criterion by recalling that the rent of land is the same as its net product.

Chapter Six integrates the time analysis of Chapters Four and Five with the equimarginal analysis to round out the hypothesis of how differences of individual interest rates tend to obstruct an equimarginal allocation of land. From the time analysis it is observed that the annual marginal cost to the individual of holding land depends on interest rates, and as funds are available to different individuals at different rates, different individuals tend to add land to their holdings to different margins of productivity, contrary to the equimarginal ideal. That is the major conclusion of the study.