THE RENTAL FOR UNCERTAINTY AND OLIGOPOLISTIC EQUILIBRIUM

Volume I

A Dissertation

by

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ABSTRACT

The Rental for Uncertainty and Oligopolistic Equilibrium. (August 1986)

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This dissertation is concerned with the imputation of rental income for entrepreneurial uncertainty. It begins with a review of the historical development of rent theory. Chapter I briefly summarizes contributions to the theory of rent from the time of the mercantilist economists to the neoclassical era. Chapter II considers the conditions giving rise to rents for functional inputs. It also considers the appropriate imputational procedures to be employed. It is shown that variable cost imputations are consistent with Marshall's view of rents.

Chapters III and IV consider the rental income of nonfunctional inputs. In Chapter III Greenhut's model of entrepreneurial rents and competitive-oligopolistic equilibrium is considered. It is shown that the rental for nonfunctional inputs reflects the opportunity cost of the factor in question. In Chapter IV Greenhut's model of nonfunctional inputs is contrasted with Chamberlin's. It is shown that factor

conformability requires production at optimum efficient scale. A utility-theoretic model of the market for entrepreneurial uncertainty is developed. This model indicates that factor conformability must always emerge in an industry characterized by competitive factor markets.

Chapters V and VI are devoted to Baumol, Panzar, and Willig's model of monopolistic competition. Chapter V summarizes BP&W's general theory of contestable markets. Chapter VI is more specifically concerned with an analysis of BP&W's behavioral postulates and monopolistically-competitive market structures. It is shown that BP&W's theory fails because their primary behavioral postulate, namely, that firms engage in entry-forestalling pricing behavior, is unacceptable under the assumption of fictionless entry and exit. Their theory also lacks generality since it is based upon the fictional concept of the representative firm. Contrary to BP&W's theory, it is shown that equilibrium is consistent with different industry configurations involving a multiplicity of size-distributions of firms.

The dissertation reaches several important conclusions. Firms in a competitive-oligopoly will, in general, produce the output associated with minimum efficient scale. Rental income correctly, reflects the opportunity cost for entrepreneurial services, including, most importantly, entrepreneurial uncertainty. Finally, firms need not be the same size in a zero pure-profit equilibrium.

DEDICATION

This dissertation is dedicated to those who have supported and sustained me in so many ways. It is dedicated to my parents, to my loving wife and children, and to my brothers and sister.

ACKNOWLEDGMENTS

I feel I must acknowledge those primarily responsible for the completion of this dissertation. I must first acknowledge Melvin L. Greenhut, the chair of my committee. His guidance, encouragement, and long-suffering through numerous readings of material have contributed significantly to my work. He has been open-minded and allowed me to pursue my own course.

Secondly, I must acknowledge Hendrix College, which kept that wolf at bay for the extended period necessary to complete this work.

Finally, but not least, I must acknowledge the efforts of Amy Raymond and Linda Benefield. Linda has assisted me in so many ways by serving as a liaison at Texas A&M University during my absence. Amy has served as my typist. She has tirelessly and cheerfully worked long hours in the midst of her own examinations. Without her personal sacrifices, this dissertation would not have been accomplished.

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CHAPTER I

AN INTRODUCTION TO THE THEORY OF RENT

Frank Knight has argued that rents arise under perfect competition, being attributable to differentials in the level of risks faced by firms. He argues further that no such rents may be imputed for uncertainty. Uncertainty results in the existence of a non-imputable pure profit [18, 308]. Knight views a long-run, competitive equilibrium which is characterized by a tendency towards the dissipation of such profits.

Greenhut [13] has extended Knight's analysis to describe long-run equilibrium in spatial [oligopolistic] markets. He argues that the uncertainty associated with such markets will yield long-run economic profits.

An adequate appraisal of a long-run equilibrium within the spatial context is necessarily keyed to a clear concept of the term rent! What are the sources of rent? Under what conditions may rent be expected to persist? How does the analysis of rent fit within neoclassical economic analysis?

The dissertation will follow the format of the Southern Economic Journal. The specific article used as a model is by Lloyd R. Cohen, "The Firm: A Revised Definition", Southern Economic Journal, Vol. 46, October 1979, 580-590.

This chapter traces the historical development of the theory of rent. In a later chapter, this concept is applied to the spatial firm.

Pre-Ricardian Rent Theory

Keiper [17, 4] attributes the origin of the theory of land rent to the mercantilist economists of the late seventeenth century. By land rent they meant the payment to an owner of a scarce resource which is in relatively fixed supply. Sir William Petty appears to be the first major writer to analyse rent in his 1662 book, A Treatise on Taxes and Contributions. This tract is important for several reasons: it is the first to identify rent as a residual; it implies that the magnitude of rent depends upon market forces; it associates rent with a concept of opportunity cost; and, it attributes rent to variations in fertility and production techniques [24]. Petty did not explicitly associate rent with a fixed supply of land. Nor did he address the question of returns to scale which was later to be taken up by Ricardo. Charles Hull, Petty's modern editor, asserts that Petty probably thought the fertility of land could be infinitely increased with proper cultivation [24].

The physiocrats attributed all surplus, the product net, to the farming sector. Turgot, however, contributed to the theory of rent in several ways.

Turgot refers to land rent as a surplus rather than as a residuum [37]. He was the first major economist to assert that the surplus must be imputed as a cost of production. Rent merely reflects the opportunity cost of the capital invested in agricultural production. Turgot argues that when market prices are so low as to yield the cultivator insufficient returns to cover this opportunity cost, farmers will not wish to work the land. It is apparent that Turgot is using the term rent in the macroeconomic context as the factor payment to land resources. He is not referring to rents due to differentials in skills, fertility, or fixity of resources.

Adam Smith is the last of the significant pre-Ricardians to contribute to the theory of rent. Smith's analysis generated great debate concerning the nature of rent. His major point of departure was his view that land rent was a monopoly rent [32]. A monopoly rent, as used herein, refers to a return in excess of a factor's opportunity cost. A careful reading of his Wealth of Nations indicates that Smith was not rejecting the concept of land rent, but was augmenting it with another type of rent.

Smith's analysis generated much discussion pertaining to the question of whether rent is price-determining or price determined. Smith himself seemed unclear as to which was the case. Smith states:

> In the price of corn, for example, one part pays the rent of the landlord, another pays the wages or maintenance of the labourers and labouring

> cattle employed in producing it, and the third pays the profit of the farmer. These three parts seem either immediately or ultimately to make up the whole price of corn [32, 50].

Yet in Chapter XI, "Of the Rent of Land," Smith states, "High or low wages and profit are the causes of high or low price, high, or low rent is the effect of it", [32, 146].

Buchanan has argued that there is no conflict in Smith's view of rent. He suggests that the former passage was written with respect to income distribution, while the latter was written with respect to price determination. According to Buchanan [6, 599-637], there is no causal attribution to be inferred from the first citation.

Smith suggested that rent also varies with the locational advantages of the ground-site [32, 147]. While he recognized that rent reflected opportunity costs of capital as well as fertility differentials, these observations cannot be considered new or expansive.

The pre-Ricardian period provided an embryonic theory of rent. Petty identified the concept of land rent, rent as an opportunity cost, differential rent, and the qualification of rent as a residual. Turgot defined land rent as a surplus which must be expensed. He also refined Petty's concept of opportunity cost and extended it so that land rent must cover the opportunity cost of investing in other capital projects. Smith viewed a second type of rent, one which yields an unearned surplus to be expropriated by the monopolist. He further recognized that locational advantages were reflected in the rents paid to different tracts.

The Ricardian Period

The theory of rent popularized by David Ricardo has been attributed by some historians to James Anderson or Thomas Malthus [27]. Regardless of its originality, the wide dissemination of the theory is attributable to the success of Ricardo's *Principles of Political Economy and Taxation* [25].

Ricardo incorporated his views into a broad theory of distribution. Gootzeit [12, 41-53] and Spiegel [33, 326] both provide excellent tabular illustrations of Ricardo's distributive mechanism. Ricardo viewed the price of a good as covering the cost of production associated with land at the extensive margin of cultivation. Inframarginal lands therefore received surpluses which reflected their greater productivity. Increasing demand for agricultural products would necessitate the employment of more marginal land in the long run. Thus rents paid to landlords would thereby increase.

Long-run competitive conditions fail to bid away rents since they are not viewed as scarcity rents. Ricardo's rents are most appropriately viewed as *differential rents*. These rents are attributable to the heterogeneous productivity of land. The acknowledgment of the persistence of rents in the long run was Ricardo's major lasting contributions to rent theory.

Francis Amasa Walker [38] was the American apologist for David Ricardo. As such, his views on rent do not significantly differ from those of Ricardo. However, two passages from Land and Its Rents are noteworthy.

In the first, Walker uses the term "law of diminishing returns" in reference to Ricardo's theory [38, 20]. Secondly, Walker seems to have anticipated Wicksteed's product exhaustion theorem. Walker states:

> Rent arises from the fact of varying degrees of productiveness in the lands actually contributing to the supply of the same market, the least productive land paying no rent, or a rent so small that it may be treated as none. The rent of all the higher grades of land is measured upwards from this line, the rent of each piece absorbing all the excess produce above that of the no-rent land [38, 21].

This passage is very similar to Wicksteed's verbal expression of the product exhaustion theorem: Under ordinary conditions of competitive industry, it is sensibly or approximately true that if every factor of production draws remuneration determined by its marginal efficiency or significance, the whole of the product will be exactly distributed", [41, 38].[1]

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1. It should be noted that Wicksteed disapproved of the manner in which the term "rent" is commonly used by economists.

Ricardo's and Walker's views of rent were based upon a production function characterized by diminishing returns. By diminishing returns, Ricardo means diminishing average and total products on marginal units of land.

Karl Marx chastised Ricardo for basing his analysis upon the marginal principle [22, 772]. Marx indicates that the mere existence of differentials in productivity suffice for the existence of land rents. Marx was explicit concerning the relationship between opportunity costs and rents. He extended an example originated by Adam Smith concerning the use of land to raise cattle. Marx notes that such land must provide the same rental as if the land were used for growing cereal [22, 891-892].

Nassau Senior [31] also attacked the Ricardian view that rent arises solely from differentials in the yields of land. Senior viewed part of the return from investing in agricultural production as a return on capital. He was also explicit about the ascription of differential rents to all factors of production. Senior reacted strongly against the use of the term "rent" as an income generated by many different processes. The term had come to be used in several different ways by the height of the Ricardian era. Some economists were using the term as describing the total factor payments to land resources. Other economists were using the term to describe differential returns due to differences in productivity. While the term is still used in both ways, it is usually clear to modern economists which definition is appropriate.

Like Walker, John Stuart Mill must be viewed as an apologist for Ricardo's view of rent. His views mirror Ricardo's preoccupation with the law of diminishing returns [23, 690].

Mill did depart from Ricardo's analysis in that he recognized that scarcity rents are indeed a short-run cost of production:

> Rent is not an element of the cost of production of the commodity which yields it; except in the cases (rather conceivable than actually existing) in which it results from, and represents, a scarcity value. But when land capable of yielding rent in agriculture is applied to some other purpose, the rent which it would have yielded is an element of the cost of production of the commodity which it is employed to produce [23, 479].

The Ricardian period was characterized by a great deal of confusion concerning the origin and nature of rent. There was no logical organization of rent concepts into a cohesive body of theory. During this period, however, most of the basic tenets of modern rent theory were established.

The German Theorists

During the Ricardian period, German theorists made significant contributions to the theory of rent. However, it appears that there was little interchange of ideas between English and German economists at this time.

As early as 1800, German theorists were ascribing rents to differentials in the skills of workers. This is notable given the myopic preoccupation of English economists with the rent of land. John George Bush notes that:

> ... in store the more skillful packer is paid better than the unskilled...if it was worth the trouble to be very exact in the matter, one could even contest whether wages-gain (Arbeiterslohn-Gewinn) is rightly so characterized, for it can, at least in part, be regarded as a rent of the mere skill of the labor, for though the rent is so insignificant, yet the incapable labourers cannot draw it [7,107-108].

Gottlieb Hufeland made several significant contributions to the theory of rent. Hufeland used the term rent to refer to productivity differentials rather than to the factor payment for land. Hufeland classified all rent as being of four types: the rent of land, the rent of capital, the rent of labor, and the rent of the Unternehmer (entrepreneur). It is the rent of the Unternehmer to which Hufeland devotes the most attention. Hufeland is one of the first economists to clearly distinguish between the entrepreneur and the capitalist. He states,"He who employs the capital is the Unternehmer, the owner of the capital is the capitalist, and the return which the Unternehmer receive is called the 'Unternehmungsgewinn", [16, 109]. Hufeland considers the unternehmungsgewinn as a surplus after abstracting wages with gain, repair of capital, repair for the risk of capital, and capitalgewinn (interest). This is the first clear reference to a return for the risk of capital. Hufeland views this repair for risk of capital as a cost of production which must be paid to the capitalist. However, he also recognizes the risk of the Unternehmer.

> The balance comes to the Unternehmer, and is partly a gain which he draws because of the greater risk which he incurrs, and partly for a rent for his talent or other mental qualities. And so it is in the class of successful Unternehmers that the greatest wealth is gained. The rent for the talent and other qualities has no limit because men of this sort are scarce [16, 110].

The Unternehmungsgewinn is in part a return for entrepreneurial risk. Mangoldt later emphasized that the Unternehmer's rent does not cause an increase in the price of products [20]. The return for entrepreneurial risk is not considered to be a cost of production.

Charles William Macfarlane was an American who studied at Freiburg University. Macfarlane was in closer contact with his English contemporaries than his predecessors had been. This is evidenced by his diagrammatic presentation of a marginal productivity theory of rent. This presentation is almost indistinguishable from that of Alfred Marshall [20, 86].

Macfarlane did make one notable contribution to the theory of rent. He expanded upon Ricardo's ascription of a rental due to the producer's distance from the market [20, 87].

The German theorists were much more explicit in their analysis than most of their English contemporaries. They recognized rental payments for skill differentials, entrepreneurial talent, entrepreneurial risk, capital, and distance from the market.

The Post Ricardian Period

Phillip Wicksteed strongly objected to the Ricardian view of rent as differentials in the productivity of hired factors [40, 22].

Ricardo had been interpreted as having defined rent as the shaded area in figure 1.1. This is a somewhat gratuitous interpretation, as Ricardo's tabular example is based upon diminishing average product and a total product which, after a point, increases at a decreasing rate.

Wicksteed's criticism is based upon the reflexive nature of the product curves for land and labor. In figure 1.1, at OL units of labor and with fixed quantity of land, labor's earnings are given by LMNO. The factor payment to land is given by the shaded area. Analogously, one may view a similar figure for the marginal product of land with labor held constant. The shaded area in figure 1.1 is not a surplus but the factor payment to land. Wicksteed was considering production processes characterized by Euler's equation. There can be no surplus when

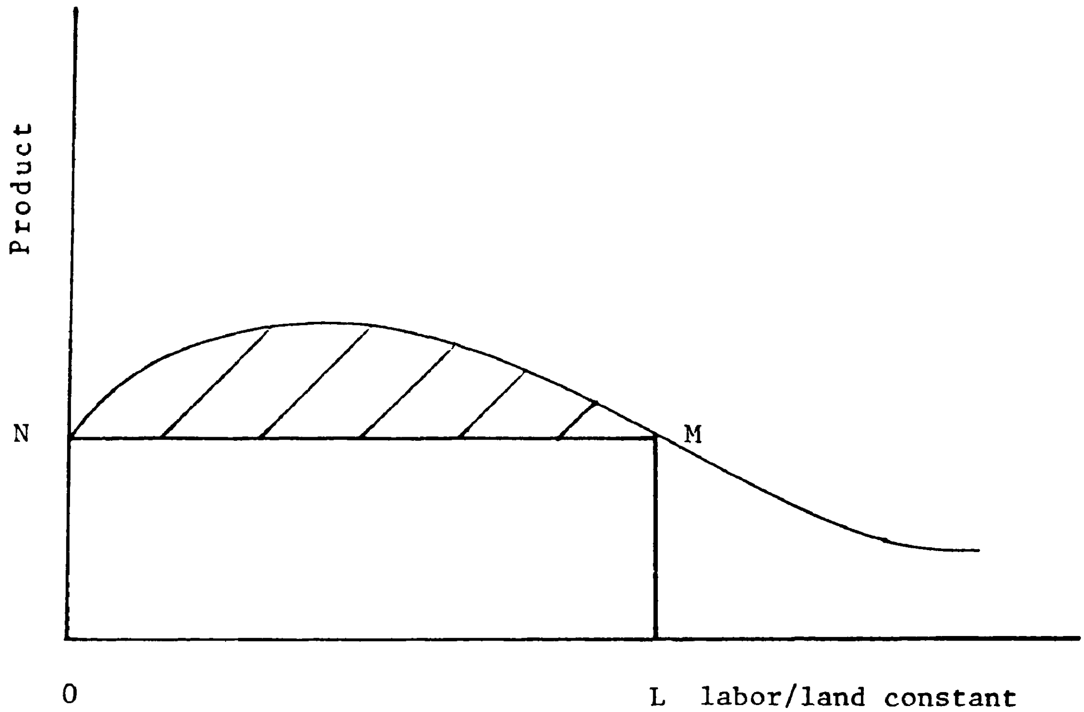

Figure 1.1. Wicksteed's View of Rent

production is linearly homogeneous and each factor is paid its marginal product. In Wicksteed's view, all factor payments may be viewed as rents under the Ricardian theory.

Alfred Marshall adopted a qualified version of Ricardo's theory. Like the German theorists he viewed the rent of land as "not a thing in itself, but as the leading species of a large genus", [21, 412].

Marshall held that rents may be viewed as either scarcity rents or differential rents. The choice is a matter of expository convenience [21, 442-443]. In his example of a shower of meteoric stones, he analyzed the rental payment from both points of view.

Marshall also distinguished between quasi-rents and rents. Quasi-rents were viewed as returns in excess of variable costs. As such, they are short-run in nature [21, 424]. In the long run, the confident expectation of coming quasi-rents yields a normal rate of profit on free capital. These opportunity profits are discounted to determine the value of a piece of capital equipment. Marshall views this value as the factor payment (rent) to capital.

Henderson analyzed the factor payment of land which was subject to a number of alternative uses. He formulated the concept of the "margin of transference." Land is said to be at its margin of transference when its rent is just sufficient to prevent its tranference to some alternative use [15, 94-97].

Joan Robinson utilized Henderson's margin of transference as the basis of her concept of rent. She notes that, "The essence of the conception of rent is the conception of a surplus earned by a particular factor of production over and above the minimum earnings necessary to induce it to do its work", [26, 102].

Robinson attempted to salvage Ricardian rent theory. However, her treatment is concerned with marginal costs and not average product as was Ricardo's. She defined "intensive marginal cost as: "...the cost of making a unit increase in the output produced with the aid of any given portion of the scarce factor by increasing the amount of the other factors", [26, 122]. Intensive marginal cost for each factor will equal the price of the commodity. This is true whether or not a factor is in perfectly elastic supply. If the price of a commodity exceeded intensive marginal cost, it would be profitable to expand output until intensive marginal cost rose to equal price. This would be accomplished by using the scarce factor more intensively.

As demand for a commodity increases, more of all factors of production will be employed. The price of the marginal units of factors will increase. The price of all units of a factor will equal the price of the marginal unit. A profit maximizing firm will increase the employment of those factors whose prices do not rise as much relative to the scarce factor. The scarce factor (with less elastic supply) will be used more intensively as output increases, subject to the technical possibilities of substitution. The intensive marginal cost and the cost at the margin will both rise and remain equal to commodity price. Robinson states:

> In every case the supply price of the commodity is equal to cost at the margin and to intensive marginal cost. Rent makes up the difference between the price and the cost of producing a unit of the commodity with the aid of inframarginal units of the factors, and supply price is equal to average cost including rent [26, 126].

Robinson graphically illustrated the case where entrepreneurship was the scarce factor, and all other factors were in perfectly elastic supply.

Figure 1.2 is reproduced from Robinson's figures 41 and 42 [26, 125]. In figure 1.2, AC is the average cost of the output of the firm (excluding rent) for each firm. Likewise, MC is the marginal cost of each firm. AC' is the average cost of the firm including the entrepreneur's rent. ADCB is the total rent of the entrepreneur, Robinson ascribes rent as a lump sum to the total costs of the inframarginal firm. This ascription does not shift

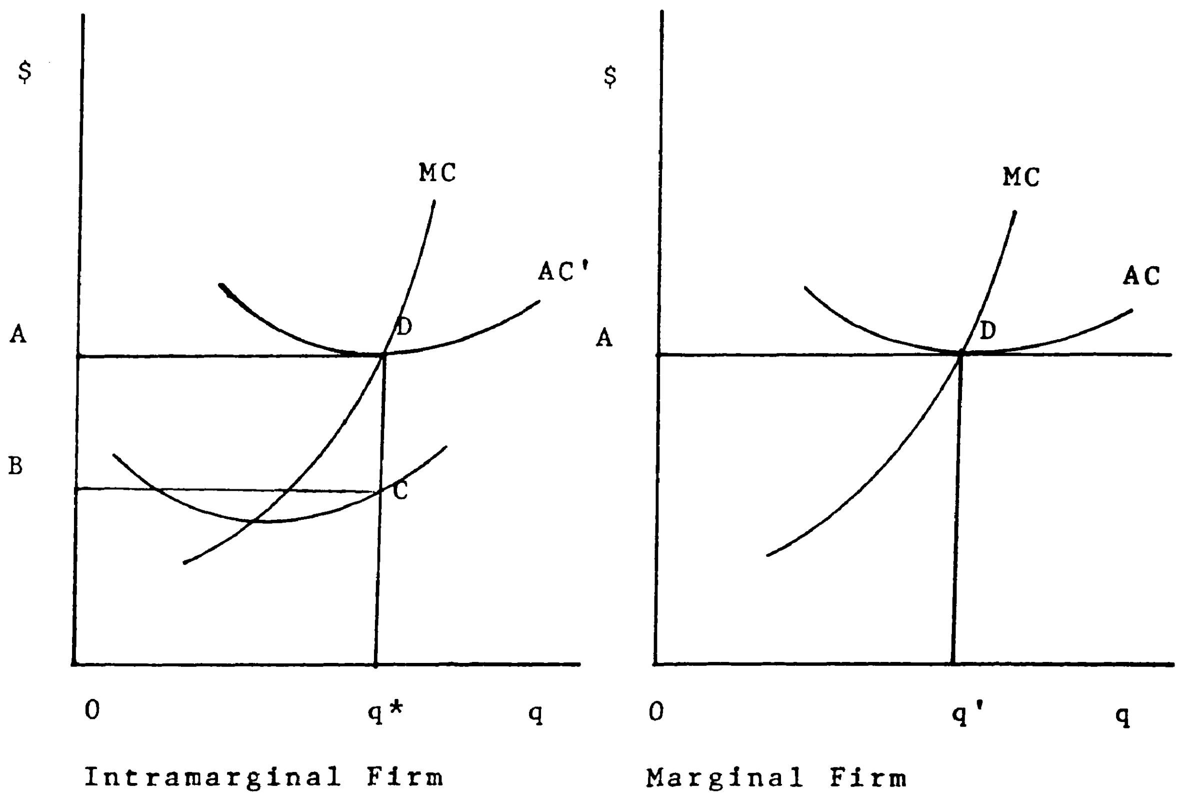

Figure 1.2. Robinson's View of Rent

the marginal cost curve, which will cut both AC and AC' at their minimum points.

It is important to note that the AC and MC curves are not the same for the inframarginal firm and the marginal firm. The cost at the margin is the marginal cost of the firm on the border of transference, or the marginal firm in figure 1.2. Intensive marginal cost is the marginal cost of the inframarginal firm. The cost at the margin of the commodity is equal to the cost of the firm using only marginal units of all factors. Inframarginal firms, however, work the scarce factor more intensively. Their costs will be less than those of the marginal firm.

There are several problems with Robinson's analysis. Robinson has defined rent as the surplus earned by a factor in excess of the minimum earnings necessary to induce it to do its work [26, 102]. Elsewhere Robinson defines rent as the difference between total revenue and total cost of the inframarginal firm [26, 124]. These definitions are not consistent. The expansion of production drives up the market price of all units of the scarce factor. The total, average, and marginal cost curves of the marginal and inframarginal firm will be the same. If the new, higher price for entrepreneurial services is not paid to the inframarginal firm, his services will be bid away.

Robinson also assumes that the scarce factor may be worked more intensively by the inframarginal firm at no increase in expense. It is hardly conceivable that increases in the intensity of factor utilization do not entail higher factor payments. Even in the case of land or capital, more intensive utilization is not likely to be costless. It will result in an accelerated depreciation of the factor's productive life and efficiency. The level of intensity will normally be proportional to the level of output. It therefore seems logical that rent should be ascribed as a variable cost rather than a fixed cost.

Finally, as these costs are actually incurred, rents should not be viewed as a surplus. Chamberlin is explicit in this regard:

> The curve for the inframarginal producers will evidently have the same minimum point, if their rents are included as costs, and they must be so included. Although rents may be surpluses from certain points of view, or for certain purposes, or subject to certain interpretations, they are to the individual producer no different from any other money expense. They do not arise as a surplus from his own operations; they are a cost rigidly imposed upon him by the competition of his rivals for the use of rent yielding property. They figure in the same way as do the wages of labor and the interest of capital in his computations as to the most advantageous proportion between the factors and as to the most advantageous scale of operations [8, 22].

In Robinson's terminology, increases in output bid up the price of factor units at the margin of transference. In competitive factor markets, the minimum amounts of earnings necessary to induce a factor to do its work is bid up to the same level. There will remain no surplus, and therefore no rent.

Robinson's analysis is a theory of marginal wage determination rather than a theory of rent. It is, however, of monumental significance in the development of rent theory. Fritz Machlup provided the appropriate extension of Robinson's work into a true theory of rent.

Machlup recognized that an excess of total receipts over total costs could persist in the long run under certain conditions. He identifies these conditions as factor immobility, uncertainty, and indivisibility in the production process. He categorizes the anticipated excess of receipts over all costs as either specific rent or pure profit [19, 243].

Specific rent is that portion of net-earnings which can be imputed to a specific resource whose value to the firm is in excess of its opportunity cost. The portion of net earnings which cannot be imputed to any resource is known as pure profit. Factor immobility is a source of specific rent. Uncertainty and indivisibility of the production process are sources of pure profit [19, 237-238].

Machlup's definitions imply that returns for uncertainty or indivisibility cannot be imputed to any of the cost curves. Indeed, he does not attempt any type of imputational process for pure profit. He does, however, specify an imputational procedure for the specific rents created by natural or artificial scarcity (immobility).

Machlup considers the case of an increase in product price occasioned by an increase in demand. In figure 1.3 the firm has been a marginal producer. The initial price, OA, has been equal to average cost, KQ, and the firm has been earning no economic rent. Assume that the firm now faces price OB due to the increase in market demand. The firm will now maximize profits by producing where price equals marginal cost, or OM units of output.

At OM units of output average revenue, MP, exceeds average cost exclusive of rents, MR, by RP. RP is the firm's average rent. If this rent is included in the average cost curve, average revenue must be equal to average cost. Machlup states: "If the new average cost curve including rent is drawn (by spreading the total rent over the output and adding it to the average cost with-out rent), this curve, AC_2, must of necessity have its lowest point in P and thus be tangent to the new demand curve", [19, 289].

Machlup provides no justification for this imputational procedure nor elaborates further upon it. Note that Machlup makes no attempt to distinguish between an exclusive and inclusive marginal cost curve. The imputational procedure is implicitly one of ascribing rent as either a fixed cost or as a

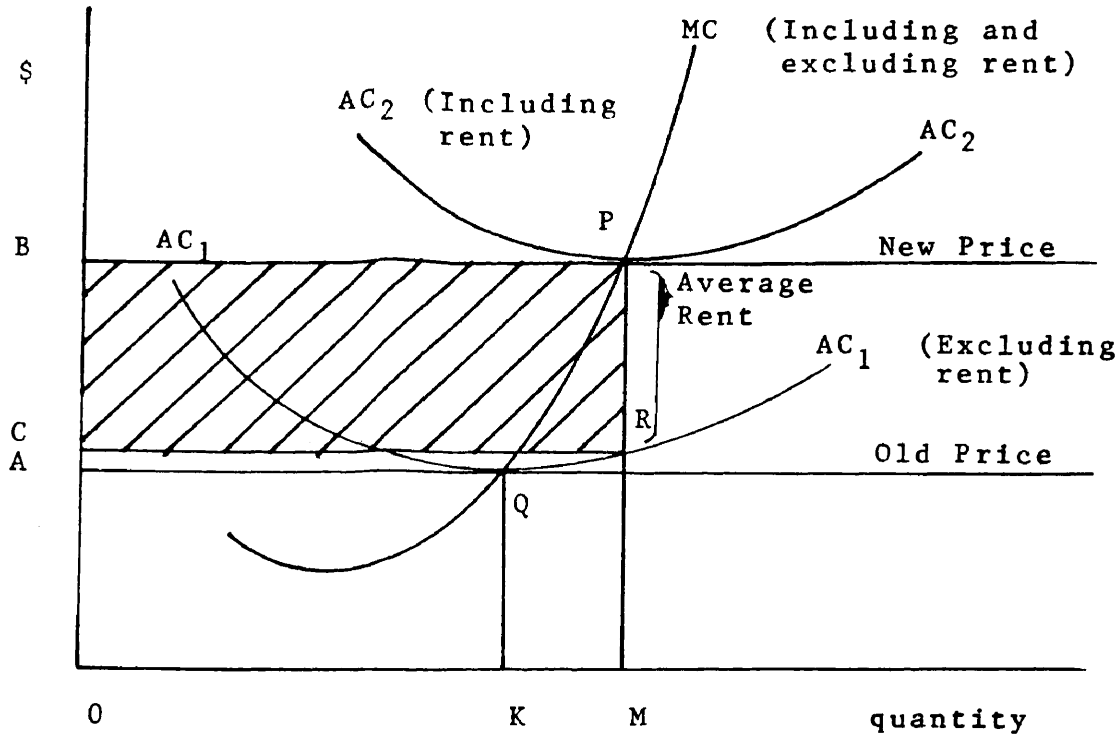

Figure 1.3. Machlup's View of Rent

constant variable cost. In either case, the marginal cost curve will be unaffected.

Machlup categorizes rents and profits as the *anticipated* excess of receipts over all costs. The italicized term is used to distinguish between historical or incurred cost, and anticipated or opportunity cost. He emphasizes that economic cost curves fully reflect opportunity costs.

Machlup recognizes that rents arise only because of factor immobility. With factor immobility no equilibrating mechanism exists which will bid up the price of inframarginal units to that of the marginal unit. Commodity price will exceed average cost. In Robinson's example, the entrepreneur will continue to receive income in excess of the minimum necessary to induce it to do its work. Under conditions of perfect mobility of resources rents will dissipate.

Uncertainty or indivisibility in the production process implies the reaping of pure economic profits. Machlup does not specify a process which would lead to the dissipation of such profits in a competitive, long-run equilibrium. Economic activity in a spatial context is primarily differentiated from that of a spaceless economy by the persistence of uncertainty nd indivisibility. The existence of long run profits is characteristic of a spatial firm.

Machlup's analysis of rent is widely accepted by microeconomists. His views on pure profit (attributable to indivisibility and uncertainty) have not been as widely accepted. Machlup did not develop this theme as vigorously as his theory of rent. His theory also does not adequately address the question of whether firms face different cost curves. Nor does Machlup explore a variable cost ascription of rent. These areas are developed in detail in the next chapter.

The post-Ricardian period must be primarily characterized as an era in which economists sought to refine Ricardo's theory to the exclusion of contributions made by previous writers. Since the primary thrust of Ricardo's Principles is the theory of distribution, it is only natural that Wicksteed should explore this aspect of rent. Alfred Marshall, more than any other economist of his era, recognized that heterogeneous factors of production other than land may earn rental income. Joan Robinson appears to be the first economist to suggest a fixed-cost ascription for rental income. She unfortunately dwells upon Ricardo's view of rent as a surplus. Fritz Machlup also proposes a fixed-cost imputation procedure. While his approach is little differentiated from Robinson's, he at least recognizes the possibility that rental income may persist in the long run.

Summary

This chapter briefly summarized the major contributions to the theory of rent from the time of the mercantilist economists to the neoclassical era. The mercantilists dwelt upon the nature of rent as it applies to land resources.

Classical economists extended the concept of rent to apply to differential ground-sites as well as differential productivities. Contemporaneously, Karl Marx recognized that the rent of land must be viewed as reflecting the full opportunity cost of the resource.

The German theorists extended the concept of rent to apply to all factors of production. They focused primarly upon the rent of the entrepreneur.

Neoclassical economists were the first to propose specific imputational procedures to reflect rental income. Both Robinson and Machlup appeared preoccupied with Ricardian analysis. They tended to view rent as a residual rather than as an opportunity cost. Machlup argued that rents may persist in the long run. Marshall and Knight both emphasized the emergence of rentals for factors of production other than land.

CHAPTER II

EXTENDING THE THEORIES

The analyses of rent by Marshall, Robinson, and Machlup form the nucleus of present-day rent theory. Their work, however, left unanswered several questions concerning the nature of rents. These questions concern the socially optimal scale of output for inframarginal firms, the conditions which allow rental earnings to evolve, and the appropriate ascription procedures for imputing rents. These questions have been addressed by several modern exponents of the theory of rent.

The Optimal Scale of Output

Schumpeter [29] cites Ricardo as making the observation which is well-known to the "man in the street": there are low cost firms and high cost firms. This is a theme expanded upon by Blodgett, who states,

> In the long run, the size, productive capacity, and output of a competitive industry will tend to be such that the equilibrium price will be equal to the long-run minimum average cost of all the firms in the industry, when each firm is at the optimum size on the basis of the particular agents of production at its disposal [italics mine] so that all firms will have the same long-run minimum average cost of production [5, 285].

The existence of different sized firms in long-run competitive equilibrium is often obscured by the recently modern convention of focusing upon the representative firm.

The concept of a representative firm is often credited to Alfred Marshall. Schumpeter refers to this inappropriate citation as a "methodological fiction [29, 1045]. Blaugh refers to Marshall's representative firm as an abstraction. It was not perceived by Marshall as an arithmetic average, median, or a modal firm. It is representative only with respect to the minimum average cost of production, and not with respect to size [4, 374].

Schumpeter credits Pigou with introducing the concept of an "equilibrium firm." Pigou's equilibrium firm represents the modal conditions within an industry. Pigou did not suggest that all firms are identical to the modal firm [29, 1045].

The location of the cost curves of the marginal and inframarginal firms appears to have been the source of some confusion with respect to the imputation of rents. Machlup's procedure seems to imply that the inclusive average cost curve will coincide with the marginal firm's average cost curve. Robinson, however, depicts different sets of cost curves for the marginal firm and the inframarginal firm after the ascription of rents.

Ferguson provides a lucid description of the effect of entry in an increasing cost industry [9, 279]. When this analysis is combined with his analysis of rents [9, 411], a clear picture of the cost curves of the two firms emerges. Ferguson initially assumes an industry in long-run competitive equilibrium. The firm represented by SAC_1 and LAC_1 in figure 2.1 need not be considered a representative firm. The cost curves SAC_2 and LAC_2 more appropriately represent those of the high-cost producer.

Assume that all factors are in perfectly elastic supply to the industry with the exception of capital. An increase in

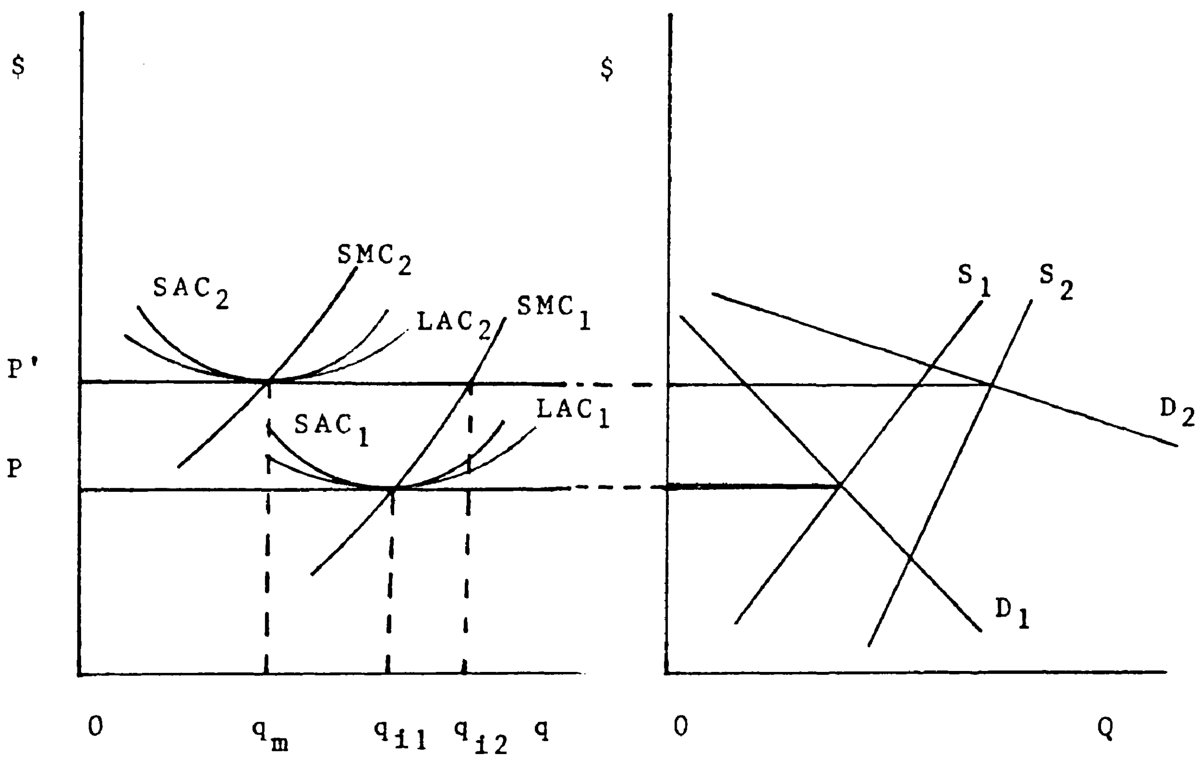

Figure 2.1. The Inframarginal and Marginal Firms in Competitive Equilibrium

market demand for the industry's product will increase the value of marginal product of capital. The price of capital will be bid upwards.

Stigler provides two reasons for the rise in price of a factor in inelastic supply. First, additional units may be ill-suited for employment. Their cost to the industry rises in terms or productivity. Second, as other industries lose capital and restrict output, the remaining quantities of capital become more valuable because of their higher marginal products. Their products will therefore command higher prices. Resource prices will be bid upwards and the value of the marginal product of capital will rise.

Stigler asserts that the marginal firm's marginal cost curve will lie to the left of the inframarginal firm's marginal cost curve [34, 164]. Indeed, in the long run the inframarginal firm's cost curves will coincide with those of the marginal firm. This is because in the long run the inframarginal firm's capital must be replaced at the new higher price of capital.

Ferguson also indicates that a leftward shift of marginal cost curves will ensue. In his analysis, the existence of more firms insures that the industry supply shifts to the right, so that more output is produced [9, 279].

Figure 2.1 illustrates the cost curves of the inframarginal (subscript 1) and marginal (subscript 2) firms. q_m must be less than q_{i1}. The level of output associated with minimum average cost is different for the two firms. Manifestly, if the rents are attributable to differences in the quality of resources there is no reason why the cost curves of the two firms should coincide in the long-run.

Ferguson depicts the inframarginal firm's rents as shown in figure 2.2. Quasi rents are given by the difference between short-run total revenue and total variable cost. This quantity is given by the area of the rectangle P'ACD. Quasi rents may be divided into pure economic profit and opportunity cost

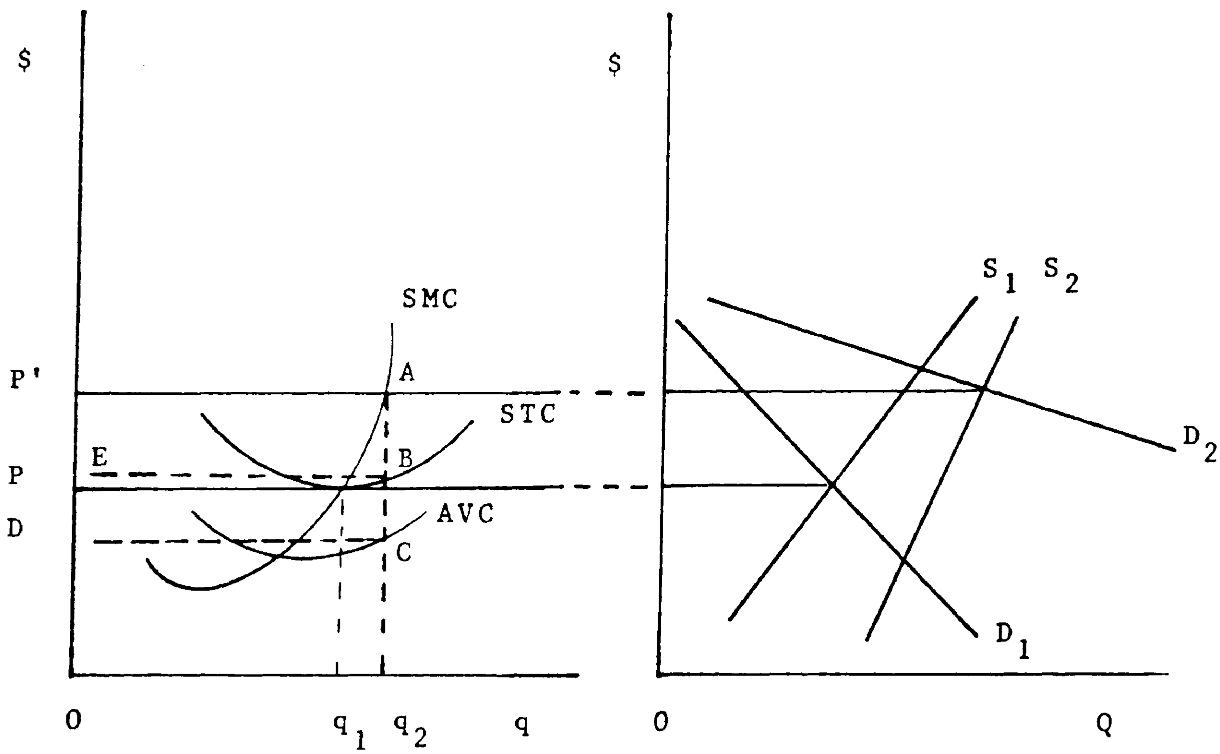

Figure 2.2. The Rent of the Inframarginal Firm

components.

Pure economic profits are attributable to the employment of the scarce resource in this industry rather than in their best alternative use. These profits are represented by the area P'ABE. The opportunity cost of the scarce resource is given by fixed costs. These costs are represented by the difference between total costs and total variable costs. These costs are given by the area EBCD in figure 2.2.

This particular ascription of opportunity costs has its foundation in Marshall and its embellishment in Stigler [35, 250-253]. Marshall explicitly considers the scarce factor to be capital. The difference between average total cost and average variable cost times the level of output represents interest plus depreciation on capital. If total quasi rents exceed this amount, more of the scarce factor will be produced and employed. If quasi rents fall short of these fixed charges, the factor will be depreciated off the books and not replaced. The firm will exit the industry in its given form. As Stigler notes, the return to the factor must equal the current market rate of return including an allowance for risk. Quasi rents may fail to return the original cost plus interest over the factor's entire life. The failure to do so reflects expectational errors with respect to the value of the quasi rents over the life of the machine. It is the quest for quasi rents which induces entry into an industry. The failure of these rents to cover the opportunity cost of capital will lead to exit from the industry.

While Ferguson's and Stigler's analyses suggests the role of quasi rents as a guiding mechanism, they do not explicitly provide appropriate imputational procedures.

The Conditions Giving Rise to Rents

Ferguson's analysis implicitly assumes that an upward sloping industry supply curve is necessary for the existence of rents. Blaugh notes that this is a necessary but not sufficient condition. The supply curve may be upward sloping due to the existence of either pecuniary or real diseconomies of scale [4, 368].

External diseconomies are pecuniary when they reflect an increase in factor price due to an increase in factor demand. Inframarginal firms are viewed as possessing stocks of the scarce factor purchased at the previous price. When the opportunity costs of these stocks are explicitly recognized, the total cost of production will increase by an amount equal to the increase in the value of the stock. Since the total cost of producing all levels of output rise by a constant amount, the short-run marginal cost curve of the firm does not shift in the presence of such scarcity rents. Such diseconomies appear to imply the propriety of fixed cost imputations.

Real external diseconomies occur when entry changes the technological milieu in which firms operate. Blaugh cites a publicly owned road or a common oil field as classical examples. He views such factors of production as "implicit" or "hidden" inputs. While these inputs are free to the firm, they are nevertheless scarce. An increase in the utilization of such resources shifts the short-run supply curve of every firm to the left, according to Blaugh. Real external diseconomies do not create rent! This is because the increased costs are actually incurred by all firms within the industry.

The cost curves of the inframarginal firm for an industry subject to pecuniary external diseconomies is illustrated in figure 2.3.

Assume that all inputs but one scarce factor are in infinitely elastic supply. Only the price of the scarce factor will be allowed to rise. Further assume that there are n firms in a competitive industry. The short-run marginal cost curve of one firm with its accompanying envelope curve is illustrated on the left. The long-run industry supply curve is illustrated on the right. While the relevant short-run industry supply curves are omitted by Blaugh, they are understood to pass through the points (Q_1, P_1) and (Q_2, P_2) respectively. Blaugh asserts that the short-run marginal cost curve of the firm does not change when scarcity rents emerge. This is because the total cost of

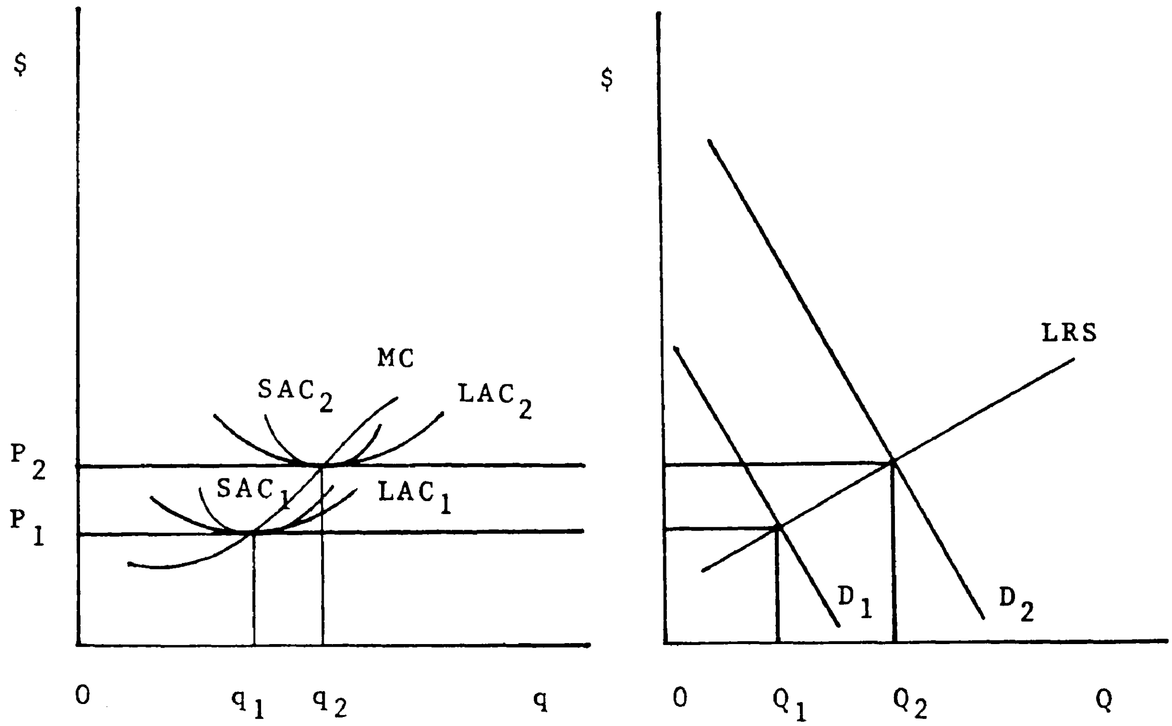

Figure 2.3. Pecuniary External Diseconomies and Competitive Equilibrium

producing all levels of output rises by a constant amount. Blaugh is implicitly assuming a fixed cost imputation.

Consider an increase in market demand from D_1 to D_2. The equilibrium price will increase from P_1 to P_2. The firm sets the new price equal to short-run marginal cost, increasing production from q_1 to q_2. In Blaugh's example, the rent adjusted SAC curve is just tangent to the average revenue curve given by P_2. Since potential entrants view entry as profitless, entry does not occur. The number of firms does not change in Blaugh's example.

Since the SMC curve and the number of firms do not change, neither does short-run industry supply. Blaugh's long-run supply curve therefore coincides with short-run industry supply.

There are two troublesome aspects of Blaugh's analysis of pecuniary external diseconomies. First, Blaugh implicitly assumes that SAC_2 in figure 2.3 represents the relevant SAC curve of the marginal firm. It does not. SAC_2 is the representation of the rent-adjusted SAC curve of the inframarginal firm. These two curves do not coincide in general. Ferguson and Saving have shown that the shift in the entire set of cost curves depends upon the expenditure elasticity of the scarce factor [11]. Their results are presented in the second appendix to this chapter. They show that the output associated with minimum long-run average cost will decrease if the scarce factor is superior. In Blaugh's example, the scarce factor must be either a normal or inferior input. More importantly, the minimum level of long-run average cost may be either greater than or less than the new market price. If P_2 exceeds minimum long-run average cost for the marginal firm, entry will occur. If P_2 is less than minimum LAC, exit of inframarginal firms will occur. This is so because when the stocks of the scarce resource are depleted, they must be replaced at the higher price in the long run. In any event, it is unlikely that the number of firms remain constant. A more detailed analysis of pecuniary diseconomies is presented later in this chapter.

Figure 2.4 is representative of industries characterized by real external diseconomies. As industry output expands and the supply price of the industry as a whole increases, the supply curve of each firm shifts to the left. Blaugh associates real economies or diseconomies with variations in the number of firms. In the case of real diseconomies, the increase in industry supply is attributable to the entry of new firms.

The higher cost curves illustrated in figure 2.4 are actually incurred by existing firms. Rentals, therefore, do not emerge. The higher cost curves illustrated in figure 2.3

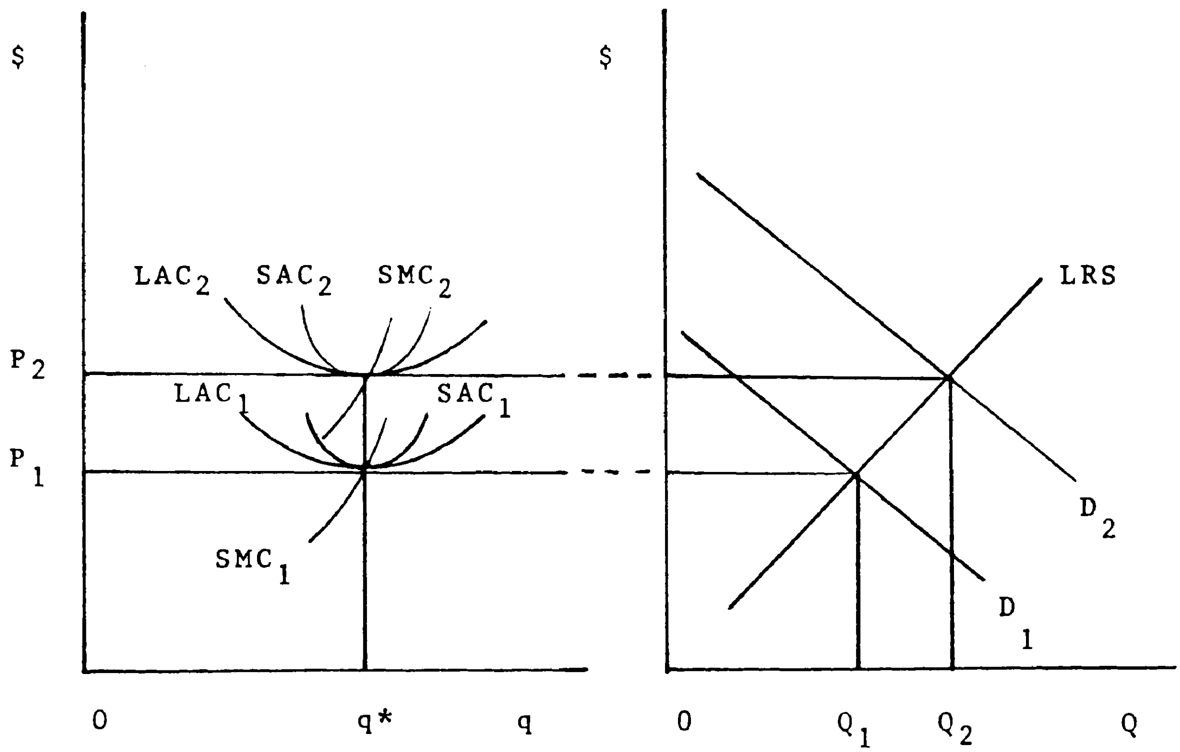

Figure 2.4. Real External Economies and Competitive Equilibrium

represent ascriptions of opportunity costs to existing firms. Since these costs are not actually incurred, rentals are earned within the industry.

Figure 2.4 is drawn such that the optimal level of output of each firm does not change; this will never be the case. The third appendix to this chapter demonstrates that the level of output associated with minimum average cost must always decrease where real external diseconomies prevail.

As indicated above, Blaugh's analysis of pecuniary diseconomies constitutes a special case. Figure 2.3 assumes that the scarce factor is a normal or inferior input. It further assumes that the rent-adjusted cost curves for the inframarginal firm coincide with the cost curves of the marginal firm. The analysis of real external diseconomies is incorrect since it can be demonstrated that the level of output associated with minimum long-run average cost must always decrease. Since such diseconomies do not create rent, however, further analysis of this case is relegated to the appendix.

Consider the situation in which all factors of production are in infinitely elastic supply except for capital. Let an increase in market demand occur so that the equilibrium price increases. Entry will occur if new firms view entry as profitable under the new set of factor prices, where only the price of capital has increased. Since relative factor prices have changed, the equation of the expansion path changes, defining a new set of long-run cost curves.

If the new market price exceeds the new minimum level of average cost, entry will occur. As entry proceeds, the price of capital is bid upwards and the long-run average cost curve keeps shifting upwards. Simultaneously, entry causes a rightward shift of short-run industry supply. These forces cause the long-run average cost curve of the marginal firm to rise while the market price continues to fall. Entry ceases and equilibrium is established when price is just equal to minimum long-run average cost. Such an equilibrium is illustrated in figure 2.5. In this figure, the cost curves of the marginal firm in equilibrium are represented by LAC_3 and LMC_3. The cost curves of an inframarginal firm are represented by SAC_1 and SMC_1. The rent-adjusted SAC curve is SAC_2. Figure 2.5 employs a fixed cost imputation of the type suggested by Robinson, Machlup, and Blaugh. If the cost advantage of the inframarginal firm dissipates in the long run, the relevant LAC curve for the firm will be determined by the then current prices of capital and other resources. As capital is depreciated it must be replaced at current market prices. If the inframarginal firm's capital is relatively long-lived, rentals may persist for extended periods of time. Indeed, if the price of capital rises continuously over time, inframarginal firms will <u>always</u> earn rentals.

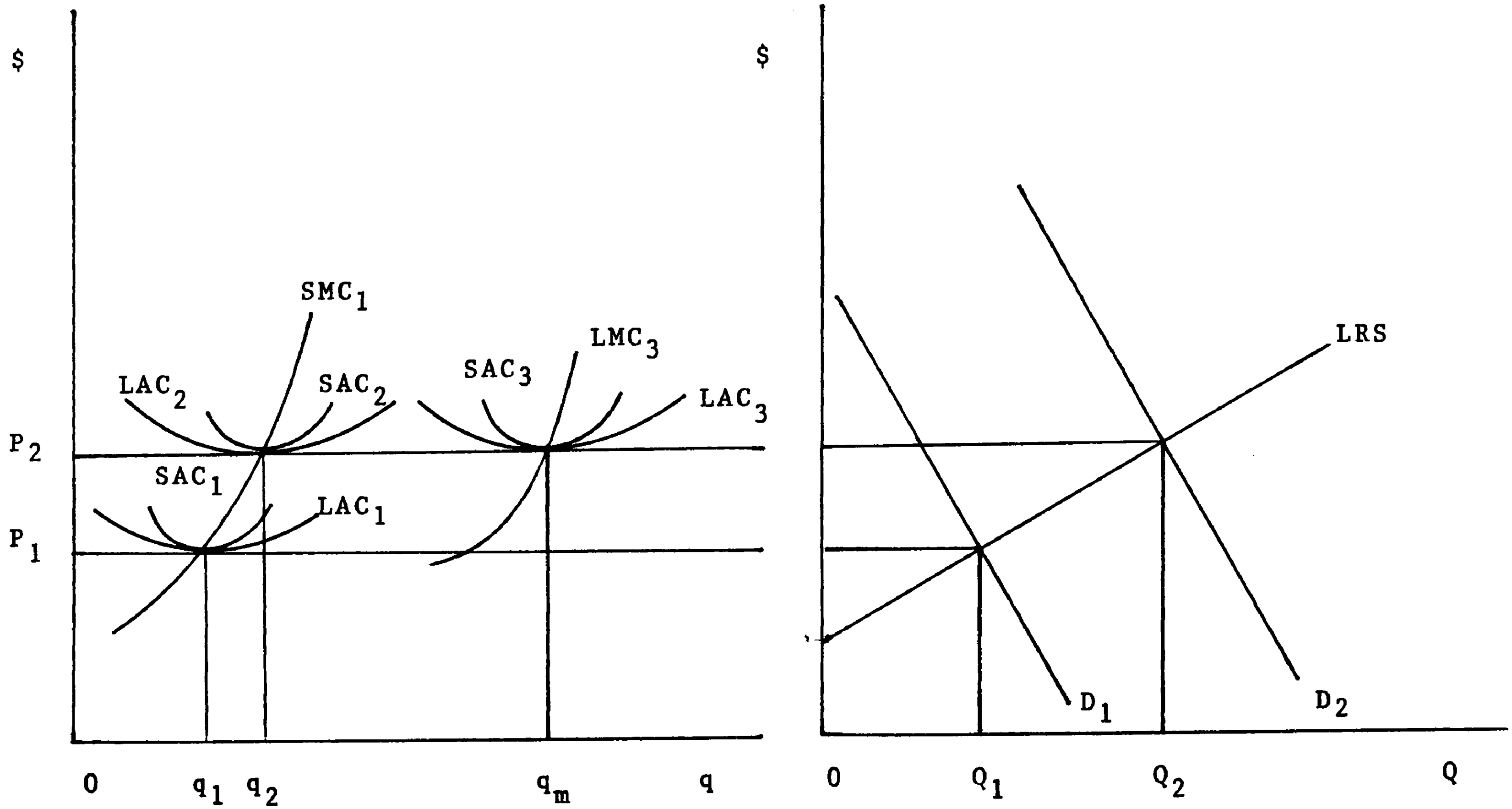

Figure 2.5. Fixed Cost Imputations for Rent and Long-Run Competitive Equilibrium

As indicated in figure 2.5, the appropriate imputation for rents need not result in a coincidence of cost curves for the marginal and inframarginal firms. The optimal level of output varies for the marginal and inframarginal firms.

Imputation Procedures

Machlup suggested a fixed cost imputational procedure. This procedure is based upon the ascription of the value of the opportunity cost of resources as a lump sum. As such, the imputation will have no effect upon the marginal cost curve of the firm. In figure 2.5, the rent-adjusted SAC curve will slide up SMC_1 until minimum adjusted average cost is equal to minimum SAC_2. This result is easily demonstrated.

Assume a situation in which entry of the marginal firm is associated with pecuniary external diseconomies. The unadjusted cost curves are given by SAC_1 and SMC_1 in figure 2.6. The cost curves for the marginal firm are given by SAC_2 and SMC_2. The adjusted cost curves for the inframarginal firm will be given by SAC_3 and SMC_3 under a lump sum imputation.

Figure 2.6 assumes the scarce factor is superior since the level of output associated with minimum long-run average cost decreases as the factor price increases. The marginal firm pays R_m per unit of the scarce factor. The inframarginal firm has only paid R_i ($<R_m$) per unit of the scarce factor. The task at

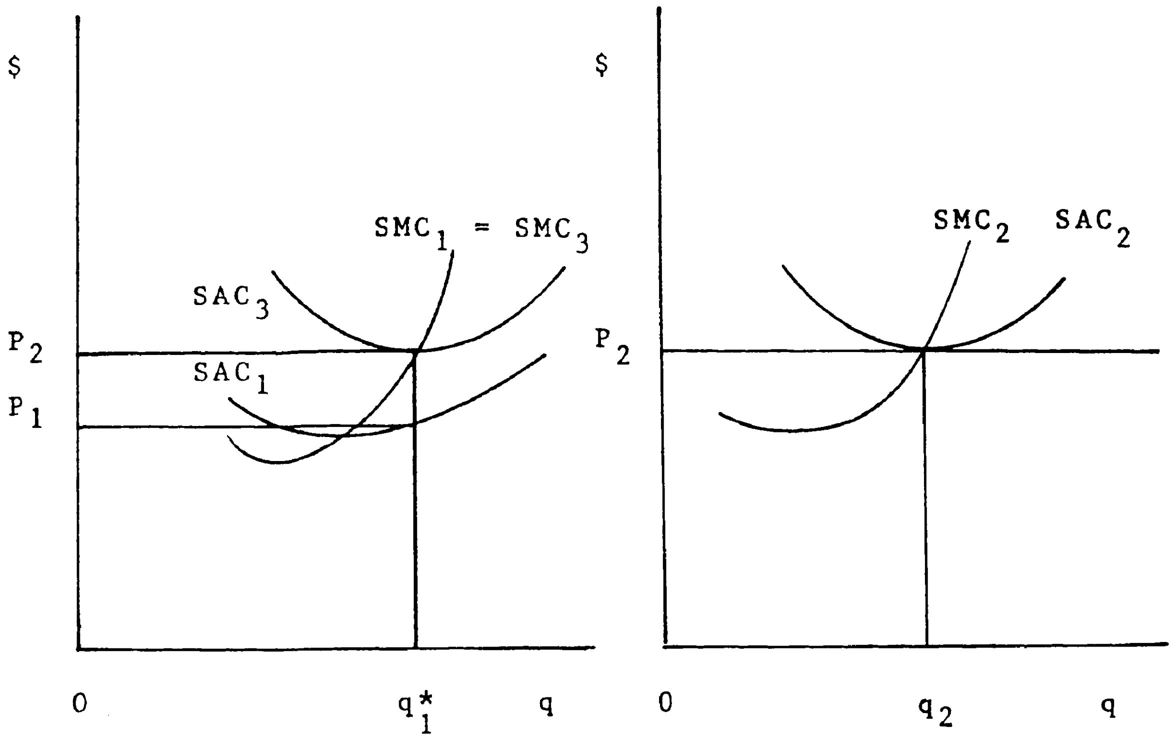

Figure 2.6. Fixed Cost imputations for Rent and Short-Run Competitive Equilibrium

hand is to ascribe the full opportunity cost of the inframarginal firm's scarce factor to SMC_1 and SAC_1.

In neoclassical rent theory the scarce factor is assumed to be fixed for the inframarginal firm to the extent that it is immobile and the cost of the factor represents a sunk cost. If the scarce factor was mobile, the firm must pay the higher market price for it to prevent the migration of the factor to firms willing to bid more for it. If the factor costs are not sunk costs, the inframarginal firm must hire it at its current market price. Thus no rentals would be earned. It seems plausible to therefore impute the full opportunity cost as a fixed cost. The ascription must be accomplished such that the full opportunity cost is reflected at the actual level of output produced by the firm. This level of output is given by q_1* in figure 2.6.

Mathematically, let the unadjusted cost curves of the inframarginal firm be obtained by:

2.1) $c(q) = v(q) + f$

2.2) $c(q)/q = [v(q) + f]/q$

2.3) $c'(q) = v'(q)$

where c(q) represents total cost, v(q) represents variable cost, and f represents fixed cost. Further, let the lump sum rental be given by:

2.4) $r_f = (R_m - R_i) \cdot S_i$

[where R_m and R_i are as previously defined], and S_i represents the quantity of the fixed scarce factor used by the inframarginal firm. With the ascription of the full opportunity cost of these resources, the inframarginal firm's cost curves are given by:

2.5) $c(q) = v(q) + f + r_f$

2.6) $c(q)/q = [v(q) + f]/q + r_f/q$

2.7) $c'(q) = v'(q)$

This type of imputational procedure results in a divergence between the inclusive and exclusive average cost curves. Equations 2.3 and 2.7 indicate that marginal cost is stationary under fixed-cost ascriptions. Note that the rental determined by equation 2.4 is determined by the difference in prices paid for the scarce factor and the absolute quantity of the scarce factor utilized by the inframarginal firm. Equation 2.4 indicates that the opportunity cost to be imputed is independent of the level of output. Such an assumption may not be warranted for all types of resources. For the moment, abstractly consider the situation in which the opportunity cost is dependent upon the rate of utilization of the scarce factor. Further assume that as output increases, the rate of utilization of the scarce factor increases. By way of example, let the opportunity cost (required rental) be given by $r(q)$ such that

2.8) $r(q) = a + b \cdot q$.

Inclusive total cost will exceed exclusive total cost by $a + b$ q. Inclusive average cost will exceed exclusive average cost by $a/q + b$. When q is zero, inclusive average cost explodes to infinity. As q increases, the difference between the curves converges to b.

Inclusive marginal cost will exceed exclusive marginal cost by precisely b at every level of output. These curves are illustrated in figure 2.7.

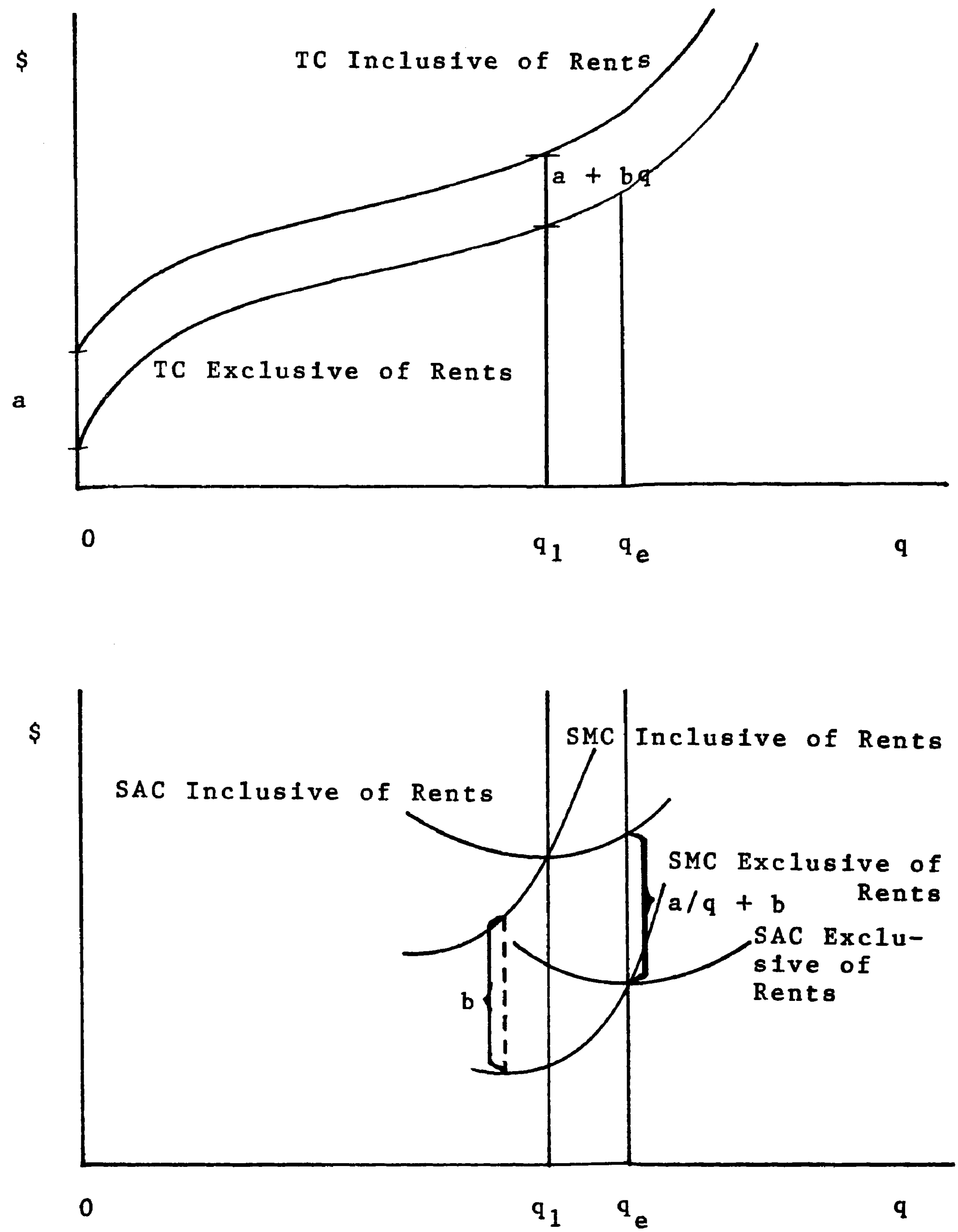

Figure 2.7. Variable Cost Imputations for Rent

Note that the quantity associated with minimum inclusive average cost lies to the left of minimum exclusive average cost. Such a shift is not economically appealing. When the firm entered the industry, it acquired the scarce factor in anticipation of utilizing it such that the firm's average cost of production was minimized for every possible level of output. Furthermore, in the long-run competitive equilibrium, the rate of utilization of the factor must be consistent with the actual level of output produced. In the absence of rentals, this level of output is given by q_e in figure 2.7. If the factor in question is over-utilized, production costs will rise. Likewise, when the factor is under-utilized production costs will not be minimized. When the scarce factor is such that its optimal level of efficiency occurs at the level of output consistent with minimum average cost, the factor is said to be conformable [13].[1]

The class of variable cost imputations for rents must be restricted so that factor conformability holds. One type of variable imputation consistent with factor conformability is of the form:

2.9) $r_v = k \cdot q$

where k is a constant. This type of imputation is appealing for reasons other than factor conformability. Assume that the scarce

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1. See the appendix to Chapter V.

factor is a machine. The machine's economic lifetime may be considered in terms of the units of output that it is expected to produce. For example, a welding machine may be expected to produce only so many sets of table legs during its economic lifetime.

Assume the machine is expected to produce one hundred units of output over its lifetime and will only be used to produce ten units during the current production period. The opportunity cost to be ascribed is one-tenth of the total cost of the machine. If the machine is used to produce one hundred units in the current period, the full cost should be ascribed as a current cost. Thus, the current period opportunity cost is directly proportional to the level of current production. Let

2.10) $R_t = [q_t/q_L] \cdot R_0$, or equivalently,

2.11) $R_t = [R_0/q_L] \cdot q_t$

where R_t is the opportunity cost to be assigned to the current production period, R_0 is the total opportunity cost of the factor, q_L is the expected lifetime use of the machine, and q_t is the level of production in the current period. The level of opportunity cost to be ascribed during the current period is function of the factor's total opportunity cost and its rate of depreciation. This is indicated by equation 2.10. Equation 2.11 indicates that the current allocation of opportunity cost is proportional to the level of production. $[R_0/q_L]$ is the constant factor of proportionality.

Increases in the opportunity cost of the machine will still be allocated according to this constant factor of proportionality. Let the rental to be ascribed due to an increase in opportunity cost be given by:

2.12) $r_{vt} = R_{mt} - R_{it}$ where

2.13) $R_{mt} = [R_m/q_L] \cdot q_t$, and

2.14) $R_{it} = [R_i/q_L] \cdot q_t$

where equations 2.13 and 2.14 are derived from equation 2.11, and the subscripts v, m, i, and t refer to a variable cost imputation (v) for the marginal firm (m), the inframarginal firm (i), and the current time period (t). So

2.15) $r_{vt} = [(R_m - R_i)/q_L] \cdot q_t$

where the term in parenthesis is a constant factor of proportionality. Designate this term by k, so that:

2.16) $r_v = k \cdot q$,

where the subscript t is dropped for simplicity. The cost curves apply at a particular time, t.

The inclusive average cost curves of the inframarginal firm are given by:

2.17) $c(q) = v(q) + f + k \cdot q$

2.18) $c(q)/q = [v(q) + f]/q + k$

2.19) $c'(q) = v'(q) + k$

By reference to equations 2.1, 2.2, and 2.3, inclusive marginal and average cost exceed the exclusive counterparts by the constant, k. Since exclusive marginal and average costs are equal at minimum average cost, the same will be true of inclusive marginal and average costs. This type of imputational procedure is illustrated in figure 2.8.

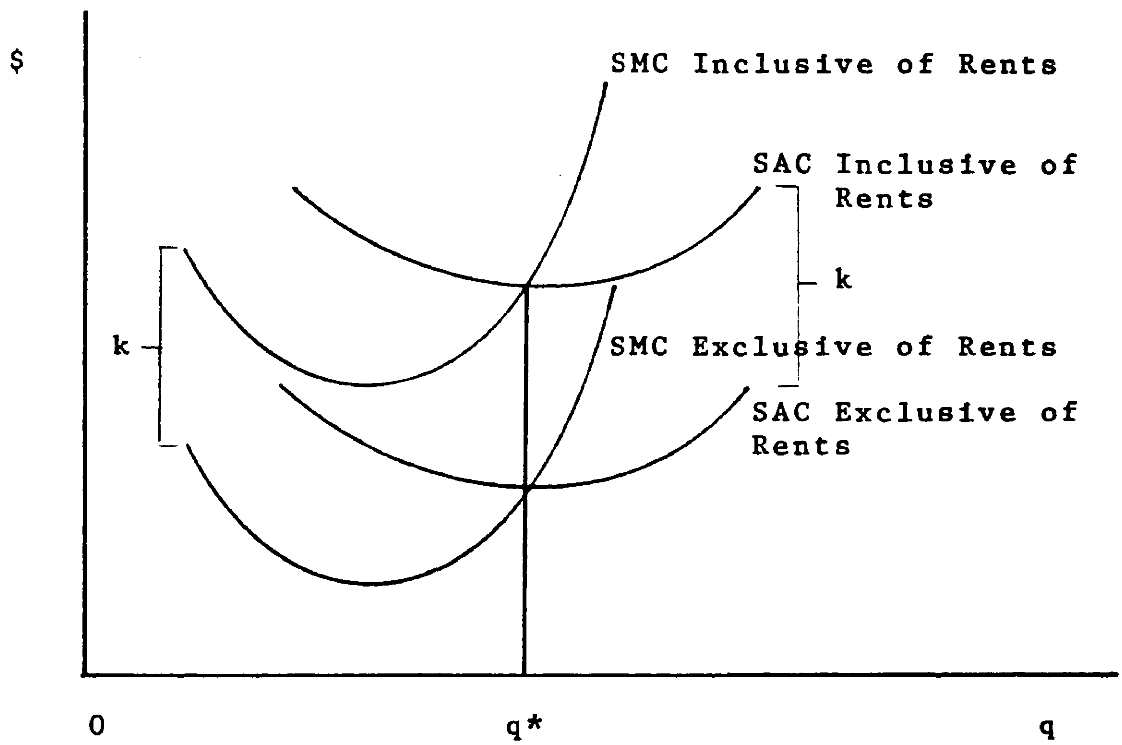

Figure 2.8. Variable Cost Imputations Under Factor Conformability

In equations 2.10 and 2.11, q_t was assumed to represent that level of output which results in the maximum efficiency associated with the fixed factor. Average costs of production are therefore minimized. When rents are imputed based upon the optimal level of utilization, minimum adjusted average cost occurs at the same level of output as minimum unadjusted average cost.

The relationship between the fixed cost imputation and the variable cost imputation is not readily obvious in Marshall's machine example. It is, however, determinate. The fixed rental was given by:

2.4) $r_f = (R_m - R_i) \cdot S_i$

The variable rental was given by,

2.15) $r_v = [R_m - R_i)/q_L \cdot q_t$

The relationship of the adjusted curves is seen therefore to depend upon the relationship between S_i and q_t/q_L. Note, q_L was assumed to be equal to S_i times some constant for simplicity. This relationship will actually depend upon the form of the production function. The relationships between the variable and fixed adjusted curves is perfectly determinate.

Summary

This chapter examined the conditions which give rise to rents. Rental income was seen to depend upon an upward sloping long-run industry supply curve, where the upward slope is due to pecuniary external diseconomies. Real external diseconomies cause the long-run industry supply curve to be upward sloping but do not result in the emergence of rental income.

It was also indicated that the generalization of the representative firm obscures the obvious fact that the economic landscape is characterized by firms with varying cost structures. Low cost producers receive economic rents for their greater efficiency. However, these rents should not be viewed as surpluses. They reflect the opportunity costs of the resources employed. When the proper imputations reflecting the opportunity costs of specialized resources are made, all firms are seen to operate at the same level of minimum average cost. The optimal scale of output will vary between firms, however.

Two methods of imputation were presented, the fixed cost imputation used by Machlup and Robinson was mathematically derived. The propriety of this type of imputation requires opportunity costs to be independent of the level of resource utilization. Such an assumption is questionable. An alternative imputational technique was developed. This variable ascription is consistent with Marshall's concept of rent. It is also consistent with the concept of factor conformability.

The types of imputations proposed are appropriate for factors of production which are differentiated either by their costs to various firms or by the differentials in quality of the factors. Rentals for uncertainty have not been explicitly considered. In the following chapters the discussion is broadened to encompass rentals for uncertainty in a competitive oligopolistic industry.

CHAPTER III

THE RENTAL FOR UNCERTAINTY ON INVESTMENT

Frank Knight viewed risk as a legitimate cost of doing business. He concluded that the residuals viewed as accounting profits include returns for risk. Inter-industry differences in the rate of profit find their validity in risk differentials. Knight distinguished between risk and uncertainty. Whereas risk is subject to quantification, uncertainty is not.

Machlup viewed accounting revenues in excess of accounting costs as being composed of two elements. The first element is rent and the second is economic profit. Rents derive from either factor scarcity or qualitative differences. The part of accounting profits which is incapable of imputation to a specific production factor is economic profit. Within the context of Machlup's thought system, risk may be viewed as giving rise to rentals. Uncertainty gives rise to economic profits, since it is not subject to objective quantification.

For operational purposes, Greenhut accepts Knight's distinction between risk and uncertainty. He proposes an imputational procedure for uncertainty. This procedure is not dependent upon a priori probability assignments. It depends only upon the entrepreneur's ability to evaluate his personal preferences toward uncertain prospects. This evaluation process may or may not involve probability assignments.

The term "economic profits" in Machlup's analysis represents the rental for uncertainty in Greenhut's context. While these profits are shown to persist in long-run equilibrium, they are, at the same time, legitimate costs of production. In customary usage, economic profit refers to a residual in excess of the full costs of production. In Greenhut's long-run analysis, profits are just sufficient to offset the full economic cost of uncertainty. There will be no residuals over it.

The emphasis upon the meaning of "economic profits" is critical to Greenhut's theory of the firm. He demonstrates that Chamberlinian tangency solutions are, in general, inconsistent with the existence of uncertainty. Chamberlin did not explicitly consider imputations for the cost of uncertainty. His tangency solution yields no economic profits. In Greenhut's analysis of Chamberlin's theory, economic profits typically persist.

Greenhut emphasizes the relationship between a spatial economic order and uncertainty. He explicitly views the economic order as one in which perfect competition is unlikely to persist. Competitive oligopoly is the dominant market structure which emerges in the real world space economies. His view of long-run equilibrium, however, does not depend upon spatial considerations.

Greenhut's analysis is strongly tied to his concept of opportunity cost. The measurement of opportunity cost underscores the determinant long-run equilibrium which emerges from this analysis.

Opportunity Costs

Machlup and Robinson proposed to impute the difference between incurred accounting costs and the full opportunity cost of a scarce factor. They both employed a fixed cost imputation.

In the explanation of the diagram where Machlup depicts the imputation for rent, he states,

> If the new average cost curve including rent is drawn (by spreading the total rent over the output and adding it to the average cost without rent), this curve, AC_2, must of necessity have its lowest point in P and thus be tangent to the new demand curve [19, 289].

In Machlup's figure 14 a fixed cost imputation is depicted. The parenthetical phrase in the above quote indicates that Machlup is adding the fixed quantity, r/q where q is the output associated with minimum SAC to the unadjusted short-run average costs of production.

Elsewhere, Machlup states,

> ... The supposed adjustment refers only to average cost and not to marginal cost... The marginal costs of production are the same whether they are calculated on the basis of the old or the revised average total cost figures or even without any fixed costs at all [19, 291-292].

Joan Robinson also proposes a fixed cost imputation. In the explanation of her figure 41, she states, "Since the inclusion of rent adds to total costs a lump sum which is independent of the firm's output (given the price of the commodity), the marginal cost curve cuts A', as well as A, at its minimum point", [26, 126]. In this figure A' is the rent adjusted average cost curve, A is the unadjusted average cost curve, and marginal cost is stationary. Both Machlup and Robinson implicitly assumed that a factor's foregone earnings represented the appropriate value to be ascribed. They remained silent concerning the discounting of foregone opportunities. They may have implicitly assumed, however, that Marshall's method of discounting applied.

Marshall recognized that the current value of a factor represented the discounted flow of expected earnings over its economic lifetime. Greenhut also discounts these earnings. However, he discounts earnings not only to reflect the marginal rate of time preference, but also to reflect the uncertainty associated with these earnings. Given two monetarily equivalent flows of receipts, the more uncertain flow will have a lower opportunity cost. This discounting procedure reflects an individual's preference for the more certain flow.

The identification of the best alternative strongly depends upon estimates of the degree of uncertainty associated with varying prospects, and the evaluator's response to it. This ranking of alternatives is not necessarily dependent upon a priori probability assignments. The measurement of lost opportunities is predicated upon the discounted "income utils" expected to be received by a factor in alternative employments. The individual optimizes utility when he equilibrates the ratios of discounted expected income utils to the expected energy expenditures for all choice alternatives. This procedure is the counterpart in classical economics of equilibrating the ratios of marginal utility to product price. The composite discount to be applied reflects the personal rate of time preference as well as relative preferences for a given type of energy expenditure.

Greenhut refers to the latter type of discount as a special discount, the employment preference discount. This special discount influences the composite discount. The discounts for time preference and employment preference are not necessarily additive. The employment preference discount will also reflect the uncertainty associated with a prospect.

The employment preference discount, d, may be expressed as,

3.1) $d = f[I, E]$

where I represents income and E represents energy requirements. Assume the existence of two alternative employments with their associated streams of income. Alternative one may involve lower expected costs in terms of mental and physical health, or uncertainty. The special discount applied to this prospect would be less than that applied to alternative two. If the expected income streams are monetarily equivalent, alternative one would yield a greater discounted ratio of income utils to energy expenditures than alternative two.

Let r_j^a be defined as the expected net revenues associated with an alternative activity in time period j. If the factor in question is capital, r_j^a refers to gross revenues less depreciation. With respect to the human factor, r_j^a may be viewed as referring to gross revenues less work-related expenses such as clothing costs, personal travel expense, etc. The stream of such revenues is discounted by the composite discount c. The average expected revenue over the life of the alternative is given by,

$$3.2)\quad r^a = \sum_{j=1}^{n} [r_j^a/(1 + c)^j]/n$$

The symbols s and s' are used below to identify the optimal levels of energy expenditures per calendar period in the chosen activity and the best alternative activity, respectively. The s need not be equal to s', as the optimal level of energy expenditure may be expected to vary among activities. In fact, the optimal level of energy expenditures within any given activity will also vary among evaluators. Thus, s may be viewed as the acceptable transform of s' between the two activities, albeit s may still be preferred to s' or vice versa. Any preference for s will be reflected by the application of a lower discount rate than that applied to s'.

The selection of an activity is governed by the factor's expectation that he will expend s energy utils per calendar period, and the acceptance of s as the acceptable transform of s'. Selection of the activity associated with s requires that the total discounted income utils of the subject activity be preferred to those associated with the alternative activity. The total discounted income utils are given by $\Sigma\, w_j$ in the following equation,

$$3.3)\quad \sum_{j=1}^{n} w_j = n(r^a)$$

Employment preference in turn is governed by,

$$3.4)\quad \sum_{i=1}^{m} w_i \quad \sum_{i=1}^{m} s_i \geq \sum_{j=1}^{m(+)} w'_j \quad \sum_{j=1}^{n} s'_j$$

where m and n stand for the corresponding lengths of the economic lifetimes associated with the two activities. The variables s and s' are expressed in terms of the annuity of equal annual energy expenditures associated with the discounted income utils, w and w'.

Whenever $m > n$, the income-energy ratio in the selected activity must be compared with the alternate income-energy ratio over the same m years. The economic lifetime in the alternate activity must be supplemented by a period of years (n+1,..., m) over which returns on accrued savings are received. The symbol + in equation 4 is used to convey this concept.

If $m < n$, the income-energy ratio in the selected activity must be compared with the alternate ratio over the same n years. In this case, the m(+) symbol would apply to the left-hand side of equation 3.4 with related adjustments made on both sides.

When the employment preference formula holds as a strict equality, the individual will be indifferent between the two activities and their associated lifetimes. When the greater-than expression holds, it provides a necessary and sufficient condition for the selection of the subject activity vis a vis the alternate activity.

Greenhut's employment preference formula does not provide the lost opportunity cost per se; as indicated, expression 4) simply identifies the activity selected and the opportunity foregone. An optimal rate of return, R_o, is identifiable for the best alternate activity. This R_o is the average of the discounted income utils received per average energy utils expended. Mathematically, it is defined by:

3.5) $R_o = (1/n) \cdot [\sum_{j=1}^{n} (w_j'/s')]$

where $s' = (1/n) \cdot (\sum_{j=1}^{n} s_j)$.

(w_j'/s') is expressed as a rate per average energy expenditure. It may be viewed as the dollars per kilowatt hour of energy expenditure. It may also be viewed as the income utils per util of energy expenditure. The latter is probably more consistent with the manner in which choices are actually made. R_o is the optimal alternative rate of return which would be received on the average in the best alternate employment. Equation 3.5 may be rewritten as,

3.6) $n \cdot R_o = \sum_{j=1}^{n} (w_j'/s')$.

The recovery of the full opportunity cost in the chosen activity requires equivalence of the total optimal returns over the chosen activity's economic lifetime with those of the best alternative. This condition is given by,

3.7) $mR = nR_o$.

This equation permits the mapping of R_o from the alternate activity into a transformed rate R, such that the entrepreneur is indifferent between the two streams of income.[1] R is given by,

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1. In recent lectures, Greenhut has proposed that when
Footnote 1 Continued on Next Page

3.8) $$R = (1/m) \cdot [\sum_{j=1}^{n} (w_j'/s')].$$

Note at this juncture that we are now referring strictly to entrepreneurial investment. As such, our opportunity cost concept no longer relates to all factors of production, including, of course, managerial services. This means that instead of the employment preference basis which distinguished income utils from working lifetimes of different m's and n's, we are now alone considering investment lifetimes. These too, of course, may differ. However, to the extent that any differences

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Footnote 1 Continued from Previous Page
opportunity costs are ascribed for the entrepreneur's services, the longest working lifetime should serve as the basis for the imputation. For example, if the subject activity allows only m years of work which, let us assume, is less than the n years that the individual could (would) work in the alternate activity, the required R will be greater than R_0,, This condition would require an income stream for the m nonworking years to be added to the income in the m working years so that the aggregate satisfies the employment preference formula. If $m>n$, the resulting lower R, signifies an income stream for the lost opportunity for n years which, when added to the n years (=m), provides a total income stream in that alternate activity which is equal to or less than in the subject, selected activity.

Now, when the imputation is effected not for services but for the lost investment income, Greenhut proposes we should conceive of m n instead of allowing the inequality. Thus if $m<n$, he would impute as if the years of the alternative investment only lasted m not n years, in effect imagining that another investment would generate a sufficient new income stream over the extra m years that when added to m equals the n years of income in the last alternative. And if $m>n$, he proposes a comparison (and imputations) for n years only via the assumption that a new income stream over the alternative investment n years
Footnote 1 Continued on Next Page

exist, we can either add to or substitute from the alternative income stream what could be obtained in the next investment which brings n's investment period up to m or brings m's investment period up to n. As such, the effective m and n values in equation 3.7 become the same. (Later on, we shall propose that a different value for m and n can be used to differentiate the uncertainty that characterizes the selected activity vis a vis the uncertainty involved in the alternative investment.)

Associated with R is an optimal absolute dollar (income-util) return, r, which is sought by the entrepreneur. This r corresponds to the factor cost assigned as a fixed cost by Machlup and Robinson. It is defined as,

3.9) $r = R \cdot s.$

It is the optimal average rate of return in the subject activity times the average level of energy expenditures in that activity. It is the amount assignable on the average to any of the ith periods. This amount must be defrayed to justify the selection of the subject activity.

Footnote 1 Continued from Previous Page
would balance the income involved during the years m>n. In still other words, he takes the shorter period of m or n, thus leaving the discount factor alone as the variable to equilibrate differential uncertainties on investments. In contrast to the human services case, where laws, labor union-company policies, or simple factor preference make m often unequal to n, it is suggested that investments can always be conceived to run for identical periods. So, for
Footnote 1 Continued on Next Page

Greenhut's methodology with respect to the measurement of opportunity cost is both innovative and comprehensive. This measurement takes cognizance of factor depreciation, uncertainty, and personal attitudes towards different employments. It represents an extension of the concept of opportunity cost to human factors of production. It recognizes the utility maximizing behavior of the human factor. The measurement of opportunity cost forms the basis for the imputational procedures employed.

Imputational Procedures

Greenhut approaches the problem of imputing opportunity costs from a different perspective than Machlup and Robinson. They concentrated upon the imputation of the difference between a factor's income and the full opportunity cost of the factor. Greenhut's approach is to impute the full opportunity cost to the other factor costs of production.

Marshall also emphasized the imputation of the full opportunity costs of production. He states:

> We may now discuss the question under what head to class those extra incomes which are earned by extraordinary natural abilities. Since they are not the result of the investment of human effort in an agent of production for the purpose of increasing

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Footnote 1 Continued from Previous Page
simplicity, Greenhut selects the shorter of the m, n periods as the basis for the imputation.

> its efficiency, there is a strong *prima facie* case for regarding them as producer's surplus, resulting from the possession of a differential advantage for production, freely given by nature... But when we are considering the whole body of those engaged in any occupation, we are not at liberty to treat the exceptionally high earnings of successful men as rent, without making allowances for the low earnings of those who fail... These fortunes are therefore part of the price that is paid in the long run for the supply of labor and ability that seeks the occupation: they enter into the true or "long period" normal supply price of labour in it [21, 577-578].

Elsewhere, Marshall states, "...the greatest caution is required in the application of the term producer's surplus to the earnings of extraordinary ability", [21. 579]. It is apparent that Marshall recognized the true nature of rent as a legitimate cost of production. Thus Greenhut's approach is more akin to Marshall's than to Machlup's or Robinson's, who tended to view differential rent as a residual. These different perspectives are in no sense inconsistent, however.

Greenhut analyzes the effects of both fixed and variable imputations for opportunity costs. Both methodologies yield the same results with respect to the long-run equilibrium characteristics of the competitive-oligopoly firm.

In equation 3.9, s is the optimal average expenditure of energy (optimal cost investment dollars, if you prefer) in the chosen activity. In figure 3.1, s is given by the area OABC. The dollar expenditure OABC is the transform of s energies into dollars.

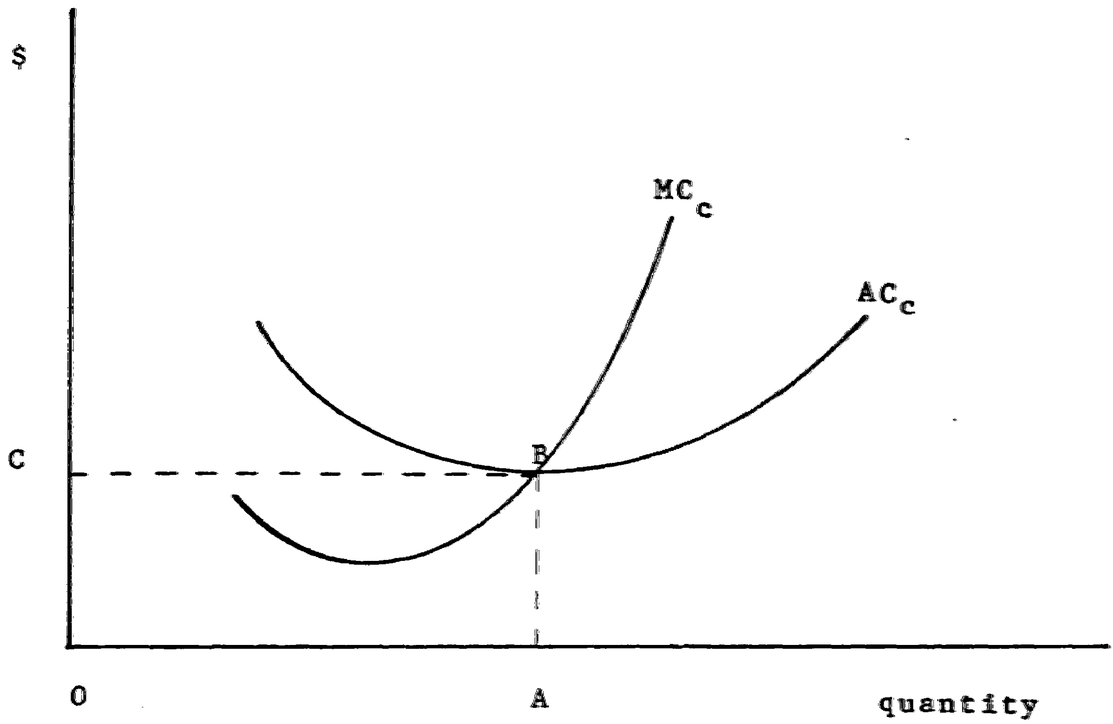

Figure 3.1. The Transformation of Energy Expenditures into Dollars

There are several reasons for associating s, and therefore OABC, with the optimal cost level:

1) There is a need to establish some base or common criterion as a point of reference. OABC is easily identifiable for the subject firm. It is readily identifiable for every firm within the industry, as well as for all firms in all industries. It provides a consistent point of reference.

2) OABC is the analog of perfect competition as viewed in traditional theory. The association of s with the optimal level

of energy expenditures permits an easy comparison of the results of this theory with those of traditional theory.

3) OABC is consistent with the concept of factor conform ability. This concept was previously alluded to in the discussion of variable cost imputations. It plays a major role in the formulation of Greenhut's model. With respect to the considerations concerning efficiency, conformability is shown by the consistency of s with its transform OABC.

Consider an entrepreneur within an industry where the optimal level of energy expenditures are given by some known quantity. This quantity results in the maximum physical productivity of the factor. If a firm employs a unit of the factor which is not conformable, the firm will be a high cost producer relative to other firms within the industry. Such a firm is unlikely to survive in the long run. An exception would occur if the subject firm held some other off-setting production advantage. In the absence of such offsets, all factors must be conformable in the activity of their employment. OABC reflects the conformability of the entrepreneur to the technological relations of production. Offsets would be eliminated in time under free entry, exit conditions with factors mobile in the long run at least.

4) OABC reflects the concept of the viability of the firm. The average cost curve in figure 3.1 reflects all costs exclusive

of the return for uncertainty on the investment. The firm with the least cost exclusive of rents is the most likely to survive in the long run. This point is brought to focus by considering an industry where price wars may be expected to occur. The firm with the lowest average cost is certainly the most likely to survive such a war. Thus, it is said to be a prospective viable firm.

"s as the Transform of OABC"

The concept s was originally defined as the optimal level of energy expenditures in the selected activity. It therefore represents the total current investment of the firm in terms of energy expenditures. R represents the dollars per unit energy expenditure required by a factor. The factor must earn R dollars per energy unit in order to cover its full opportunity cost. So r is the absolute dollar return required in a factor's optimal use, at its optimal level of energy expenditures. We find that r, R, and s were originally defined as:

3.10)	r	=	R	$\cdot$	s
	dollars		dollars per energy unit		energy units

Figure 3.1 transforms r, R, and s to establish:

3.11)	r	=	R_T	$\cdot$	s_T
	dollars		dollars per dollar's worth of energy		dollars of energy

By way of example, assume that one hundred dollars will purchase five units of energy. Then the physical quantity s is being transferred into the dollar value of the quantity, (s_T), at a rate of twenty dollars per unit of energy. If the required net rate of return per unit of s is $10, the factor must earn $50 to recover its full opportunity cost. The rate of return per dollar's worth of energy (R_T) must be transformed in inverse proportion to the rate at which s is transformed into s_T. A dollar's worth of energy must net 1/20 of $10, or 50 cents in order for $100 to yield a net rental of $50. The following table summarizes this argument.

Table 3.1. The Transformation of R into R_T

r	=	R	x	s	
$50	=	$10	·	5	
(1)	=	(1/20)	·	20	rates of transformation
$50	=	$0.50	·	$100	
r_t	=	R_t	·	S_T	

In table 3.1, s (5 units) is transformed into s_T ($100) at a rate of $20 per unit. The rate of return R($10) is transformed into R_T ($0.50) at a rate of $1.20. Most importantly, note that r is transformed into r_t at a rate of 1. In other words, there is a direct one-to-one correspondence between r and r_t. The same total net rental, $r=r_T$, must be earned on an investment of s (or s_T) regardless of the units in which the investment is denominated, that is, whether investment is viewed as the number of energy units or as the dollar value of these units.

"Fixed and Variable Cost Imputations"

The set of cost curves exclusive of the uncertainty opportunity cost on investment will be referred to as the classical cost curves. The opportunity cost to be ascribed to these curves is given by,

3.12) $r = R_s$

where s refers to the optimal level of energy expenditures which would occur in the selected alternative activity. Let e substitute for the optimal s level of energy expenditures in the selected activity, so that we can use e' to designate the <u>actual level</u> of energy expenditures that may apply to the chosen activity. Then r' designates the actual rental incurred, where the value r' is given by:

3.13) $r' = Re'$

When e' = e, the actual level of energy expenditures in the chosen activity is equal to the planned s level of energy expenditures. When e' and e are equal, r' and r are equal, and the full opportunity cost of uncertainty on the investment will be recovered. But, it is possible that the actual level of energy expenditures will diverge from the optimal level in the chosen activity, as e' may be greater than, equal to, or less than e. The full opportunity cost of uncertainty on the investment will be covered in the long-run equilibrium which will only occur when e' is equal to e. Now the rent r, which we note is associated with the opportunity cost of uncertainty on investment, may be ascribed either as a fixed cost or as a variable cost. These ascriptions are shown in figure 3.2.

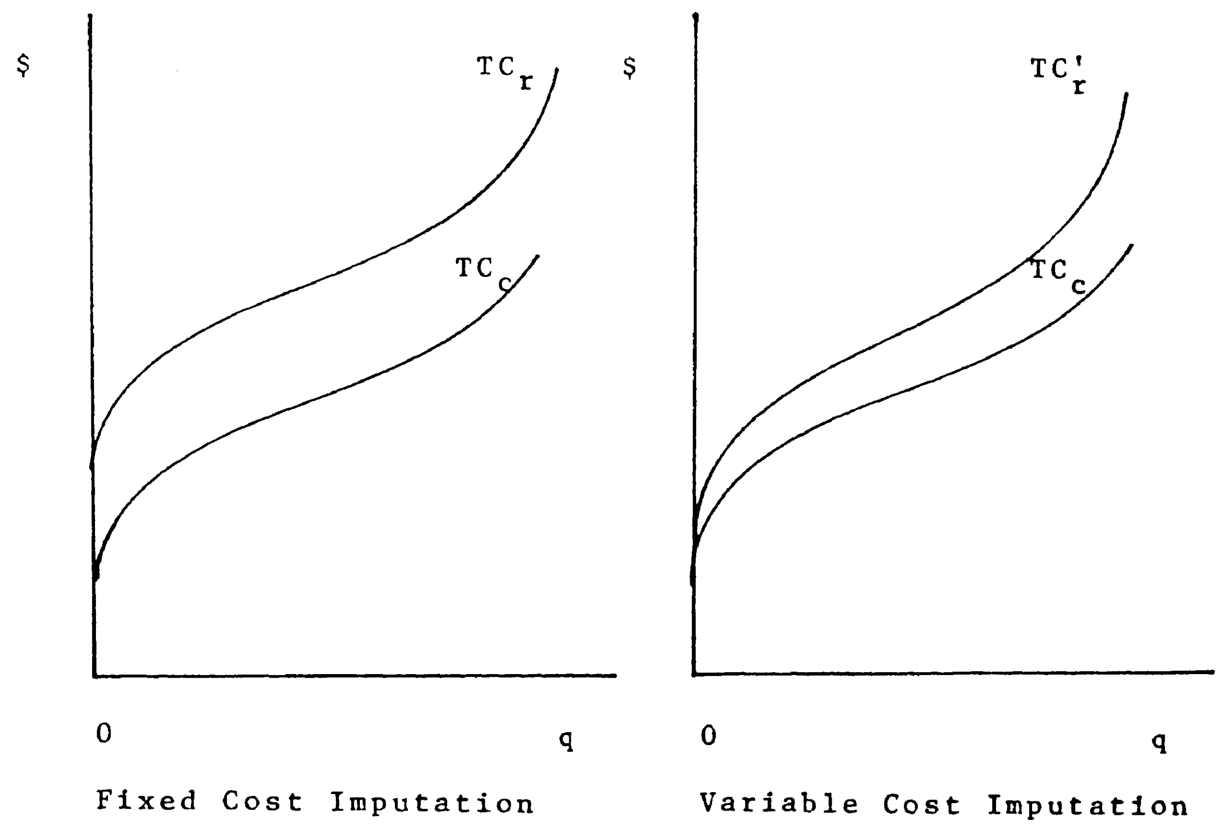

Figure 3.2. Fixed and Variable Cost Imputations for Energy Rentals

In this and the following figures, the prime symbol is used to indicate a variable cost imputation, while the subscript c will be used to indicate cost curves exclusive of rents for uncertainty.

The relationship between Greenhut's variable and fixed imputations is illustrated in figure 3.3.

In accordance with the concept of factor conformability, the full opportunity cost associated with uncertainty must be recovered at the technologically optimal level of production, q^*. TC_r and TC_r' must therefore intersect at q^*. Accordingly, the

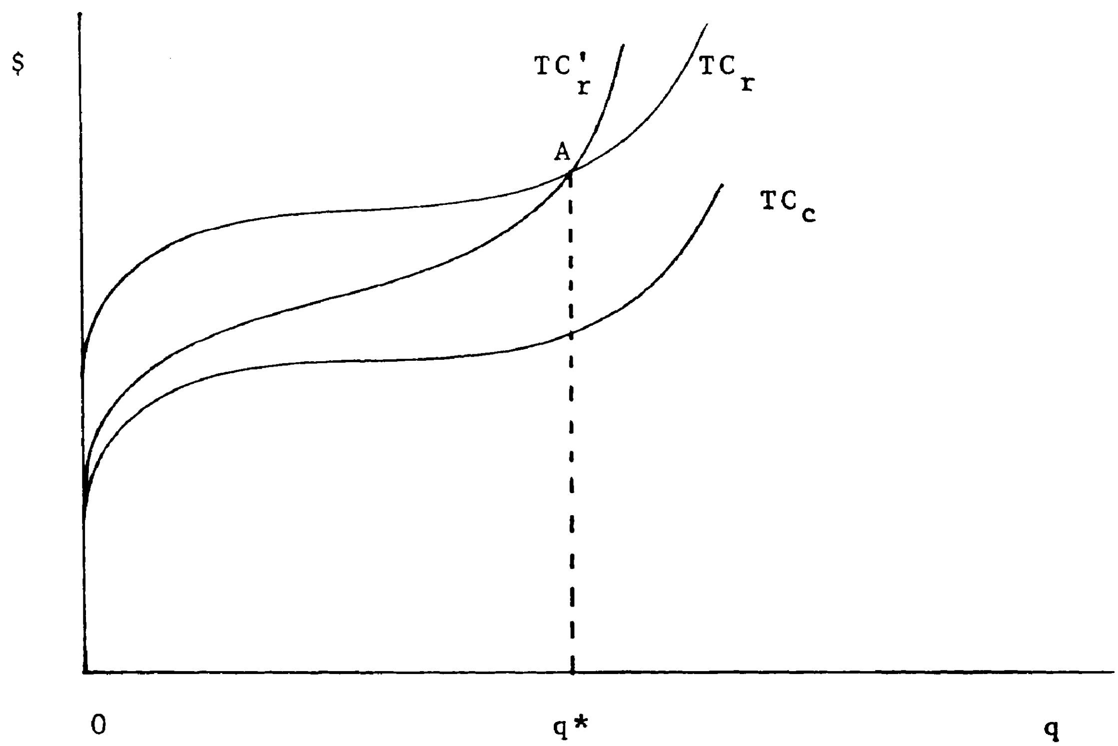

Figure 3.3. The Relationship of the TC_r' and TC_r Curves

adjusted average cost curves must also intersect at q^*. The relationships between the adjusted cost curves are illustrated in figure 3.4.

The choice of imputational methods is not a matter of indifference. Classical imputations for rents were traditionally associated with such functional inputs as land or capital. As inputs into the production process, the level of output will vary with the intensity of factor application. The ascription of rents for functional inputs will cause the marginal and average cost curves to shift upwards. Variable cost imputations are

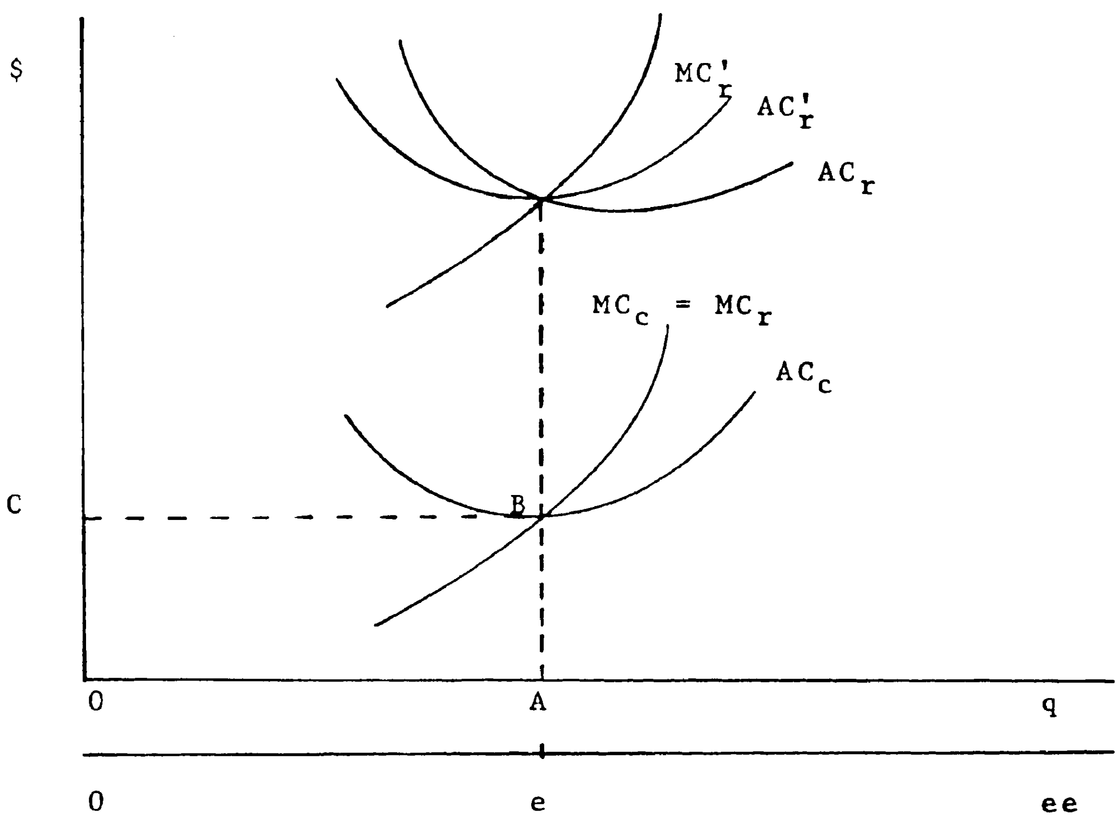

Figure 3.4. The Fixed and Variable-Adjusted Average and Marginal Cost Curves

appropriate where functional inputs are involved.

Uncertainty is not a functional input. The level of output does not vary with the degree of uncertainty. The production map is unaffected by the application of uncertainty. The appropriate imputation for uncertainty is a lump-sum ascription to total cost. Such ascriptions do not affect the classical marginal cost curve. The cost of uncertainty will increase dollar per dollar invested since $r' = Re'$. Unlike other factors, uncertainty is not a functional input. Its rental should, therefore, be imputed as a fixed cost.

In figure 3.4, OABC is the transform of the optimal level of energy expenditures, e, in the selected activity. If average revenue is very high, marginal revenue will intersect marginal cost at a level of output at which average revenue is greater than adjusted average cost. The total return to the entrepreneur exceeds technological costs plus the uncertainty cost. This windfall will induce entry, which shifts average revenue to the left. If average revenue lies below adjusted average cost at all levels of output, losses are incurred. The resulting exit of firms from the industry will shift average revenue to the right.

In the short run, equilibrium occurs where marginal revenue equals marginal cost. Long-run equilibrium requires the tangency of average revenue to the fixed adjusted average cost at a level of output associated with minimum classical average cost. This requirement will be expanded upon in some detail below. Long-run equilibrium is illustrated in figure 3.5.

Unlike Marshall, Machlup, and Robinson, Greenhut's analysis permits the accrual of rents in long-run equilibrium. His analysis is distinguished from their analyses since he views rents as variable factor costs rather than as residuals, relegating profits alone to the latter role.

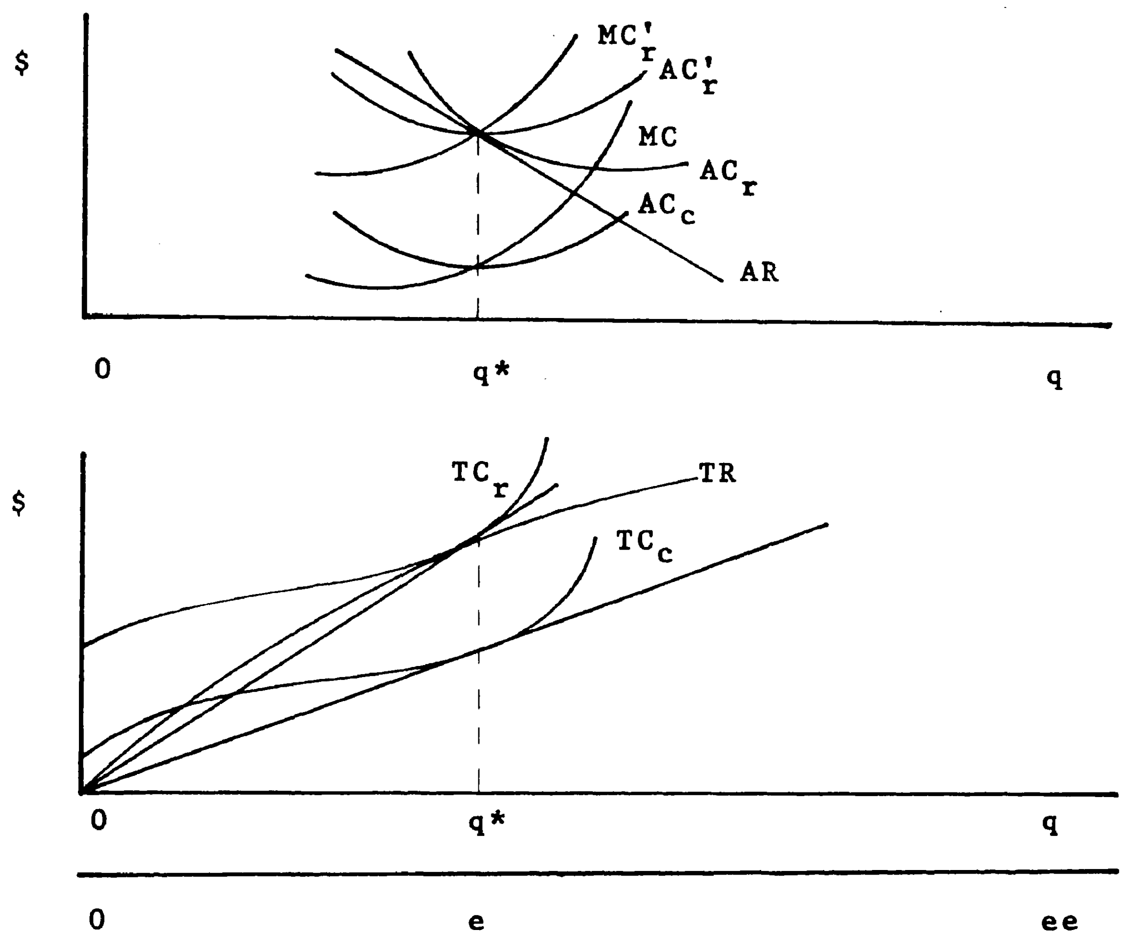

Figure 3.5. Oligopolistic Equilibrium and Rental Imputations

The Chamberlin Tangency

Chamberlin claimed production would occur at an output less than that associated with minimum average cost. He described the difference between minimum-cost production and the actual level of production as excess capacity. If Chamberlin was referring to the fixed adjusted average cost curve, production does occur at a cost in excess of the minimum. His concept of excess capacity has no clear significance along this curve. Furthermore, as Greenhut indicates, there is only one unique Chamberlinian tangency that represents a stable equilibrium. It is the tangency associated with minimum classical average cost. This result will be demonstrated in the following discussion by reference to figure 3.6.

If Chamberlin envisioned a fixed cost adjusted average cost curve, point F could reflect his stable equilibrium. However, at point F the owner's investment is less than optimal. OA'B'C' is less than OABC. e' is less than e. The owner receives a rental equal to the difference between the adjusted and unadjusted average cost curves. The rental is given by r = Re', where r would be the desired rental. The owner's desired r is based upon energy expenditure e, or investment expenditure OABC. But at F he is receiving r for energy or investment expenditures of e' and OA'B'C'. The Chamberlinian tangency solution therefore reflects

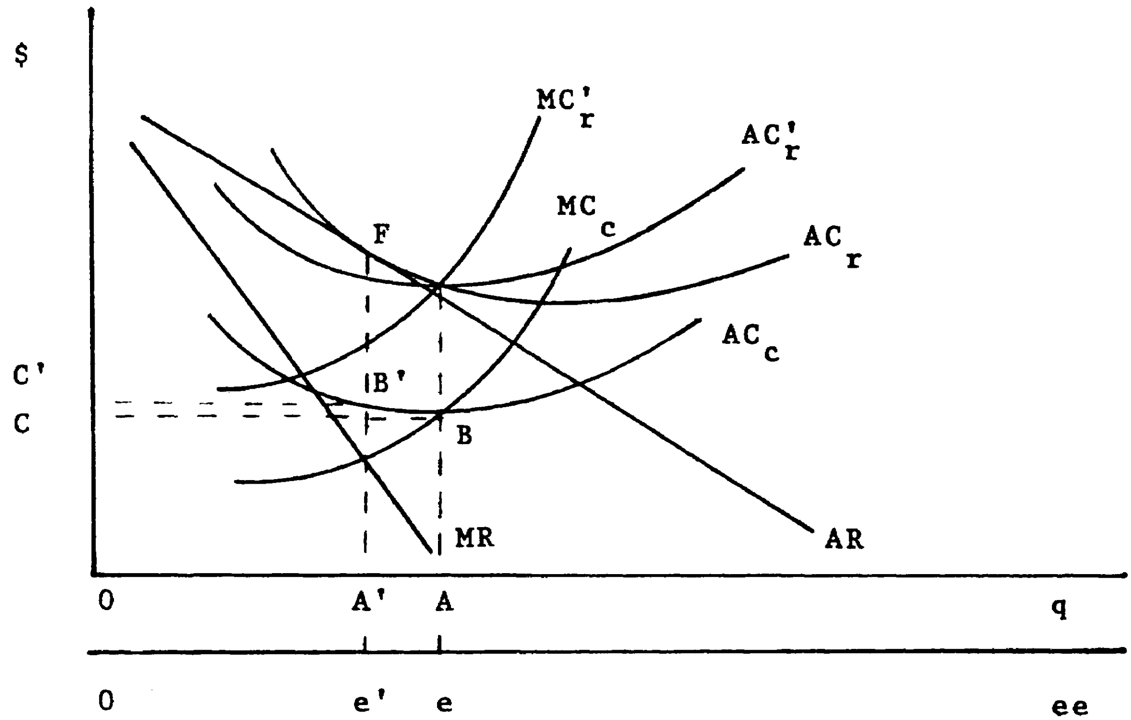

Figure 3.6. The Instability of a Chamberlinian Tangency to the AC_r Curve

profits vis-a-vis other industries. Interindustry equilibrium will only occur when r is received for e energy expenditures. The existence of the windfall will attract entry. The firm's average revenue curve will shift to the left and flatten out. The Chamberlin equilibrium at point F is therefore unstable.

Chamberlin indicated that there would be no profits or losses at his equilibrium, where marginal revenue equals marginal cost. In the sense that precisely r dollars for uncertainty are being recovered at point F, Chamberlin is correct. However, r is the appropriate rental only for e energy expenditures. The possibility that e' is equal to e at point F is inconsistent with the concept of factor conformability.

It is conceivable that the average revenue curve may shift so that it is just tangent to the variable adjusted average cost curve AC_r' shown in figure 3.7. Point G in figure 3.6 would also be unstable.

At output OA', a tangency of AR to AC_r' would make marginal revenue equal to the variable adjusted marginal cost, MC_r'. This adjusted marginal cost reflects what the entrepreneurs view as their best alternative. However, the accountant-engineers can only view the classical marginal cost curve as the relevant curve. Since marginal revenue exceeds classical marginal cost, they will seek to expand production. If the entrepreneur restricted production to OA', the accountant-engineers might wish to enter the industry on their own elsewhere. Entry would induce a further flattening and leftward shift of the marginal revenue curve. The entrepreneur, however is also unlikely to want to restrict output to OA', since the entrepreneur originally desired the optimally ordered energy and investment expenditure of e and OABC. By receiving r' for energy, investment expenditures e' and OA'B'C', he is frustrated since r' is less than the desired rental, r. (Recall that the AC_r curve reflects the rental r at all levels of output. Note further that at OA' units of

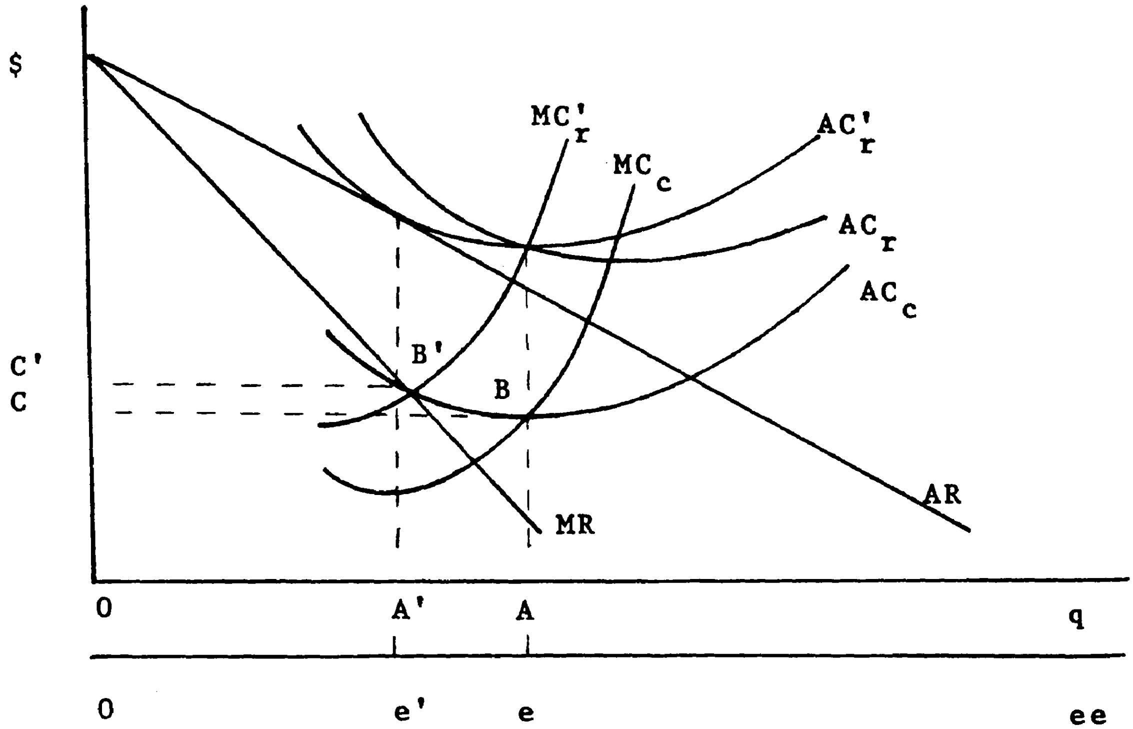

Figure 3.7. The Instability of a Chamberlinian Tangency to the AC_r' Curve

production, AC_r' lies below AC_r. Therefore r' is less than r.) The owner is not earning the rate R on [e-e'] or its transform, [OABC - OA'B'C'], the unrealized level of investment. Instead, he is earning rate R on only e', the actual level of energy expenditure. Thus, he does not realize the desired level of revenue, $r = R_e$.

The classical marginal revenue curve does not reflect the desired rentals. Where a variable adjustment is employed, it is necessary to adjust the marginal revenue curve artificially.

Such an adjusted marginal revenue curve will reflect the desired level of rentals, just as the variable adjusted MC curve reflects the factor's conception of "rental" costs.

The adjustment to marginal cost is given by R as indicated in Chapter II. R may be written as $[R \cdot q]/q$ or r'/q. Let the adjustment to marginal revenue be given only by r/q (not r'/q). The artificially adjusted marginal revenue is then given by $MR_c + r/q$, whereas the adjusted marginal cost is given by $MC_c + r'/q$. They are equal only when r' equals r. In still other words, the rental actually received will be equal to the optimally ordered rental when $e = e'$. When classical marginal revenue equals adjusted marginal cost, the adjusted marginal revenue exceeds the adjusted marginal cost. The owner will then optimize his behavior by expanding production until adjusted marginal revenue equals adjusted marginal cost.

A tangency solution will be stable only when both the owner and the accountant-engineers view the level of production as optimal. These two requirements are fulfilled when adjusted marginal revenue equals adjusted marginal cost, and when their classical counterparts are equal. The tangency in figure 3.7 at D is unstable because $MR_c > MC_c$. Since $MR_c = MC_r'$ it must be the case that artificial $MR_r > MC_r'$. Therefore, both the owner as well as the accountant-engineers will want to expand production given an output less than OA.

The intuitive appeal of the owner's desire to expand production is revealed by reference to a practical example. Consider the entrepreneur to be a self-employed insurance agent. The agent desires to work 50 hours a week and earn an income of $70,000 a year. If total energy expenditures are 2,500 hours, R will be equal to $28 per hour. Suppose the demand for his services is such that he currently earns $56,000 a year based upon 2,000 hours of work. While still earning $28 per hour, the agent would prefer to increase his energy expenditures from 40 hours per week to 50 hours per week. If able to do so, he would earn an additional $14,000 per year. If market conditions are inconsistent with his desires, he will move to an alternative employment in which his income is consistent with his intended level of energy expenditures. Exit of such agents will induce rightward shifts of the average revenue curves faced by the remaining agents.

The Stable Equilibrium Tangency

There is one unique stable equilibrium. It is depicted in figure 3.8. The adjusted marginal revenue curve is not depicted, since it merely represents an operational procedure. It would be parallel to classical marginal revenue and exceed it by the amount R, where R is defined to be equal to r/q, as in Chapter II

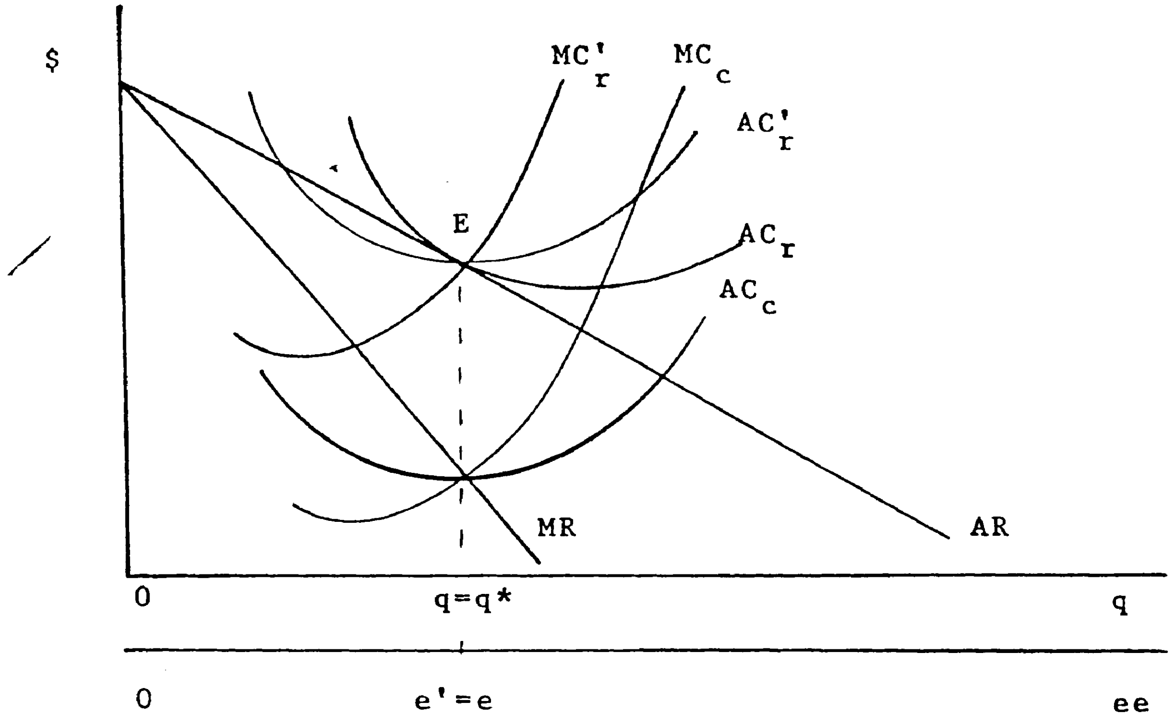

Figure 3.8. A Stable Tangency Solution

[13].[2] Adjusted marginal revenue must pass through point E. Under such conditions $MR_r = MC_r'$, $MR_c = MC_c$, $e' = e$, and $r' = r$. No excess capacity exists since the firm produces at the minimum technological average cost of production.

Adherence to the fictional concept of the representative firm places restrictions upon the characterization of long-run industry equilibrium. All surviving entrepreneurs come to demand

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2. In Greenhut's analysis, the adjustment is given by $\phi = r/q$. Thus Φ and R represent the same adjustment.

the same rentals for their services. They will also expend the same optimal level of energy expenditures. Indeed, it is possible to relate the observation of such characteristics to certain industries. Such industries will be characterized by a widely-shared knowledge of the current state of technology as it applies to the industry. Factors of production including the human factor will be characterized by a high degree of homogeneity.

In industries where factors of production tend to be heterogeneous, a distribution of multi-sized firms will emerge. In Chapter I, it was noted that Marshall used the concept of the "representative firm" to indicate that in long-run competitive equilibrium, all firms operate at the same level of minimum average cost. He did not associate the common level of minimum average cost with a common level of output, as is often done in the modern treatment [21, 579]. Marshall considered a spaceless economy. In such an economy, firms will not be as readily characterized by different cost structures as in the space economy.

In a spatial economy, geographically distinct producers face spatially differentiated demands. Not only are cost curves differentiated by heterogeneous factors of production, but firms will also choose different optimal plant sizes due to the differential demands. In both the spaceless and spatial cases, firms may be characterized by distinct cost structures. The optimal level of energy expenditures will vary from firm to firm, as will the rentals paid to the entrepreneurs. Each firm will, however, operate at the same level of minimum average technological cost.

Summary

The view of long-run equilibrium proposed in this chapter is based upon Greenhut's A Theory of the Firm in Economic Space [13]. Indeed it is so dependent upon this work that it would be operationally impractical to employ extensive footnotes.

Greenhut's theory of the imputed uncertainty cost on an investment can be summed up by resorting to a device he has used in lectures. Define the required rental as:

I) $r = RS = RAC_0 q_0$,

where subscript 0 stands for the optimal cost point. Let the actual rental be given by:

II) $r' = Rs' = RAC_a q_a$,

where subscript a stands for the actual level of output. The actual rental may alternatively be defined as:

III) $r' = Rs' = RAC_0 q_a$.

Let equation I be referred to as the adjustment and equation II as the adjustment. Next define the total cost function as:

II_1) $C = f_1(Q)$,

where $f_1(Q)$ is a cubic function which generates a monotonically increasing cost as total output Q increases. Then:

II_2) $C^* = f_1(Q) + u$,

where $u = u(Q) = f_2(Q)$, and where $f_2(Q) = f_1(Q)$. Thus $C^* = f_1(Q) + \psi f_1(Q)$,

II_3) $MC^* = \frac{dC^*}{dQ} = f_{1Q} + f_{2Q} = (1 + \psi)f_{1Q}$

and

II_4) $AC^* = \frac{C^*}{Q} + \frac{f_1(Q)}{Q} + \frac{f_2(Q)}{Q} = \frac{(1 + \quad)f_1(Q)}{Q}$.

It further follows from III that

III_1) $C = f(Q)$.

Then:

III_2) $C^* = f(Q) + u$,

where $u = u(Q) = \phi Q$. Therefore, $C^* = f(Q) + \phi q$,

III_3) $\frac{dC^*}{dQ} = f_Q + \phi$,

and

$$III_4)\quad AC^* = \frac{C^*}{Q} = \frac{f(Q)}{Q} + \frac{\phi\, Q}{Q} = \frac{f(Q)}{Q} + \phi \ .$$

It is manifest that the II conception of r' entails:

$$II')\quad r' = \psi f_1(Q) = \psi\ AC_A q_A.$$

Therefore,

$$II'')\quad \psi = R,$$

where R is the rate of return as a function of dollar investment. The III conception of r' establishes:

$$III')\quad r' = Q = RAC_0 q_A,$$

which means,

$$III'')\quad \phi = RAC_0,$$

where RAC_0 is the dollar requirement due to the percent R on the AC_0 amount). Of course, $AC_a > AC_0$ for all $a \neq$.

Note that the tangency to the fixed cost (r) adjusted curve induces entry because of the windfall profits which exist. Now, we find that the disparity between MR and MC due to equating MR with MC^* [when uncertainty is imputed by the entrepreneur-investor as a variable factor in perfect conformance to technology (the ψ adjustment) or to output (the ϕ adjustment)] would also induce new entry by erstwhile accountants, engineers, economists. In fact, Greenhut proposes additionally for any tangency to an r' adjusted curve that, besides the hired inputs, equating MR to MC^* signifies disequilibrium in the mind's eye of the entrepreneur also.

According to Greenhut, entrepreneurs aspire to the return r, not r'. Because of this, he then defines an MR adjustment (in the mind's eye of the entrepreneur) as:

$$\text{A)} \quad \psi' = \frac{r}{q_a} = \frac{RAC_0 q_0}{q_a} = RAC_0 (>1)$$

for all tangencies where $q_0 > q_a$. He also defines a proxy related ψ^* for II as:

$$\text{B)} \quad \psi^* = \frac{r'}{q_a} = \frac{RAC_a q_a}{q_a} = RAC \cdot a$$

For III we then have:

$$\text{C)} \quad \phi^* = \frac{r'}{q_a} = \frac{RAC_0 q_a}{q_a} = RAC_0 = \phi \ .$$

Note that the numerator in the third term of (A) is greater than in (B). Thus $\psi' > \psi^* > \phi^*$. So besides the expert's disequilibrium view, the entrepreneur is also in disequilibrium at any tangency to an r' adjusted curve. Moreover, for all output points beyond the technological optimal cost point where AR may equal the r' adjusted value, we have:

A$'$) $\psi' = RAC_0$ (<1),

B$'$) $\psi^* = RAC_a$, and

C$'$) $\phi^* = RAC_0$.

Hence, $\psi' < \phi^* < \psi^*$. Of course, where $q_a = q_0$ in the third terms of (A), (B), and (C), $\psi' = \psi^* = \phi^*$. It is therefore the case that entrepreneurial equilibrium can only attain when the technological level of output, q_a, is equal to the level of output associated with the optimal cost point, q_0.

Greenhut has extended traditional microeconomic theory to describe realistically the process whereby rentals for uncertainty accrue to firms. These rentals appear as economic profits from an accounting aspect. They represent true costs of production and will persist in long-run equilibrium. Qualitative differences in factors, including the entrepreneurs, will result in a size distribution of firms within an industry. Firms will differ not only in the scale of production, but also with respect to the level of reported profits. This result has important implications for the enforcement of antitrust policy. Market shares and high rates of profit are shown to be inappropriate criteria for the determination of the degree of competition.

These results also provide important implications for public policy towards business. The expansion of petroleum resources in the face of increasing demand entails increased uncertainty. Firms will be unwilling to expand exploration activities where the opportunity cost of uncertainty cannot be recovered. Windfall profit taxes are counter to the public desire for expanded energy supplies.

Greenhut's analysis is consistent with an interindustry dispersion of profits. Industries characterized by high levels of risk and uncertainty will be characterized by high levels of accounting profits. Risk and uncertainty represent legitimate costs of production. High accounting profits do not necessarily reflect any economic profits in long-run competitive-oligopoly equilibrium.

CHAPTER IV

A CRITICAL ANALYSIS OF GREENHUT EQUILIBRIA

The Greenhut equilibria described in Chapter III appear in a highly abstracted form in _Theory of the Firm_ [13]. This theory is rich in the sense that it is consistent with, and unifying of, much of traditional microeconomic theory. In order to reinforce the sustainability of Greenhut equilibria it is appropriate to examine the theoretical bases of his imputational procedures. In particular, the following issues will be addressed in this chapter.

First, it is necessary to show that sustainable equilibria exist. Chapter III of the present work accepted existence _a priori_ and merely described the properties associated with such equilibria. Second, the distinction between the terms explicit, implicit, functional, and non-functional inputs must be carefully differentiated. This is necessary to properly distinguish Greenhut's work form that of Chamberlin, Machlup, and Robinson. These distinctions bear upon the appropriateness of Greenhut's imputational procedure. Third, Greenhut's work is fundamentally differentiated from that of Chamberlin. It is associated with strong welfare implications for society. It is towards these questions that we now turn.

Existence

As previously indicated, the problem of existence was basically ignored in Chapter III, It may be argued that demand conditions are limited so that the market will not support n firms, all operating at minimum efficient scale. In Chapter 8 of The Theory of the Firm, Greenhut specifically addresses this issue. Greenhut posits the existence of multiplant firms where the required energy expenditures associated with multiplant production are a positive function of the number of production facilities.

Greenhut proposes the existence of an implicit cost function,

4.1) $H\,[C, q, m, m']$

where C is the level of cost, q is output, m is the size of an individual production facility associated with fixed capital investment, and m' is the number of production facilities operated by the firm. This function is associated with a family of average cost curves which are differentiated by the number of production facilities. The difference between these curves reflects differences in required energy expenditures and therefore the opportunity costs of the owners-managers of the firms. It is possible to construct an envelope curve of the LRAC curves associated with different numbers of plants. For any level of output there will exist an optimal number of plants which minimize the cost of production. If market demand is "large" relative to minimum efficient scale, all firms will operate the same number of production facilities, i.e. they will employ the configuration which minimizes long-run average cost. However, where market demand is "small" relative to minimum efficient scale, total production may be partitioned among a size distribution of firms. The existence of a sustainable distribution is assured by the divisibility of output among firms operating at different levels of output. In figure 4.1, any level of industry output may be partitioned among n firms operating under various configurations. For example, assume market demand will only support one firm operating at minimum efficient scale. Such a plant may operate at point A in figure 4.1. Another firm may fulfill the residual market demand by operating at point B. In Greenhut's theory, when the imputations for energy expenditures and indivisibility are made, each firm will operate at the same common level of minimum average cost. This situation is illustrated in figure 4.2. As figure 4.2 suggests, the two firms are differentiated by the number of plants operated by each, the energy expenditures required by each configuration, and therefore by the total rental earnings of the individual entrepreneurs. Manifestly, the differential imputed earnings will reflect varying levels of uncertainty as well.

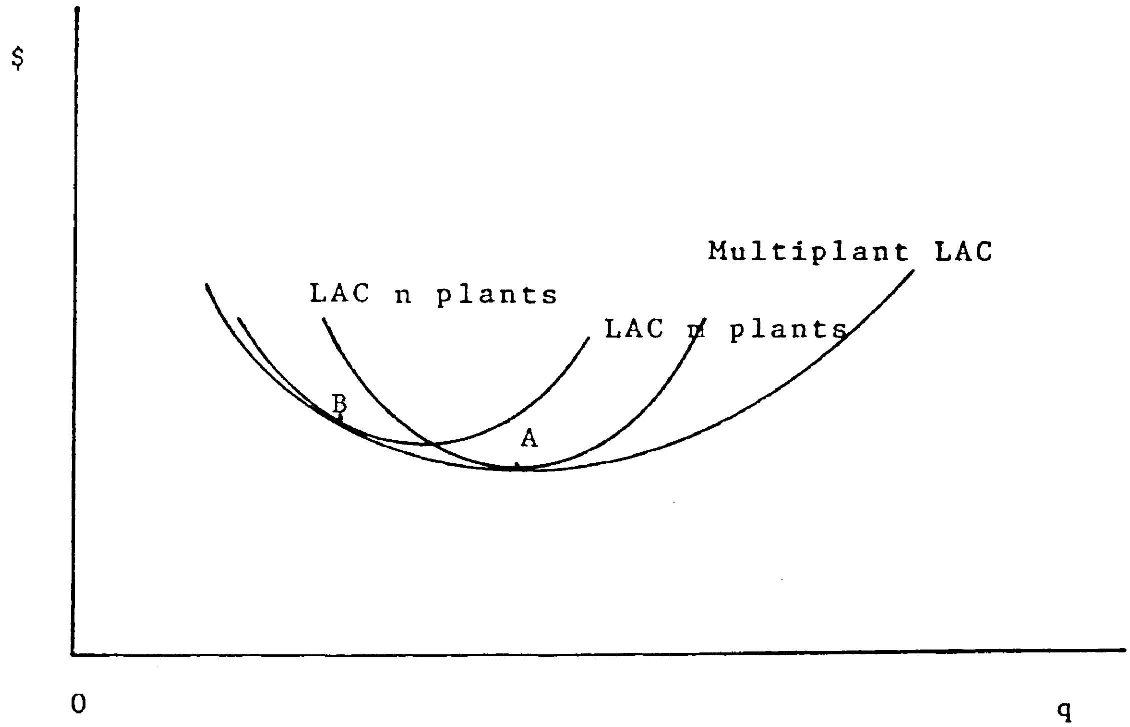

Figure 4.1. The Multiplant Long-Run Average Cost Curves

In this manner, existence of a sustainable equilibrium is assured. Indeed, the continuous nature of the envelope curve assures that a partition of market demand can always be found which insures a solution to the existence problem.

Equally important, Greenhut's theory is consistent with Marshall's comments concerning the fictional concept of the "representative firm" which were referenced in Chapter III. Casual empiricism should confirm for the reader the existence of industries characterized by price competitiveness, the absence of

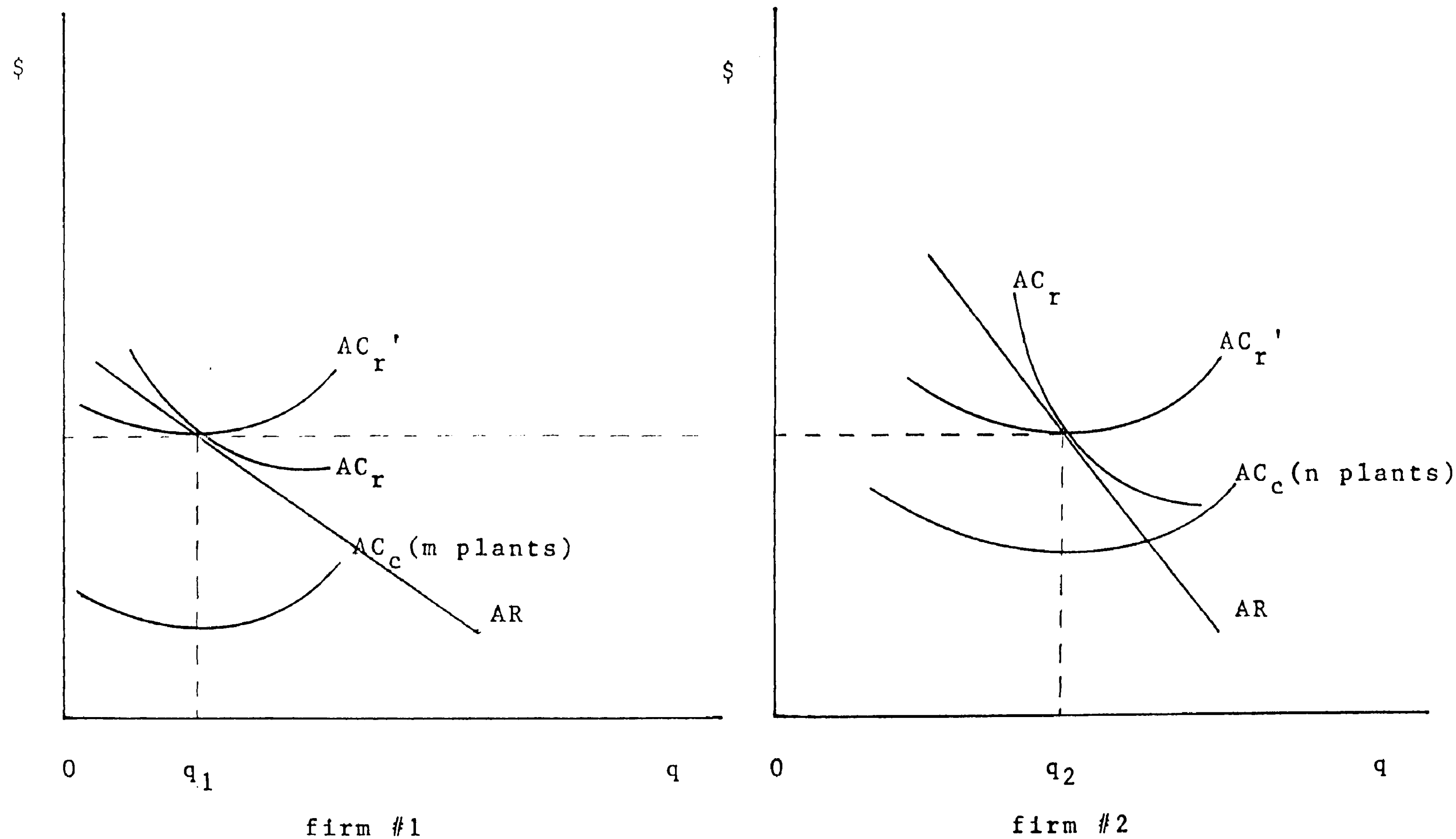

Figure 4.2. Rental Imputations for Different Sizes of Firms

economic profits, and multiple firm configurations. Structual differentiation of firms may be sufficient to allow all firms in a competitive oligopoly to produce at a common level of minimum average cost. Excess capacity is therefore not necessarily associated with such market structures. Indeed, if Greenhut's analysis is correct, excess capacity will not exist in long run equilibrium for such market structures.

The Nature of Inputs

Machlup's and Robinson's imputational procedures were discussed in Chapter II. These rentals were viewed as reflecting the opportunity costs of scarce factors purchased at advantageous prices by producers. The ascriptions of opportunity costs were meant to reflect current market prices of resources. The inputs considered explicitly entered the production function of the firm. Machlup and Robinson's theory of rents must be carefully distinguished from those of Ferguson, Blaugh, Chamberlin, and Greenhut. For purposes of analysis, the following terms must be distinguished.

A functional input is one which directly enters the production function of a firm, such as those discussed by Machlup and Robinson. A non-functional input is one which does not directly enter the production function of a firm, but whose presence is required if production is to occur.

Mathematically let production be characterized by the following relation:

$$4.2)\quad Q\ (K,L,E) = \begin{cases} 0 \text{ for } E=0 \\ Q^{*}(K,L) \text{ for } E=1 \end{cases}$$

where E represents the entrepreneurial factor, which is assumed to be a non-functional input. It assumes the binary values 0 or 1 according to whether the factor is present or not. Equation 4.2 indicates that production is not feasible when the entrepreneurial factor is absent. When present, output is a function of K and L and is given by Q^{*}. Since energy expenditures are a non-functional input, they do not directly enter Q^{*}. However, various levels of Q^{*} may call forth different levels of energy expenditures, uncertainty, etc.

Non-functional inputs also do not enter the cost functions of the firm which are directly derived from the production function. However, since they do reflect a real cost to society, the opportunity costs of the entrepreneurial factor must be imputed or ascribed to the explicit costs of the firm. Part of the entrepreneurial factor may represent functional services and therefore directly enter the production and cost functions of the firm. Our attention is directed solely towards that portion of entrepreneurial services which are non-functional in nature.

As noted above the terms "functional" and "non-functional" characterize the way an input enters the production function of the firm. The terms "explicit" and "implicit" refer to the way an input enters the cost function of a firm. By way of example, Machlup's and Robinson's scarce resources represent functional inputs whose cost to the firm varies from their true opportunity cost. Blaugh considers an implicit input which directly enters the firm's production function, but a portion of whose cost may be shifted. He cites the example of a public transportation facility. Machlup, Robinson, and Blaugh all considered rental imputations for functional, implicit-cost inputs.

In Chamberlin's and Greenhut's analyses attention is focused upon non-functional, explicit-cost factors of production. These costs are actually born by the firm and may not be shifted.

The following contrasts may be made between the various approaches to rental imputations based upon the distinctions between functional, non-functional, explicit, and implicit inputs.

In Machlup's and Robinson's approach, rentals are imputed to reflect price differentials for scarce fixed factors of production. Both suggest that these rentals be imputed as fixed costs. The difficulty with such an approach is that given a production function and knowledge of factor prices, the cost functions may be directly derived. No imputational procedure is required. The rent-adjusted average cost curve of the firm possessing a scarce factor would be the average cost curve based upon the competitively determined opportunity cost of the resource. Assuming the marginal firm pays a higher price for the fixed factor than the inframarginal firm, the minimum point of the marginal firm's LAC curve may be to the left or right of the output associated with minimum long-run average cost of the inframarginal producer. The relative positions of minimum long-run average cost will depend upon the expenditure elasticity of the scarce factor. Fixed cost imputations however always increase the optimal scale of the firm. Machlup's and Robinson's imputations are therefore seen to be inappropriate. Furthermore, as stocks of the scarce factor are consumed, the firm must replace them at the current market prices. Rentals of the type envisioned by Machlup and Robinson cannot persist in the long run and therefore are irrelevant when considering the welfare effects of rental earnings.

Whereas Machlup and Robinson considered only functional, implicit inputs, Ferguson considered functional, explicit inputs. Ferguson's theory is a theory of quasi-rents. In his model, such rents exist only in the short-run interim period in which entry is precluded. They are, in effect, short-run economic profits. With entry, price is bid down to minimum average cost and quasi-rents dissipate. In Ferguson's model, quasi-rents are the motivating force which induces firms to enter the industry, thus leading to long-run competitive equilibrium.

In Blaugh's model of rents, inputs are best described as functional and implicit. This analysis is primarily concerned with external effects. In Chapter II models reflecting such effects were developed which were consistent with Blaugh's assumptions. These models indicated that Blaugh's results need not attain. For present purposes there is no need to pursue a model of rentals where production is subject to external effects.

Chamberlin's and Greenhut's models are the only models directed towards an analysis of non-functional, explicit inputs. It is toward a contrast in these models that we now turn. First, however, a more detailed analysis of Greenhut's measurement of opportunity costs is in order, since it facilitates the understanding of the crucial differences between Greenhut's and Chamberlin's models.

Entrepreneurial Opportunity Cost

In order to evaluate Greenhut's imputational procedure it is enlightening to contrast this procedure with the traditional determination of the opportunity cost of a functional input, and with the method employed by Chamberlin.

Consider an imperfectly competitive product market where firms purchase inputs in perfectly competitive factor markets.

In Ferguson's treatment let the production function be given by equation 4.3 [10, 145-153].

4.3) $q = f\ (x_1, x_2, \ldots, x_n)$, where

4.4) $f_i > 0,\ f_{ii} < 0\ (i=1,2,\ldots,n)$.

Furthermore, let the inverse demand function and the expenditure constraint be given by equations 4.5 and 4.6.

4.5a) $q = h(p)$, where

4.5b) $h' < 0$, and

4.6) $C = \Sigma\ p_i x_i$

The profit function of the firm is therefore given by revenues minus cost, or

4.7) $\pi = r - c = ph(p) - \Sigma p_i x_i$.

The first order conditions require the following equivalent equations to hold.

$$4.8a)\quad \frac{\partial \pi}{\partial x_i} = \frac{\partial p}{\partial q}\frac{\partial q}{\partial x_i} - \frac{\partial C}{\partial x_i} = \quad , \text{ for } i=1,2,\ldots,n$$

$$4.8b)\quad \frac{\partial \pi}{\partial x_i} = MR \cdot MP_i - p_i = \quad , \text{ for } i=1,2,,\ldots,n$$

Equation 4.8b indicates that the profit maximizing firm will pay each factor of production its marginal revenue product. The existence of an equilibrium is assured if there exists a stable market price such that the quantity demanded of each firm is equal to the output of the firm, or

$$4.9)\quad h(p) = f(x_1,x_2,\ldots,x_n)$$

Equations 4.8b and 4.9 provide n + 1 equations to solve for n + 1 unknowns (x_1 though x_n and p) in terms of the parametrically given input prices (p_1 through p_n). Importantly, equation 4.8b represents the n jointly-derived input demand functions in implicit form.

In the traditional analysis the input demand functions are summed across j firms to yield industry demand for each input. The input supply function is found by summing across individual supply curves. The intersection of industry supply and demand curves inputs yield the equilibrium input prices consistent with the existence of product market equilibrium. A <u>sustainable</u> equilibrium also requires the assumption of zero economic profits in addition to the previously defined market clearing condition. Furthermore, if the product market is perfectly competitive, marginal revenue is equal to price and each unit of input is paid the value of the marginal product of the last unit hired. Along the expansion path it must be true that

4.10a) $q \, \varepsilon = \Sigma \, f_i x_i$.

Since the function coefficient is equal to one in long run competitive equilibrium, the Clark-Wicksteed theorem is seen to hold. Multiplying each side of equation 4.10a by the equilibrium product price indicates that total revenues are just sufficient to cover total factor costs when each factor is paid its value of marginal product. Equation 4.10a may be rewritten as

4.10b) $p \cdot q = \Sigma \, (pf_i)x_i$

Since each unit of x_i receives the value of its marginal product (pf_i), the summation across all units of x_i and across all inputs yields total factor costs.

If the product market is monopolistically competitive then price will exceed marginal revenue. In a stable equilibrium the average cost curve reflects the fact that factors are paid their marginal revenue products. Since price must equal average cost at a tangency solution, it is argued by Chamberlin [8, 181], Ferguson [9, 435], and others that factors are not paid the value of their marginal products. Robinson refers to this situation as monopolistic exploitation. Equation 4.10 is easily transformed to show that total revenues are insufficient to pay the value of marginal product. Multiply each side of this equation by P/ε to yield

4.11) $pq = 1/\ \varepsilon\ p\ f_i x_i.$

In equation 4.11 the expression 1/ε must take on a value between zero and one under monopolistic competition. Total revenues are therefore equal to only a fraction of the value of marginal product summed over all inputs. Both Chamberlin [8, 215-218] and Ferguson [9, 435] object to the use of the term "monopolistic exploitation" since, where all inputs are functional and explicit, the entrepreneur himself receives only his marginal revenue product. Market conditions are such that it is not possible to pay all factors the value of their marginal products.

The preceding analysis indicates that where all inputs are functional and explicit, the average cost curves fully reflect the opportunity costs of resources when the industry is in equilibrium. This is true under any type of product market organization as long as each factor is paid its competitively determined wage rate.

In Chamberlin's and Greenhut's models this traditional theory of wage determination breaks down. When an input is non-functional, the marginal productivity of the input is zero, even though production may not occur unless the factor is present. The marginal productivity theory of factor demand cannot be utilized to derive a demand curve for the non-functional input. In Chamberlin's model advertising expenditures (selling expense) are the non-functional input. The level of such expenditures is directly related to the location of the firm's average revenue curve. One effect of advertising expenditures is to increase the demand for the product. With this in mind Chamberlin proposes the following indirect method of determining the opportunity cost of advertising expenditures.

Chamberlin suggests that the costs associated with functional inputs be deducted from the value of the total product, evaluated at equilibrium prices. Then the value of the goods which are no longer produced because demand has shifted away from them would be deducted. Such a computation would require global knowledge concerning the equilibrium price and output vectors for every firm and industry in the economy. However, even when these operational difficulties are assumed away, Chamberlin concludes that to suggest such factors are paid in accordance with the value of their marginal products would be a "manifest absurdity" [8, 187].

In Chamberlin's approach the social opportunity cost of advertising is the residual left from total revenues after deducting the marginal revenue products of all functional inputs, and after adjustment for the value of goods no longer produced because of advertising-induced shifts in demand. The difficulty with such an approach is with the second step. In equilibrium the factor payment made for advertising expenditure must be the residual left after deduction of functional input costs from total revenue. By further reducing the residual for the opportunity costs of foregone consumption, Chamberlin is confusing a theory of wage determination with a theory of welfare analysis. His approach would indicate that in equilibrium the factor payment made for advertising exceeds the social value of advertising. While this indeed may be the case, it is entirely inconsequential when discussing the determination of equilibrium factor payments in a monopolistically competitive industry. Chamberlin's theory is not helpful in trying to impute the productivity value of a non-functional input.

In Greenhut's theory, marginal productivity theory also fails to explain the demand for non-functional inputs. Since the input does not directly enter the production function, the marginal product of the input cannot be computed directly. However, Greenhut's resolution of this problem proceeds along much different lines than the attempt by Chamberlin.

In order to appreciate the differences between the Chamberlin and Greenhut models, a brief summary of each of these analyses follows.

Chamberlinian Solutions

Chamberlin actually offers three models of monopolistic competition. The first model considers only functional inputs where there is no active price competition. The second model adopts the assumption of active price competition. Chamberlin's third model includes advertising expenditures as a non-functional input but requires active price competition.

Figure 4.3 is a summary of the first model. In this model equilibrium is attained when the market-share demand curve is

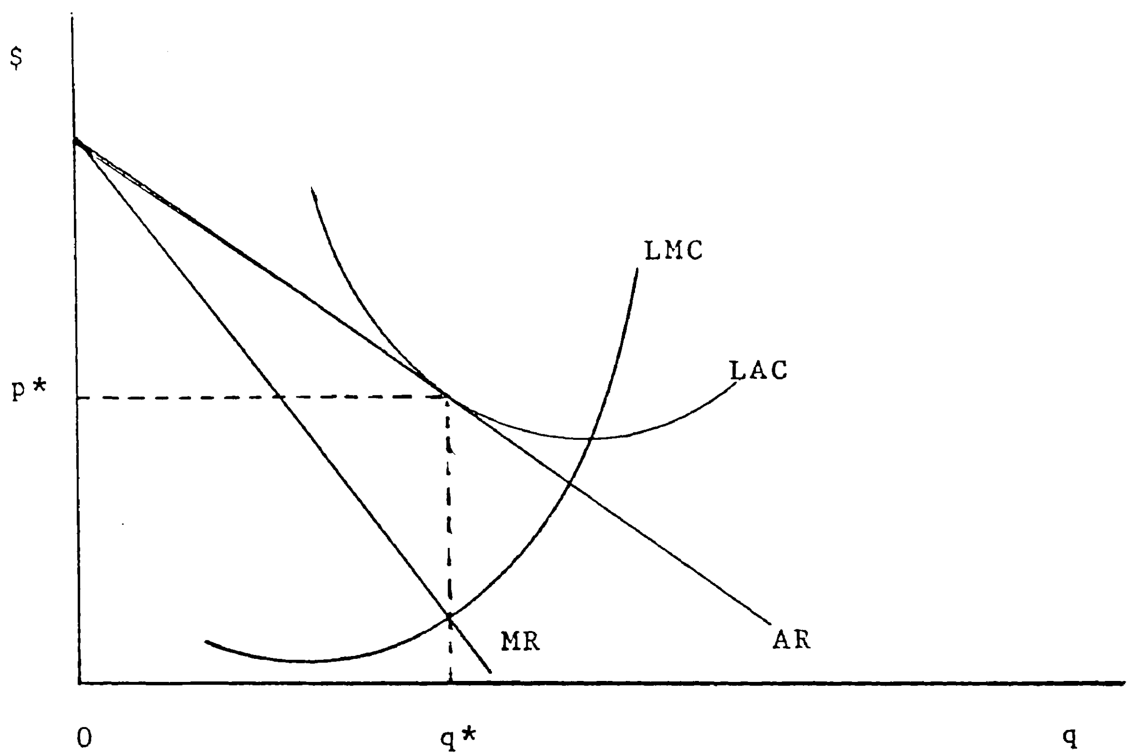

Figure 4.3. Chamberlin's First Model of Monopolistic Competition

just tangent to the long-run average cost curve. The marginal revenue and cost curves must intersect at the level of output at which the average revenue and cost curves are tangent. This is easily demonstrated. Let total revenue and total cost be given by,

4.12a) $TR = AR \cdot q$, and

4.12b) $TC = AC \cdot q$.

Then the marginal functions are given by

4.13a) $MR = AR' \cdot q + AR$, and

4.13b) $MC = LAC' \cdot q + LAC$.

Since the average revenue and average cost curves are tangent in figure 4.3, the slopes of the curves and the levels of average revenue and average cost are all equal at the point of tangency. Thus equation 4.13a must equal equation 4.13b.

The model with active price competition is shown in figure 4.4. In this model, it is assumed that close, but not perfect, substitutes exist for the firm's product. The curve dd is referred to as the perceived demand curve and the curve DD is referred to as the market-share demand curve.

Based upon the previous geometric argument, the marginal revenue curve associated with dd must equal marginal cost at q^*. Note that at equilibrium the market-share demand curve is steeper

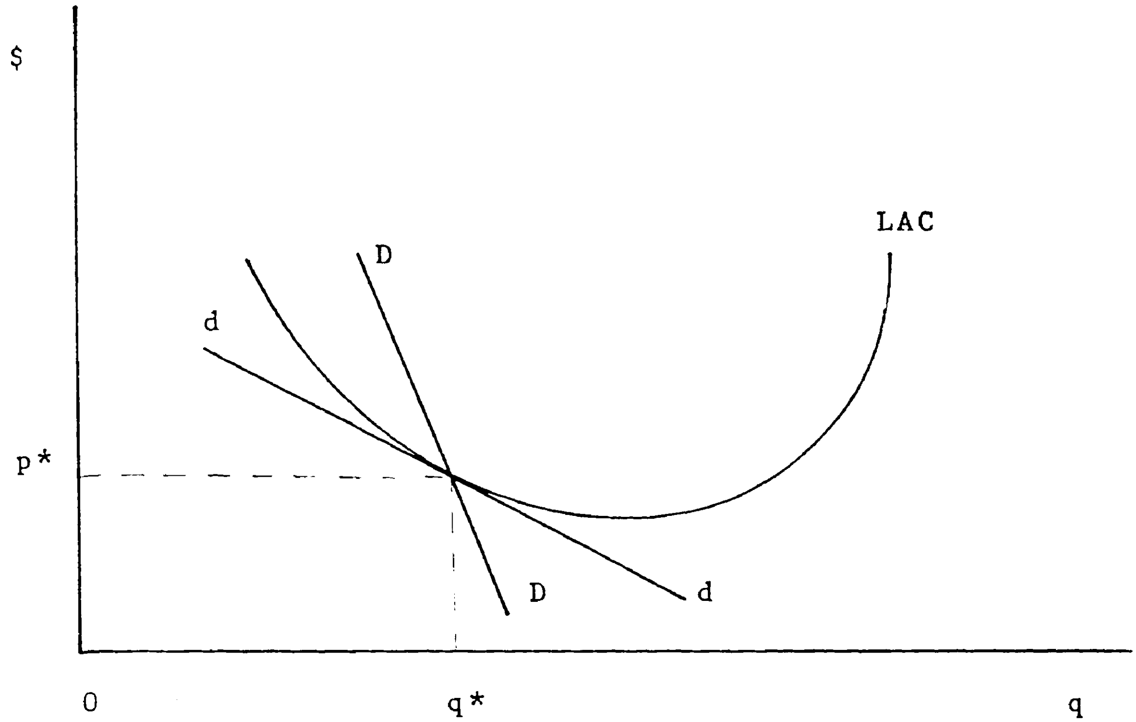

Figure 4.4. Chamberlin's Second Model of Monopolistic Competition

than the perceived demand curve. By reference to equation 4.14, it is obvious that the marginal revenue curve associated with the market-share demand curve must lie below the marginal revenue curve associated with the perceived demand curve.

4.14a) $MR = AR' \cdot q + AR$

4.14b) $mr = ar' \cdot q + ar.$

In equation 4.14 the levels of output and average revenue are equal. The slopes of the average revenue curves are negative in value and that of the market-share curve is more negative than the perceived curve. It therefore follows that while mr = MC, since MR < mr, then the marginal revenue associated with the pro-rata curve lies belows the marginal cost curve. This situation is depicted in figure 4.5. Chamberlin identifies q_0 in figure 4.5 as a stable equilibrium.

In this model while the firm thinks that it is profit maximizing at q_0, indeed it is not doing so. It would in truth maximize profits by reducing output to the level where MR = LMC, or q_1 in figure 4.5.

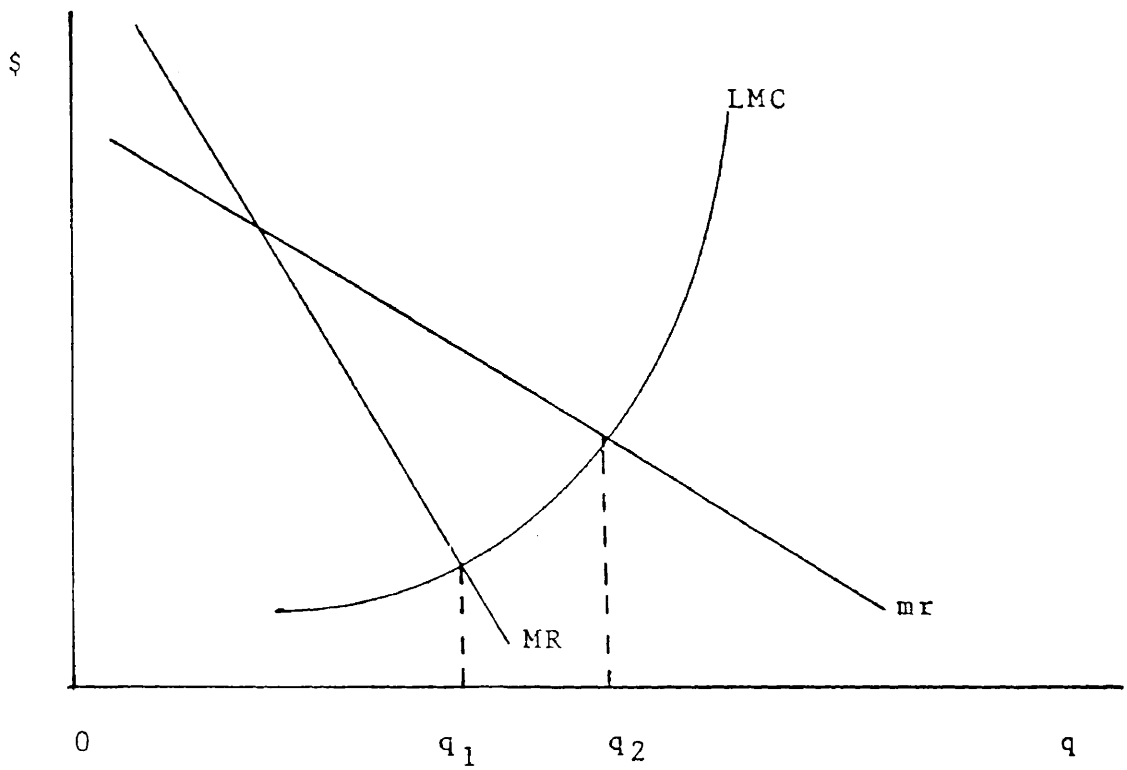

Figure 4.5. The Instability of Chamberlin's Second Model

If firms were aware of the existence of the DD curve they would restrict output and maximize profits at q_1. The problem with Chamberlin's model is that it assumes the firm never recognizes the DD curve, and its associated MR curve. Surely the firm would sooner or later experience an operational disruption which would temporarily reduce output below q_0. The firm could not help but observe that profits increased during the period of reduced output.

If a firm becomes aware of the market-share demand, then it will set output at q_1, earn positive economic profits, and attract entry. Entry will only cease when the DD curve is tangent to the LAC curve shown in figure 4.3. Thus active price competition would not be expected to persist in the long run.

In the limit, if perfect substitutes existed for the good and firms did engage in active price competition, production would occur at minimum average cost as shown in figure 4.6.

Chamberlin's third model concerns a monopolistically competitive industry in which products are differentiated by the psychological impact of advertising expenditures. Chamberlin suggests that such expenditures are inconsistent with active price competition.

In Chamberlin's third model advertising expenditures do not directly enter the production function. However they are functionally related to the ability of the firm to market its

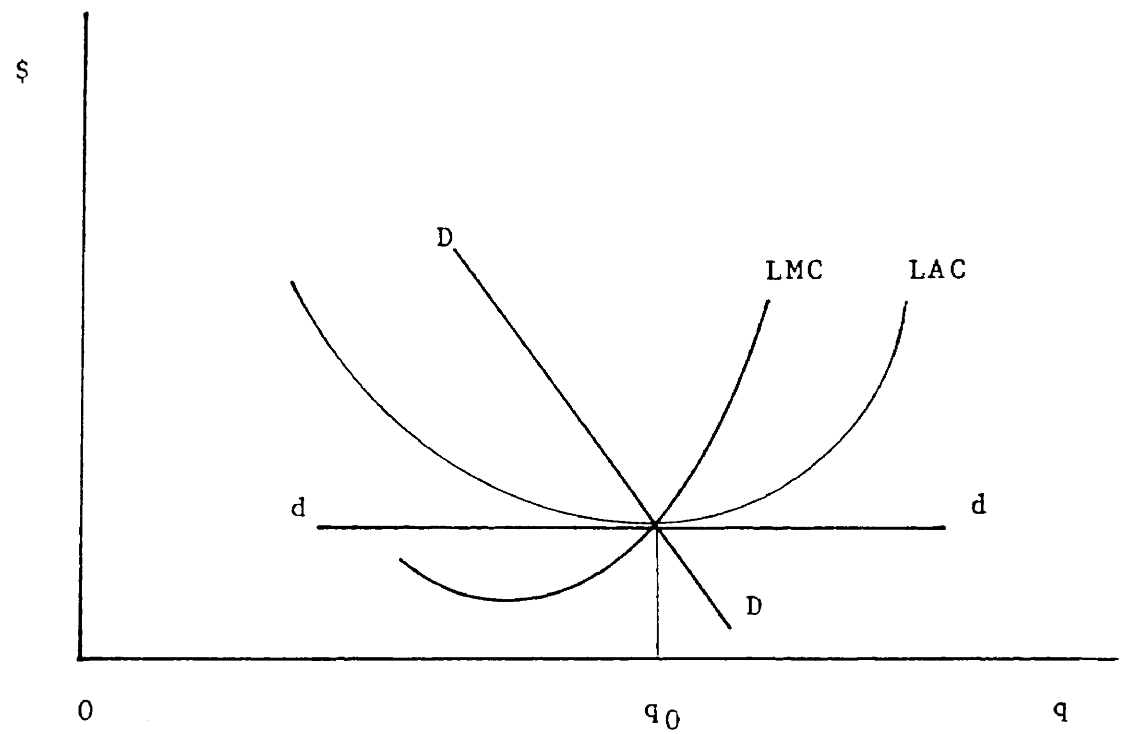

Figure 4.6. The Degenerate Case of Chamberlin's Second Model

product. He assumes the existence of economies of scale with respect to such expenditures. Chamberlin envisions a U-shaped average cost of advertising curve as shown in figure 4.7. In Chamberlin's analysis the level of output associated with the minimum average cost of advertising is not necessarily the output which minimizes the classical average cost associated with functional inputs. When he makes the variable imputation for such costs, the variable adjusted average cost curve and the classical average cost curve are as shown in figure 4.8.

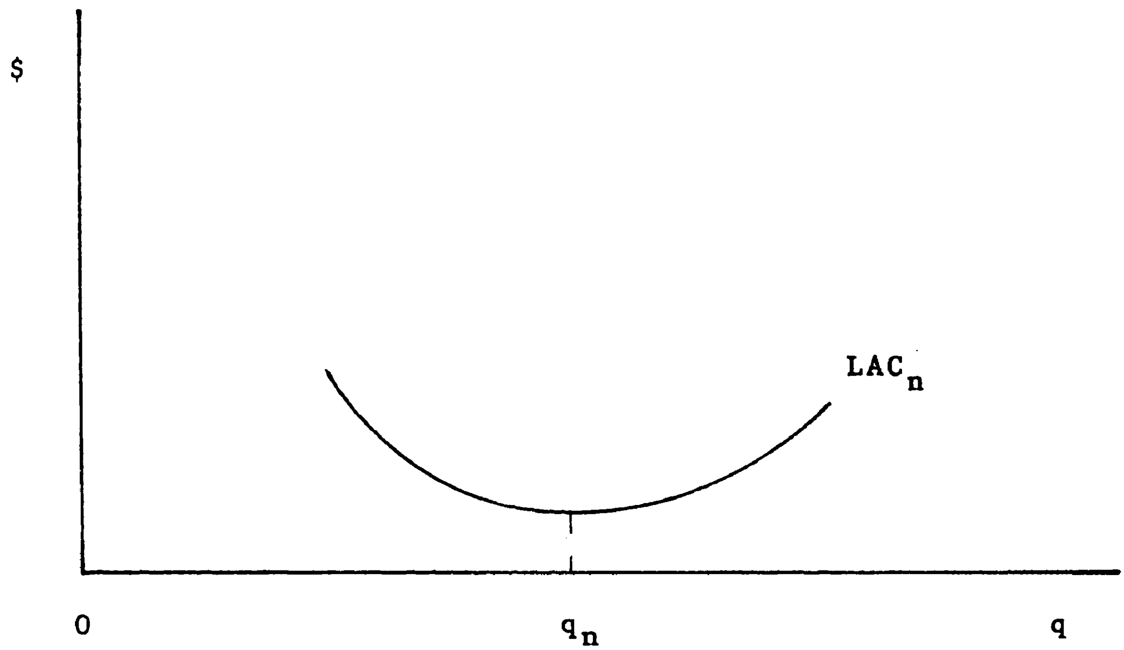

Figure 4.7. Economies of Scale in Chamberlin's Third Model

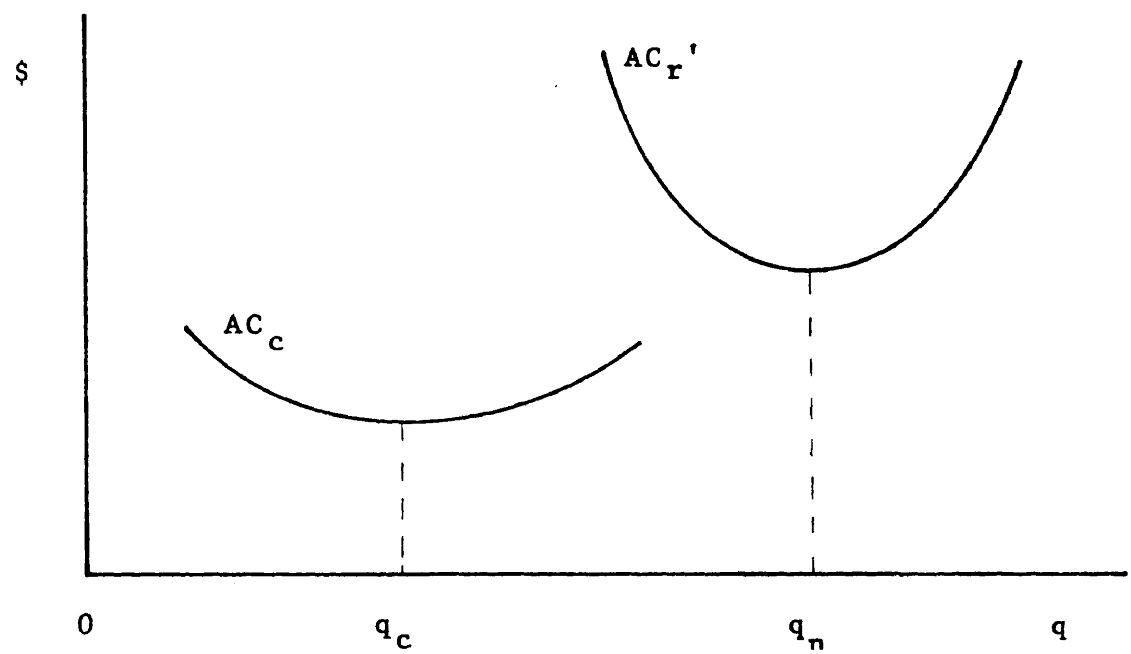

Figure 4.8. The Divergence of Optimal Scales of Production in the Third Model

Chamberlin performs his analysis in three distinct steps. He first considers price to be constant and examines variations in advertising expenditures. He next considers advertising expenditures as given and considers price movements. Finally he combines the results of the two separate approaches.

In the first step Chamberlin concludes that for a given price, the firm will adjust his advertising expenditures and output to the level where price is equal to variable-adjusted marginal cost. In figure 4.9, if the current market price is p_1, then the firm is assumed to maximize profits by producing output q_1.

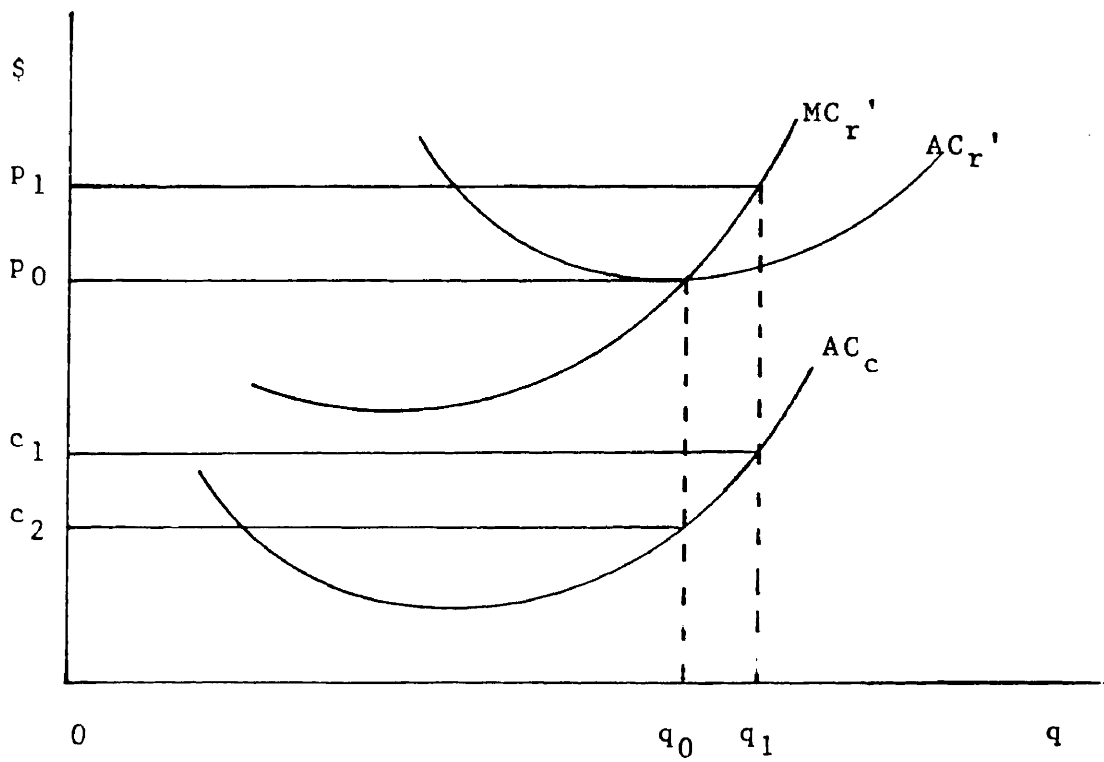

Figure 4.9. The First Step in the Equilibrium Adjustment Process

Chamberlin notes that if price is equal to p_0 then the advertising expenses incurred will be just sufficient to dispose of the output. At this price and quantity surplus profits are eliminated, while the minimum amount necessary to market the output remains. He therefore concludes that firms must produce at minimum variable-adjusted average cost in long-run equilibrium. It is only at price p_0 that there are no incentives for entry.

This portion of his analysis contains two enigmas. First, if products are differentiated, why is marginal revenue assumed to be horizontal at p_1 and p_0? Second, this portion of the analysis is distinguished by the notable absence of the market-share demand curve so prevalent in his first two models.

In the second step of the analysis advertising expenditures are considered fixed and price is allowed to adjust. This situation is depicted in figure 4.10.

In figure 4.10 advertising expenditures are imputed as a fixed cost. It is well-known that such imputations have no effect on the marginal cost curve. If demand is DD in figure 4.10, the firm will maximize profits by finding the price and output which maximizes profits. A position such as p_0, q_0 in figure 10 would exist. At this stage of the analysis, Chamberlin offers no explanation of how this profit maximizing output is chosen. It is certainly not chosen under the assumption that

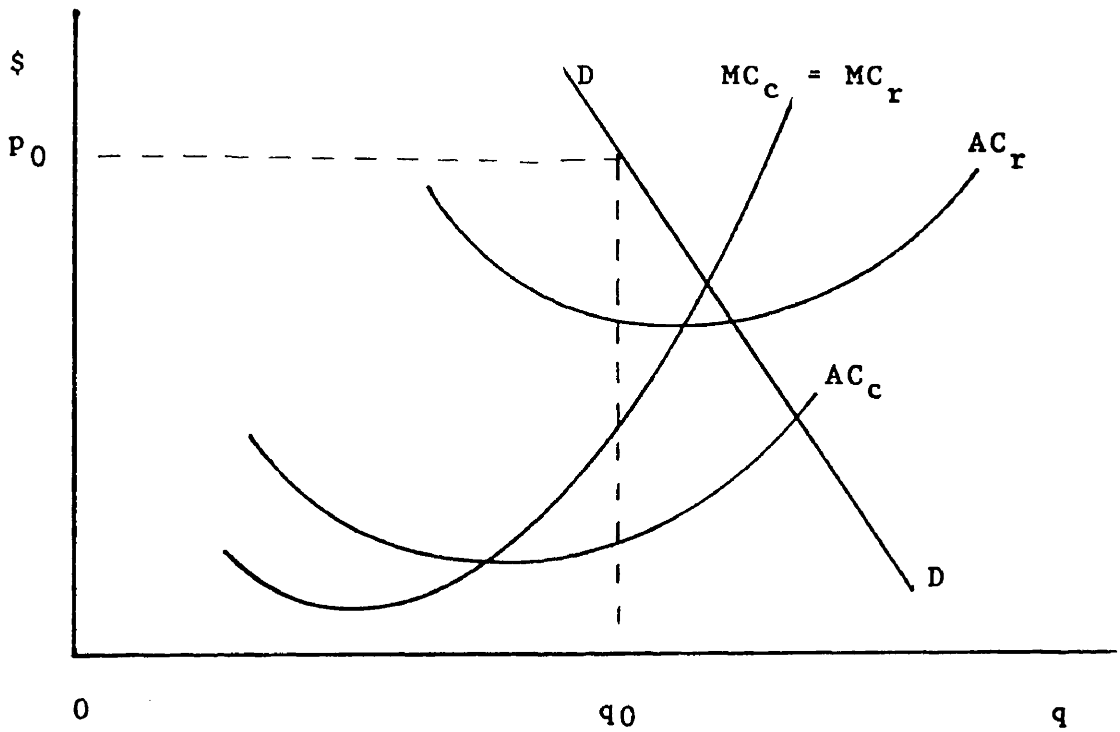

Figure 4.10. The Second Step in the Equilibrium Adjustment Process

marginal revenue is horizontal at p_0. It seems to be implied that the level of output is chosen by setting the marginal revenue curve associated with the DD demand curve equal to marginal cost.

In the third stage of Chamberlin's analysis he combines the results of the first two stage as summarized in figure 4.11. In this figure, the price and output would certainly appear stable since at the equilibrium price and output any movement along DD will surely result in a loss if advertising expenditures are

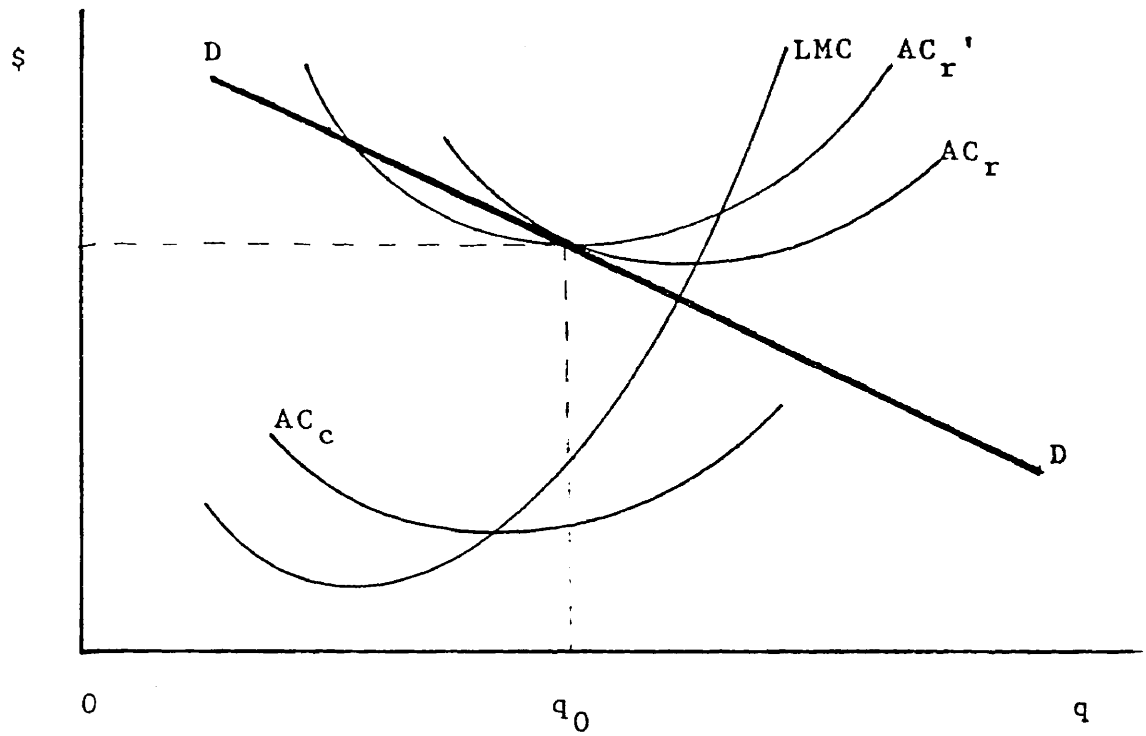

Figure 4.11. The Third Step in the Equilibrium Adjustment Process

fixed. In addition, at q_0 the costs of advertising expenditures are being recovered whether these costs are viewed as variable costs or as fixed costs. Since there are no residual profits, there is no incentive for entry or exit.

Chamberlin also offers an explanation of the equilibrium adjustment process. He assumes price is at a level such as p_0 in figure 4.12. Marginal revenue is assumed to be horizontal and equal to p_0. By setting marginal revenue equal to marginal cost, the firm maximizes profits. When all firms do likewise it causes

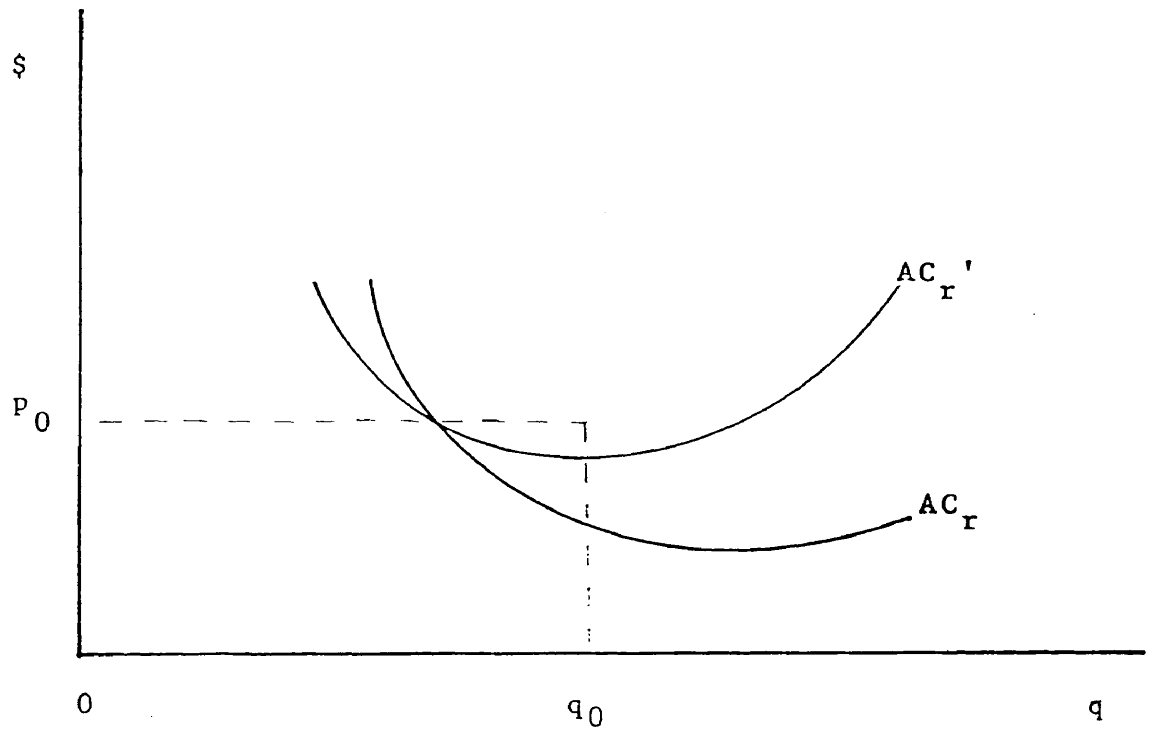

Figure 4.12. An Alternative View of Disequilibrium in Chamberlin's Third Model

each firm to bid up advertising expenditures. This has the effect of rotating the AC_r and $AC_{r'}$ curves upward and to the right according to Chamberlin. Equilibrium is reached when the curves have rotated such that the variable-adjusted average cost curve is tangent to the price line at its minimum point. This result is depicted in figure 4.13. It is only when the firm produces at q_0 and p_0 in figure 4.13 that price and advertising expenditures are sufficient to allow the firm to market its desired level of output.

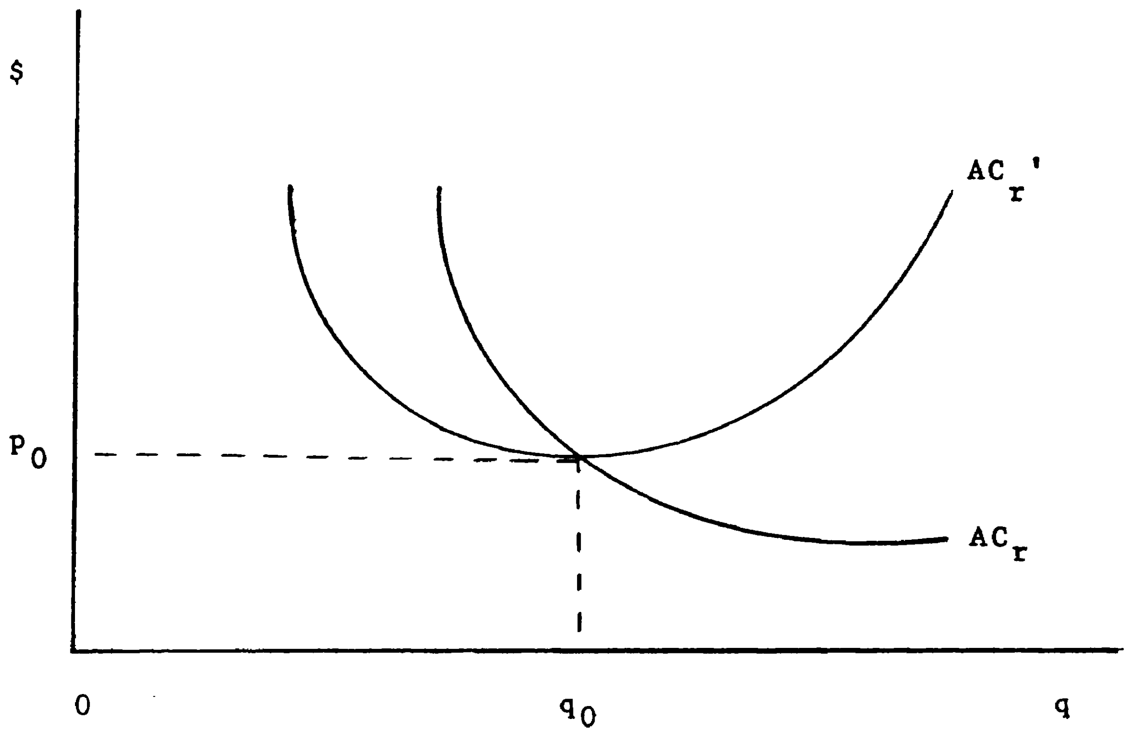

Figure 4.13. A Competitive Equilibrium in Chamberlin's Third Model

The results of this model are similar to those of the first two models. These results depend upon the firm perceiving the demand curve to be horizontal. It was shown earlier in the discussion of Chamberlin's second model that such perceptions are unlikely to continue in the long-run. In this case, however, the assumption of a horizontal demand curve seems even more unwarranted since the firms' products are differentiated. This solution is also plagued by the failure of the marginal revenue curve associated with the market-share demand curve to enter the decision making calculus.

It is Chamberlin's model of monopolistic competition involving a non-functional input which is the most interesting of the three models. It provides a basis for contrasting the results of Greenhut's model and the realism of his assumptions.

Greenhut's Solution

In Greenhut's analysis, only that portion of entrepreneurial services which is of a non-functional nature is considered. For example, the input under consideration may be considered the uncertainty associated with entrepreneurial investment. If uncertainty were a functional input, the quantity of input would directly enter the production function. Since non-functional inputs do not enter the production function it is not possible to employ traditional techniques to derive the set of cost curves associated with production. The costs associated with non-functional inputs must be imputed and ascribed to the cost curves associated with functional inputs. The failure of the non-functional input to directly enter the production function creates an additional source of difficulty with respect to the imputational process. In general, it is not possible to rely upon a marginal productivity theory of distribution to determine the opportunity cost of the input.

In the traditional analysis, the firm's demand for an input is derived by optimizing profits where the production function has been substituted for quantity in the expression for total revenue. The market demand is formed by summing the marginal revenue product curves over all firms. The intersection of market demand and supply determines the equilibrium price of the functional factor of production. This market price may be taken as the opportunity cost per unit of the input.

Consider labor as an example. An income-leisure model may be employed to show that labor determines the optimal quantity of work effort in the face of a parametrically determined wage rate. But by letting wages vary, an individual supply curve of labor may be derived. When these curves are aggregated over all units, the market supply curve is determined. Thus the market wage which evolves is the wage at which labor is maximizing utility. In this sense, the wage rate is the dollar value necessary to induce the input to provide the quantity of work effort necessary for an equilibrium in the factor market to attain. But since wage enters the production decision parametrically, it is also the wage necessary for the attainment of equilibrium in the product market. Since the wage rate is consistent with the utility maximizing quantity of labor in equilibrium, the wage rate covers all foregone opportunities of labor. It therefore represents the opportunity cost per unit of labor.

In a production model involving non-functional inputs, the marginal revenue product of the input may not be computed. The non-functional value of the input therefore creates two sources of difficulty. First, because it does not directly enter the production function, it is necessary to impute its value to the costs of the functional inputs if the full set of costs curves is to be derived. Second, it is not possible to employ marginal productivity theory to derive the appropriate cost to be imputed.

Chamberlin's analysis more or less begs the question since he imputes the "customary" expenditures for advertising services. While Chamberlin does address issues concerning excess capacity and monopolistic exploitation of inputs, he does not address questions concerning the opportunity costs of the non-functional input itself. He cannot therefore explain how the "customary" level of expenditures is actually determined.

Greenhut's model directly addresses this issue. His model indicates that in equilibrium not only is the full opportunity cost of the entrepreneurial factor precisely covered, but production occurs at the minimum levels of both classical and variable-adjusted average cost.

Greenhut's expository approach is somewhat similar to that of Chamberlin's. He begins with a fixed imputational process, proceeds to a variable imputational process, and then reconciles the two approaches. Greenhut's model was fully discussed in Chapter II. In the following discussion his model is reconsidered in such a way as to contrast the crucial methodological differences between this model and that of Chamberlin. Since the current issue is methodology, it is assumed that the reader may refer to Chapter III for more technical detail.

The Fixed Imputation

Greenhut's fixed and variable imputations both depend upon the opportunity costs of the entrepreneur and the relationship between output and the required level of energy expenditures. In this respect, his analysis immediatedly differentiates itself from that of Chamberlin.

Chamberlin never addresses the issue of opportunity cost. With respect to the relationship between the quantities of inputs and outputs, Chamberlin explicitly assumed that economies of scale exist with respect to average advertising expenditures. He further assumes that the market-share demand curve of the firm is dependent upon the level of advertising expenditures. While the ability to produce output is not functionally related to advertising expenditures, the ability to market is. It would seem more appropriate to develop a model in which average revenue is explicitly adjusted for advertising expenditures rather than adjusting the cost curves.

In Greenhut's model, the location of the average revenue curve is totally independent of the level of energy expenditures.

Production in his model is characterized by equation 4.2 supra. The level of energy expenditure enters his model in a discrete manner. If the opportunity costs of entrepreneurial services are not covered, no production occurs. If they are covered, production is a function of capital and labor, but the level of output is independent of the level of energy expenditures. Furthermore, the level of output is viewed as calling forth different levels of energy expenditures. For example, while production does not require varying levels of uncertainty, it is almost certain that different levels of output will be accompanied by varying levels of uncertainty. The level of energy expenditures does not functionally affect the production function nor the average revenue function. It seems appropriate to impute the opportunity cost as a fixed cost.

The next issue which naturally evolves is the level of opportunity cost to be imputed as a fixed cost. For the present assume the existence of an optimally-ordered opportunity cost per unit of energy expenditure. Since various levels of output call forth varying applications of energy expenditures, it is necessary to ascertain the optimal level of energy expenditures in order to know the base quantity of output at which the imputation is to be made. Greenhut argues that the utility maximizing level of energy expenditures must conform to the output associated with minimum classical average cost.

Otherwise, the entrpreneur will "tend to be a high cost producer", [13, 70]. The conformability requirement is a precondition for entering and remaining in the selected activity. Greenhut notes that, "...the optimal energy performance of the individual must conform to the prevailing technology in the industry because if this were not the case the firm would be a high-cost producer", [13, 96-97]. While Greenhut offers no further explanation of why the imputation must occur at the minimum level of classical average cost, this level of output determines the optimal level of energy expenditures. Taken with the optimally-ordered opportunity cost, it is sufficient to determine the magnitude of the fixed-cost imputation.

It should be noted that Greenhut employs an arbitrage theory of opportunity cost to determine the optimally-ordered factor price. It is given by R_0. The determination of R_0 was addressed in the previous chapter. It is the highest factor price the entrepreneur could obtain in its best alternative employment. This price is transformed to reflect the differences in economic lifetimes and individual preferences for different activities. The determination of the optimal level of output and required energy expenditures will be separately addressed below. Equilibrium under a fixed cost imputation is illustrated in figure 4.14. Note that figure 4.14 has been constructed so that the demand curve is tangent to the fixed-adjusted average cost curve at the level of output at which classical average cost is

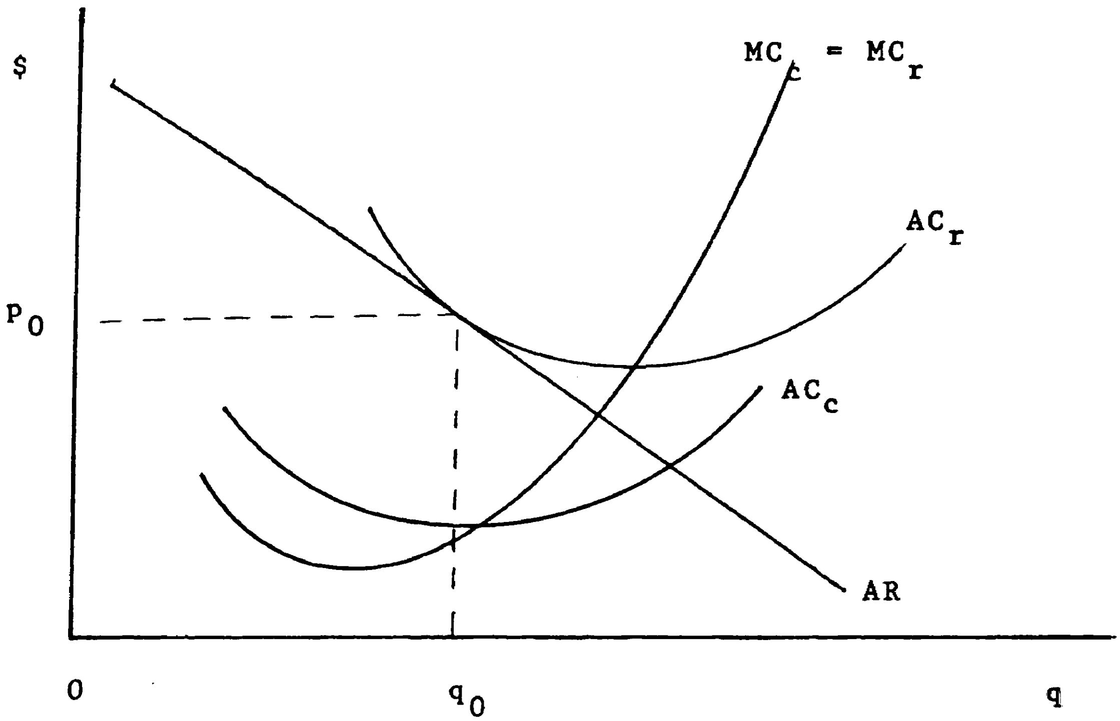

Figure 4.14 Fixed Cost Imputations and Oligopolistic Equilibrium

minimized. Regardless of the location of the demand curve, the level of energy expenditures would vary from the optimally ordered level at any other level of output. Since in equilibrium the full opportunity costs of all factors must be covered, production must occur at q_0. Otherwise the entrepreneur would exit the industry and no production would occur. If the demand curve lay to the left of that shown in figure 4.14, the firm would exit the industry since it could not recover its explicit costs of production. If it lay to the right of the illustrated demand curve, excess profits would result in entry. Entry would force the curve to shift leftward until a point of tangency occurred. At q_0, revenues are sufficient to cover the full costs of production including the opportunity cost of the entrepreneur. The equilibrium is sustainable for three reasons. These is no inducement for entry or exit. The entrepreneur is recovering his opportunity cost R_0, and applying his utility-maximizing level of energy expenditures. The firm is maximizing profits since marginal revenue must always equal marginal cost when the average revenue curve is tangent to the adjusted average cost curve.

Note that Greenhut's fixed adjustment differs from that of Chamberlin in several key respects. Chamberlinian tangencies are based upon perceived demand curves which are either slightly sloped or horizontal. If such curves were depicted to intersect the curve D in figure 4.14 at point E, then perceived marginal revenue would exceed marginal cost. Thus it would appear that there is some inconsistency in Chamberlin's treatment of the fixed-cost imputation. In Greenhut's analysis, there is no such thing as a perceived demand curve. The firm is assumed to know the location of its market-share demand curve. Thus Greenhut's analysis is free of the methodological criticism noted earlier. It was previously shown that Chamberlinian tangencies require production consistent with mr = MC such that MR < MC. The firm is assumed to remain ignorant of the DD and MR curves in

Chamberlinian models. In Greenhut's model, the behavior of the firm is always consistent with the market since the firm always equilibrates MR with MC. It suffers no illusions concerning demand conditions.

In Chamberlin's model, the point of tangency between average revenue and average cost is unrelated to the optimal quantity of advertising expenditures, from the factors viewpoint. Production in Greenhut's model always occurs at minimum classical average cost. This is not expected to be the case in Chamberlin's model due to the assumptions concerning economies of scale in advertising expenditures.

The Variable Imputation

Greenhut's variable imputation is depicted in figure 4.15. In Greenhut's variable imputation factor conformability is still required. Thus at q_0 the entrepreneur is applying the utility-maximizing level of energy expenditures. The utility-maximizing level of income is given by the area of the rectangle ABPOC. Thus the vertical distance $\overline{AB}$ is the opportunity cost per unit of energy expenditures, R_0.

At outputs less than q_0, the entrepreneur is not receiving the utility maximizing level of income or energy expenditures, although R_0 is optimally determined. To the right of q_0 the same is true. Since in equilibrium, factor markets as well as product

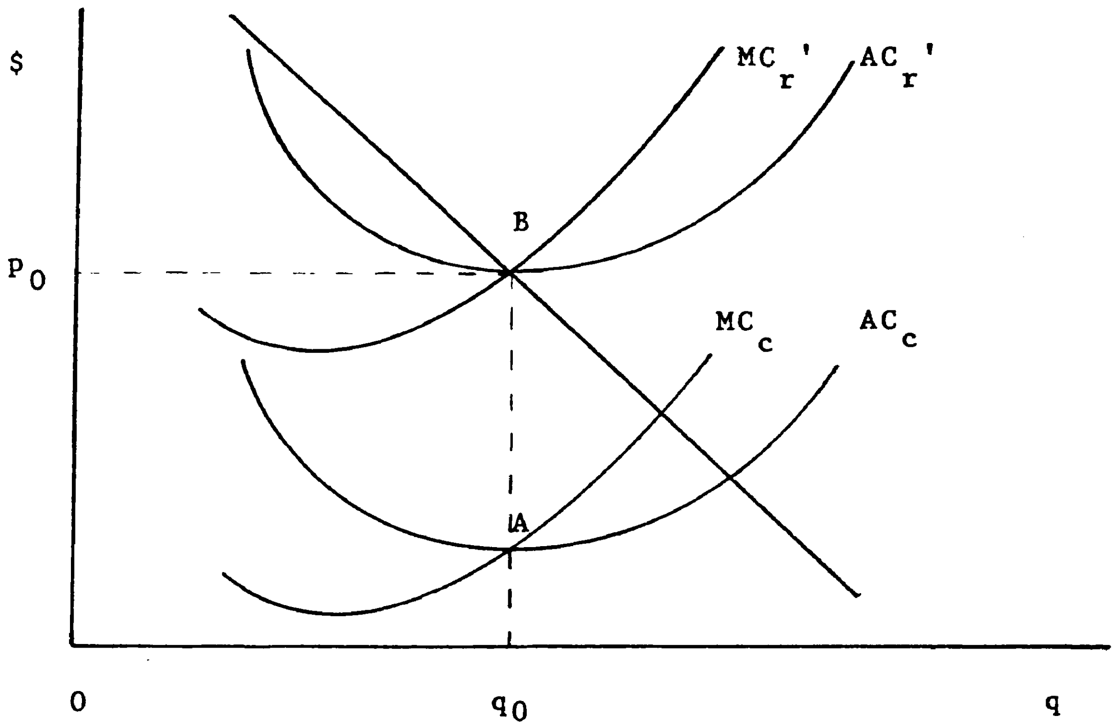

Figure 4.15. Variable Cost Imputations and Oligopolistic Equilibrium

markets must individually be in equilibrium, movements from q_0 must represent factor market disequilibrium.

The fixed-cost ascription was viewed as the appropriate adjustment from the firm's point of view since the opportunity cost of the input must be paid or no production occurs. Such opportunity costs are appropriately viewed as sunk costs. In Chamberlin's model the variable-cost ascription was also viewed from the firm's perspective. The variable cost ascription in Greenhut's model serves a different purpose. It is employed to illustrate factor market disequilibrium where the level of output deviates from the quantity associated with minimum classical average cost.

Greenhut requires the utility maximizing level of energy expenditures to be consistent with output q_0 in figure 4.15. This requirement is referred to as factor conformability. As indicated previously, the appropriateness of factor conformability will be addressed in some detail below. For the moment conformability is assumed to hold.

Greenhut's analysis assumes that e maps into q and that R e maps into entrpreneurial cost per unit of output such that average entrepreneurial cost is constant.[1] In figure 4.15 the distance between the variable-adjusted and classical average cost curves is the same, irrepective of output.

In the following discussion the symbols e and q refer to the optimal (equilibrium) values of energy expenditures and output. The symbols e' and q' refer to the actual values of these variables.

The required level of energy expenditures is given by

4.15) $TC_e = R \cdot e.$

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1. In the following discussion the phrase "entrepreneurial expense" will be used to refer to required rentals where such rentals are a function of energy expenditures. The phrase "entrepreneurial cost" will be used whenever such rentals are related to the level of production. Furthermore, Greenhut does provide for a variable average entrepreneurial cost function in the appendix to chapter 5 of Theory of the Firm.

This expense is to be allocated such that the total expense must be recovered at the optimal level of output, q. By dividing equation 4.15 by q, the rate per unit of energy expenditure, R, is transformed into a rate per unit of output, ϕ . Equation 4.16 therefore emerges:

4.16) $TC'_e = \phi q'$,

where ϕ is the average entrpreneurial cost associated with the optimal level of output. The rate ϕ is to be charged per unit of q', however.[2]

As a simple example, Greenhut cites the case where e' equals q'. If e' equals q' (and e equals q) then total and average entrepreneurial costs are given by

4.17) $TC_{e'} = R \cdot e' = R \cdot q'$, and

4.18) $AC_{e'} = R \cdot q'/q' = R$.

The difference between the variable-adjusted and classical average cost curves will be given by the optimally ordered opportunity cost per unit of entrepreneurial services, R. In this example, any deviation from q_0 in figure 4.15 must represent suboptimal levels of income and energy expenditures. The entrepreneur is receiving the correct rate per unit of e and q,

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2. In general TC_e and $TC_{e'}$ will only be equal at the optimal level of output. However, as long as e' is positively related to q', they will tend to move together.

but expending suboptimal levels of energy expenditures. Furthermore, the minimum points of the variable-adjusted and classical average cost curves must occur at the same level of output. The fixed-cost analysis indicated that equilibrium must occur at the minimum level of classical average cost. Equilibrium is therefore as depicted in figure 4.6. It does no injury to the model to view the variable adjustment as redundant since equilibrium is fully determinant based upon the fixed-cost ascription. The variable ascription is useful, however, in explaining the marginal calculus from the factor's perspective.

Point E in figure 4.16 represents a sustainable equilibrium for reasons previously cited. At point E the entrepreneur is applying the optimal level of energy expenditures at the optimally ordered factor price, R, and receiving the utility maximizing level of income.

For output less than q_0, the entrepreneur fails to receive the utility maximizing level of income due to a suboptimal level of energy expenditures. The entrepreneur will receive the optimally ordered opportunity cost per unit of energy expenditures, R, however. For outputs larger than q_0, the entrepreneur receives a larger than optimal income by applying an excessive quantity of energy expenditures.

One of the criticisms of Chamberlin's model is that it fails to take into account the marginal calculus from the factor's

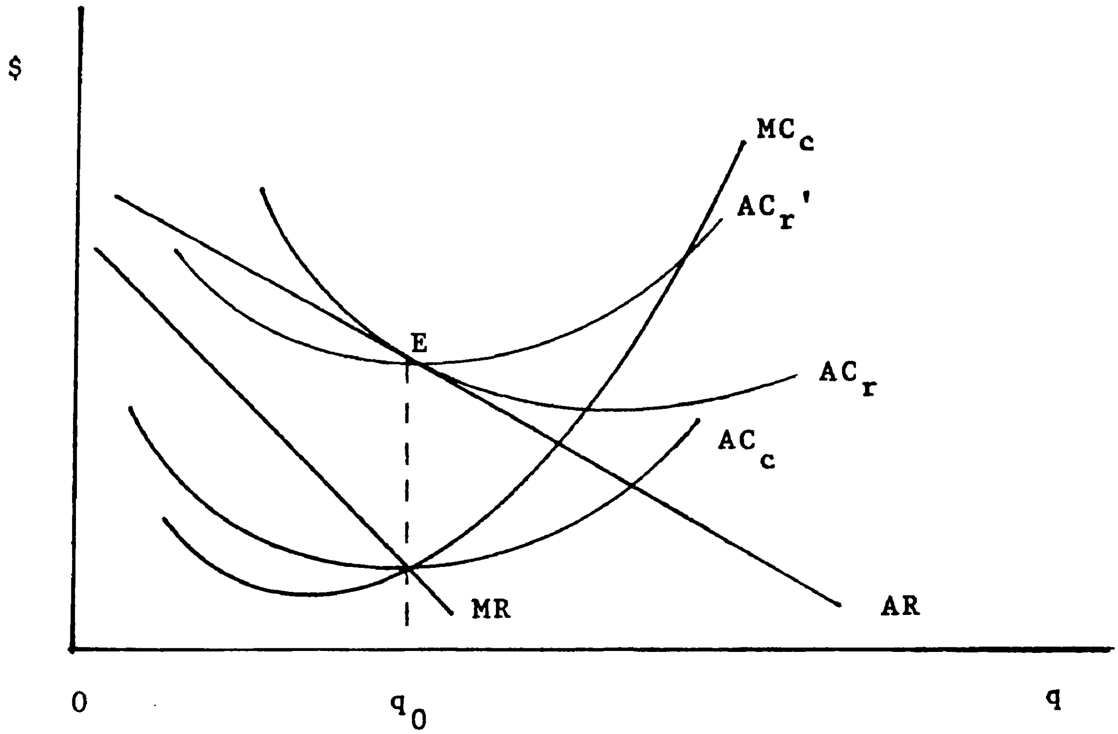

Figure 4.16. Fixed and Variable Cost Imputations and Oligopolistic Equilibrium

perspective. While Chamberlin employs a variable-cost ascription, he never recognizes the implications of such a procedure upon the marginal calculus.

In Greenhut's model market equilibrium requires that both product markets and factor markets be simultaneously in equilibrium. From the firm's perspective the fixed-cost imputation is appropriate. Since fixed-cost imputations do not affect marginal cost, the firm's marginal calculus requires setting marginal revenue equal to classical marginal cost.

From the factor's perspective, the relevant marginal cost curve is the variable-adjusted marginal cost curve. It is also necessary to employ a marginal revenue concept which reflects the dual nature of the optimization problem. Greenhut refers to this marginal revenue curve as the "artificially" adjusted marginal revenue curve. The reference to an "artificial" adjustment is unfortunate. Such an adjustment is not only appropriate but required. It is necessary to adequately explain factor market equilibrium where marginal productivity theory fails because of the nature of production as given in equation 4.2.

The level of marginal revenue required for dual optimization must always cover the required cost of the non-functional input. Since utility maximization is assumed to conform to q_0 in figure 4.16, the required level of entrpreneurial return is given by the fixed sum,

4.19) $TR_e = R \cdot e = r.$

The adjustment to marginal revenue is found by allocating this required income over q' units of production. The required marginal revenue curve is given by

4.20) $MR_r = MR + (R \cdot e)/q' = MR + r/q',$

where MR_r is required marginal revenue, MR is classical marginal revenue, and r represents the income-earning aspirations of the entrepreneur.

The adjustment to marginal revenue must be sharply distinguished from the adjustment to marginal cost. The latter adjustment is given by the constant ϕ. Greenhut also uses the symbol r'/q for this adjustment to signify he is referring to the variable cost adjustment, where

4.21) $\phi = (R \cdot e')/q = r'/q.$

While these adjustments may seem incongruous at first glance, they greatly facilitate the analysis of factor market equilibrium. Suppose for example that classical marginal revenue equals classical marginal cost at a level of output where $q' < q$, and $e' < e$. In this situation the entrepreneur is applying a suboptimal level of energy expenditures. The actual rental, r', will be less than the desired rental, r. It will also be true that adjusted marginal revenue exceeds adjusted marginal cost. The entrepreneur will seek to expand output until actual rentals equal desired rentals, or until

4.22) $MR + r/q = MC + r'/q.$

These adjustments permit the description of factor market equilibrium in cost space without reference to marginal productivity theory or utility-theoretic approaches.

Dual optimization requires both product market equilibrium ($MR = MC$) and factor market equilibrium ($MR_r = MC_{r'}$). In figure

4.16, the MR_r curve is not drawn. At q_0 the product market is in equilibrium since marginal revenue equals marginal cost whenever average revenue is tangent to fixed-adjusted average cost. The factor market is in equilibrium since revenues are just sufficient to cover classical production costs plus the required rental of the entrepreneur. The required rate per unit of output is the vertical distance between these curves, r/q. If r/q is added to the marginal revenue curve at q_0, adjusted marginal revenue will equal adjusted marginal cost. The desired rental r will equal the actual rental r'. Figure 4.16 thus reflects the duality of the optimization procedure.

Greenhut, unlike Chamberlin, explicitly recognizes the effect of variable cost ascriptions upon the marginal cost curve. Whereas Chamberlin fails to adequately address the marginal calculations which define equilibrium, Greenhut explicitly describes these calculations for both the fixed and variable ascriptions.

Chamberlin assumes that economies of scale are associated with the average level of advertising expenditures. The level of output associated with minimum variable-adjusted average cost need not coincide with that associated with minimum classical average cost. Greenhut utilizes a variable imputation which insures average entrepreneurial cost is constant. This imputation is sufficient for the coincidence of the outputs associated with the minimum points of each curve. Constant average entrepreneurial cost is not a necessary condition for this result, however. Factor conformability is the necessary and sufficient condition for these results to attain.

Factor Conformability and Variable Cost Ascriptions: A Utility-Theoretic Approach

It has been previously noted that Greenhut explicitly assumes that the utility maximizing level of energy expenditures must be consistent with minimum classical average cost in long-run equilibrium. This concept is known as factor conformability. Greenhut states:

> Suppose technological conditions in the chosen activity require t units of inputs in order to produce at optimal efficiency but that t input units entail entrepreneurial inputs greater or less than s. Then, the factor's energy preference does not conform to technological conditions...When technological conditions do not conform to the entrepreneur's preferred schedule, the said entrepreneur will tend to be a high cost producer. But this means the entrepreneur will sooner or later leave the field. Hence we may ignore as entrepreneurial prospects those enterprisers who expect that their optimal performance...will fail to conform to the technological conditions of the trade... [13, 70].

In order to fully appreciate Greenhut's model of entrepreneurial rents, it is desirable to explore the nature of factor conformability from a utility-theoretic approach. This approach also yields significant new perspectives concerning the relevance of the variable cost ascription. Figure 4.17 depicts a traditional labor-leisure model such as found in Ferguson [9, 83-87]. The level of energy expenditures is measured along the horizontal axis. The horizontal intercept, , denotes the total number of energy units available per unit of time. If an entrepreneur maximizes utility at point E, he consumes L units of in leisure activity and e = - L units in work activity. Furthermore, the wage rate (opportunity cost) per unit of energy expenditures is given by the slope of the budget constraint.

In the traditional analysis, the supply curve of labor can

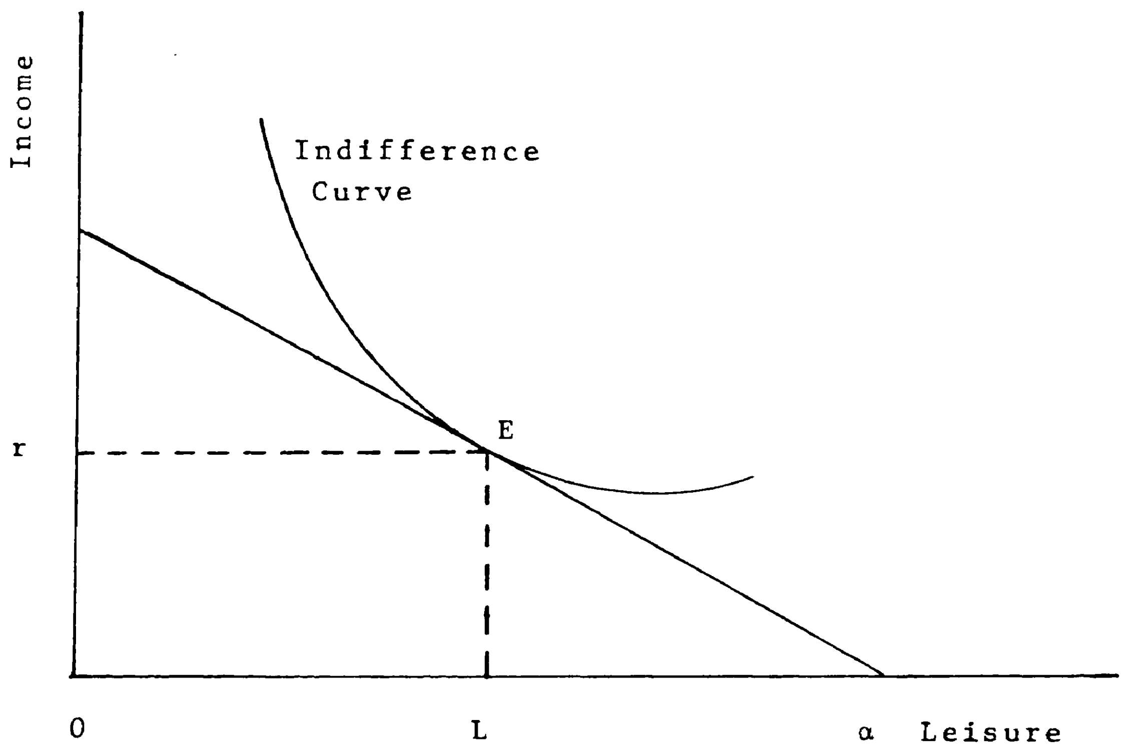

Figure 4.17. Utility Maximization in a Labor-Leisure Model

be found by varying the wage rate and noting the utility maximizing levels of energy expenditures forthcoming at each wage. Summing across all individuals yields the market supply curve of labor. Marginal productivity theory is utilized to determine the firm and market demands for labor. Factor market equilibrium determines the wage rate or the slope of the budget constraint in figure 4.17. The individual maximizes utility subject to the market wage constraint. He thus consumes L units of leisure and e units of labor.

Where non-functional inputs are involved, marginal productivity theory cannot be utilized in determining the opportunity cost of the input. Greenhut assumes that the opportunity cost per unit of energy expenditures is given by R. It is the rate transformed from the rate in the next best alternative. Consider a set of figures similar to figure 4.17 which apply to a number of potential employers offering various wage rates, R_i, but requiring different levels of energy expenditures. The appropriate wage rate for imputational procedures is that rate which leaves the entrepreneur indifferent between the chosen activity and the next most preferred alternative. This wage rate defines what Robinson refers to as the "transfer price" of the entrepreneur [26, 104]. It is the minimum price necessary to induce the entrepreneur to refrain from exiting the firm.

Consider figure 4.18 in which only the two best alternatives are shown. Employment may be obtained in firm #2 at an income of $200 per week, requiring energy expenditures of 40 units per week. In order to continue employment with firm #1, the entrepreneur must obtain a wage that yields the same level of utility for providing the required quantity of energy expenditures, 60 units per week. Thus a line may be drawn from the horizontal intercept tangent to the indifference curve. The required wage rate is the slope of the budget constraint as constructed for firm #1. This wage rate is the transfer price or optimally ordered opportunity cost per unit of energy expenditure, R. If firm #1 offers a wage rate less than R, the entrepreneur will maximize utility by exiting firm #1 and moving to firm #2. If firm #1 offers a higher wage, the firm will be a high cost producer and will be displaced in the long run. Thus, even though marginal productivity theory cannot be utilized to determine the opportunity cost of entrepreneurial services, this cost is well-defined.

The question naturally arises concerning the conformability of the entrepreneur's preferences with the technical requirements of the firm. In figure 4.18 for example, firm #1 may require 80 units of energy expenditures when the utility maximizing quantity is 60 units. Greenhut assumes that the market for entrepreneurial services is of sufficient breadth that a tangency

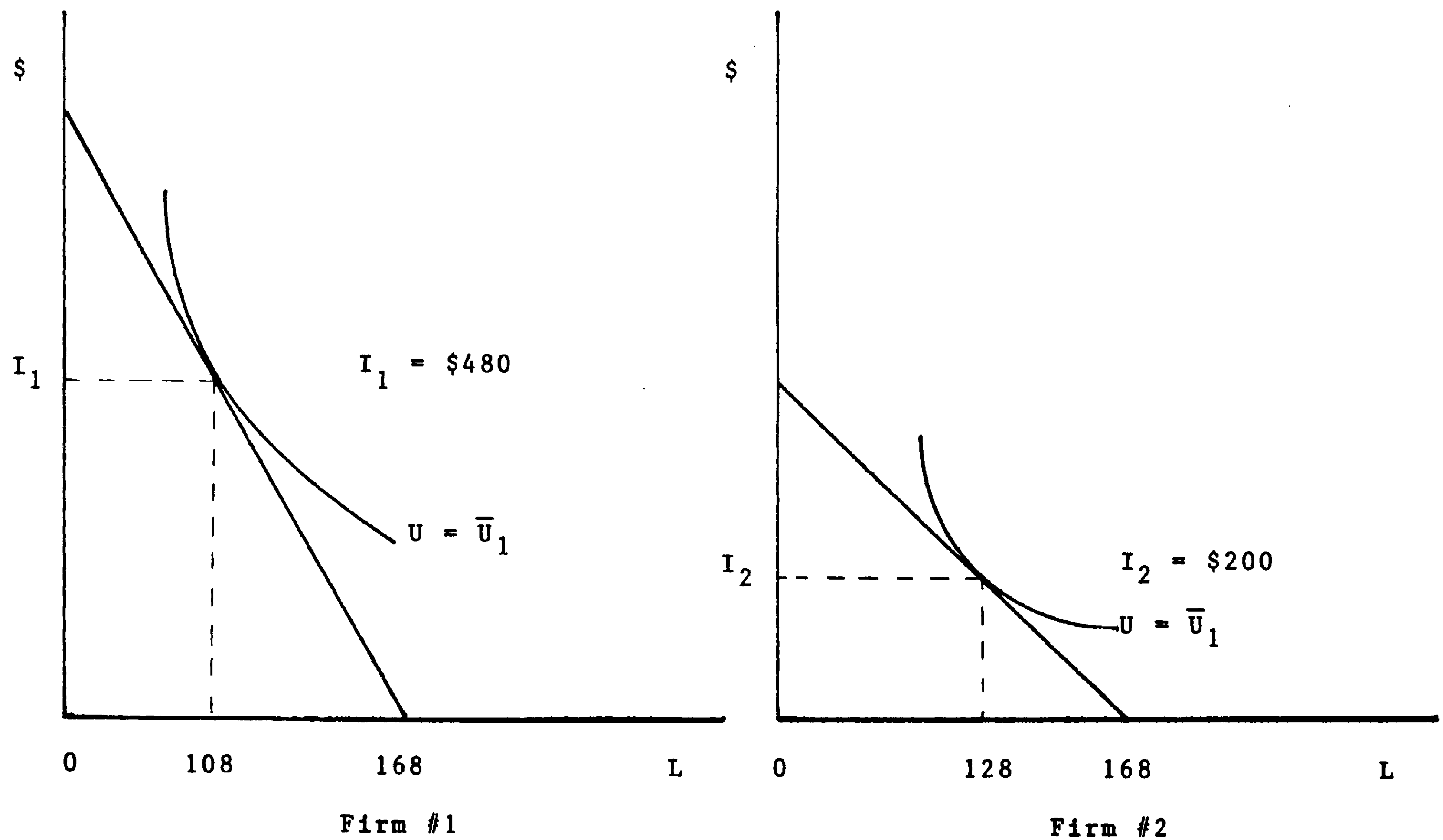

Figure 4.18. The Determination of Entrepreneurial Opportunity Cost

solution will exist. Thus the entrpreneur may exit firm #1 since his preferences are not conformable to the technological requirements of production. He will seek employment elsewhere such that his preferences conform to the technological requirements.

What if the entrepreneur's alternatives are so constrained that in the utility maximizing employment conformability still fails? Such a situation is depicted in figure 4.19. As an extreme case suppose that only two alternatives exist. In each, the technological requirements do not allow conformability. The entrepreneur will exit firm #1 unless the wage rate is sufficient to allow the entrepreneur to obtain the same level of utility offered by firm #2. The transfer price or opportunity cost of the entrepreneur is still given by the slope of the budget constraint for firm #1. However, the desired level of energy expenditures diverges from the technologically required level. Greenhut refers to this situation as a state of indivisibility of entrepreneurial services. He notes that, "It is when indivisibility is combined with uncertainty that not only may e' differ from e and r' from r but the lowest points on the adjusted and classical LRAC curves must then occur at different outputs", [13, 80]. In figure 4.19, the actual level of energy expenditures is that level associated with point F while the desired level is the level associated with point E. We defer for

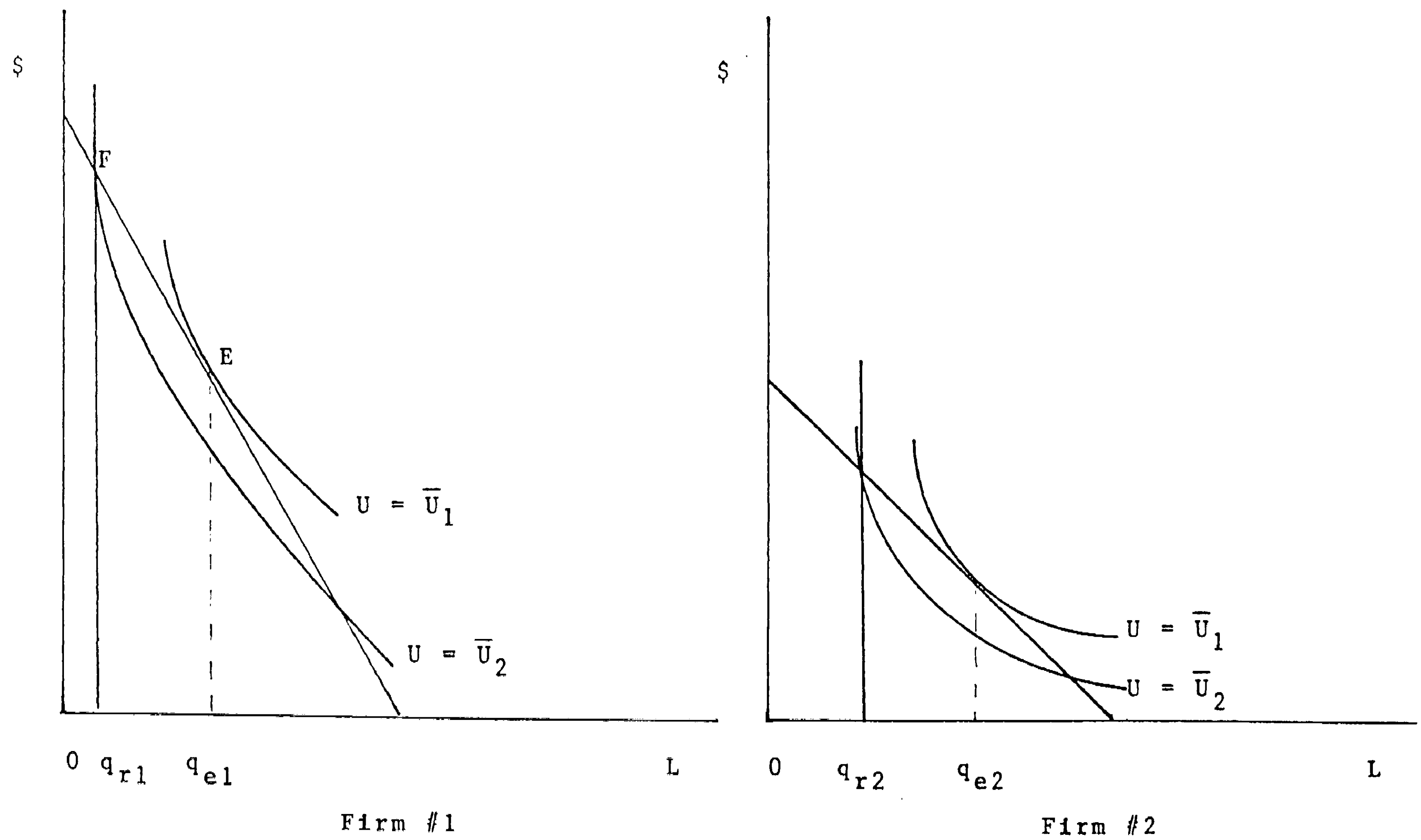

Figure 4.19. Entrepreneurial Opportunity Cost in the Absence of Factor Conformability

the moment the portion of the citation which makes reference to the minimum points of the variable-adjusted and classical average cost curves. It will be shown below that average entrepreneurial cost always reaches its minimum point at the level of output associated with point E in figure 4.19.

While Greenhut explicitly recognizes the possibility of such a divergence in the minimum points of the curves, he places little stress upon it. He states that

> ...all industries develop a character such that owner (s) - manager (s) are distributed over the hierarchy of industry types in accordance with the demands each places on these men and the costs of and consumer needs for each good. The best officials available to an industry working at their optimal efficiency mark the long run of a fully employed free enterprise system... [13, 84].

Conformability is therefore seen to require tangency solutions such as depicted in figure 18 rather than the pathological case in figure 19. It requires the identity of the utility maximizing level of energy expenditures with the technologically required level of energy expenditure in long-run equilibrium.

The utility-theoretic approach is also helpful in establishing the properties of the average entrepreneurial cost curve. If this curve is horizontal, then the outputs associated with minimum variable-adjusted cost and minimum classical average cost will coincide. If average entrepreneurial cost is convex in output but reaches its minimum at the level of output which