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Stahl, Konrad

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WORKING PAPER 81-35

TOWARD A REHABILITATION
OF INDUSTRIAL, AND RETAIL
LOCATION THEORY

BY
KONRAD STAHL

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TOWARD A REHABILITATION OF INDUSTRIAL, AND
RETAIL LOCATION THEORY

by

Konrad Stahl*

University of California, Berkeley

and

University of Dortmund, W. Germany

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Toward a Rehabilitation of Industrial, and
Retail Location Theory

by

Konrad Stahl

A B S T R A C T

It is demonstrated that with none of the classical paradigms of industrial and retail location, due to Weber, Hotelling, and Lösch, one is able to explain and evaluate a key feature of spatial economic systems, namely the concentration of industrial and retail activities in space. A unified framework is sketched informally, within which a more successful analysis of this phenomenon can be conducted. It also allows for a discussion of novel features relating to the organization of industry in space.

1. Introduction

The state of the art in industrial and retail location theory is not the best. On one hand, it is not very useful to the policy analyst because of its low explanatory power, which in turn limits its applicability as a framework for trustworthy policy impact analysis. On the other hand, it is quite disreputable to the microeconomic theorist, partly because it so far has nearly failed to demonstrate that an incorporation of space into microeconomic analysis leads to results principally different from those derived from nonspatial economics; and partly because the typical concepts used and assumptions employed in the field are very restrictive and off mainstream microeconomics.¹

It is one purpose of this paper to justify this harsh evaluation in an informal but hopefully still rigorous review of the seminal paradigms underlying that theory. I concentrate on these, because the literature produced to date with a few exceptions provides, in view of my claims, only insignificant modifications of these paradigms. The second and main purpose of the paper is to demonstrate that the two issues, lack of explanatory and predictive power, and lack of integration into mainstream economics are quite related, and, in fact, that a reformulation of location theory within a more general microeconomic framework by and large resolves the former issue as well.

This critique is designed to be both provocative and expository. I have drastically simplified the arguments of the pioneers of location

theory, and I have overemphasized the issues covered, to make points both accessible and dramatic. I also apologize to any author not mentioned here whose work has significantly advanced the theory along the critical lines drawn here.

At the outset I wish to make explicit the yardstick along which I intend to evaluate the performance of those location paradigms. In my view, a good micro-economic model of an economy with decentralized decision making should allow for the following three complexes of features:

(1) A characterization of the *equilibrium states* of the economy and, on the basis of a comparative static or a dynamic analysis, of their evolution with changes in exogenous parameters. That characterization must be believable on two grounds: first, the suppositions on individual agents, and their environment's characteristics and behavior must be plausible abstractions from the real world; and second, the characterizations generated should represent key phenomena, and should not be disconfirmed by empirical observations on these phenomena.

(2) A characterization of the *Pareto-efficient* and *welfare optimal* states of the said economy, and of their evolution with changes in exogenous parameters.

(3) A specification of the *deviations* between the latter states and the equilibrium ones; and of policies such that the decentralized economy most closely approaches the desired efficient or welfare optimal state. A quick reinterpretation of these features in light of the present topic leads us to the following requirements for an industrial and retail

location paradigm: first, it should, on the basis of plausible assumptions on individual behavior, represent the spatial distribution of producing and retailing plants and its evolution in time; in particular, the formation and differential development of clusters of producing and retailing activities. Second, it should be general enough to allow for an evaluation of individual and aggregate behavior on the basis of well established welfare criteria. It should especially provide answers to the questions whether spatial concentrations of firms are correctly located, excessive or too small, efficient or inefficient with respect to the bundle of products produced or marketed; or whether pricing in such clusters is efficient. Finally, the paradigm should be sensitive to at least some of the standard policy variables used to influence location, product choice and pricing decisions.

In view of this yardstick, my critical points can be summarized as follows. To begin with, the class of models identified by the name of Weber has little behavioral content. This is due to the exclusive focus of the paradigm on the choices of only one firm in a completely predetermined environment, which in addition is ill specified, by comparison to the variables instrumental in real life location decisions. However, if the model lacks behavioral content, then an evaluation of the resulting allocation, and a policy prescription on its basis is void.

By contrast, Hotelling type models do explicitly account for oligopolistic interactions between traders, that are so central to spatial economics. They also do lead to seemingly plausible results,

especially concerning the spatial concentration of sellers. However, as well known, the latter result is derived under, and critically dependent on, quite unrealistic assumptions on consumers' preferences and behavior, which in turn render problematic evaluations, and policy prescriptions based on the model. Also, as happens to be the case with the Weber model, the framework of assumptions used is so narrow that a meaningfully general welfare analysis cannot be carried out.

Finally, the central place paradigm developed in the Lösch tradition is based again on unsatisfactory assumptions on both consumers' and firms' preferences and behavior. In fact, it fails to generate on the basis of behavioral assumptions, the very central places that make it empirically so appealing! This is primarily so because interactions between markets for physically different goods and services that quite naturally arise, and are unique to, spatial economies, are assumed away. It finally remains unclear whether, on the basis of assumptions basic to the paradigm, the model has a behavioral or a normative flavor. This again severely limits its applicability for policy analysis.

The critical points summarized here are made more explicit in the following three sections. The Löschian paradigm will be scrutinized first. There follows a discussion of the Hotelling and Weber paradigms. This sequence is useful because a discussion first of the most general of the three paradigms, namely the Löschian one, will shorten the analysis of the Hotelling, and the Weber models. The critique is presented in a constructive way, indicating whenever I see a possibility, how the observed deficiencies can be overcome. In order to keep things

manageable, extensions are suggested only insofar as they can be realized within the static (general) equilibrium framework. The suggestions for further research are summarized in the last section.

Before moving on, one may be tempted to ask whether an effort to improve the microeconomic location paradigm along the yardstick presented here is not merely an academic exercise, and not worth its while when it comes to a discussion of public policy questions. I would argue that it is worthwhile, and even more: absolutely necessary. For without a model that is realistic in terms of the behavioral hypotheses underlying it, and general enough to account for the important interactions taking place in space, we will not be able to generate a solid basis for evaluating, and even more so for designing a policy intended to successfully influence economic behavior in space.

Let me stress that point a little bit further. Although the notion of "spatial externalities" or "agglomeration economies and diseconomies" abounds in the literature on spatial economies and regional science, and although these factors indeed seem to have a major impact on the evolution of economic activity in space, they so far are not at all made precise so as to be operational. Thus principal policy questions such as, "under which conditions do markets fail to generate a satisfactory state of affairs," or conversely, "under which conditions will we be able to leave matters to decentralized decision making?" can only be answered ad hoc.

2. The Location Paradigm of Lösch²

Of the three paradigms discussed here, Lösch's emerges as at least more comprehensive than Hotelling's. As Hotelling's model, it does account for oligopolistic interactions between firms providing one and the same good. However, it does so under a more general assumption as to individual consumers' demand and individual firms' cost. A spatial configuration of economic activities involving many different commodities is derived, which seems to be close to empirical observations.

This very satisfactory result is derived in a not quite so satisfactory set up, however. The key problem is that the systems of locations, or market areas for the different commodities are derived independently of each other, and that the central assumption underlying the "rotation procedure" by which the system of central places is obtained is not reflected in the assumptions made previously in the derivation of market areas. This leads to an internal inconsistency in the model.

To be more precise, I begin by listing, and criticizing some assumptions on consumers' preferences and behavior implicit in the Löschian model. I continue by a similar specification and critique of assumptions on producers' technologies and behavior. The discussion hopefully reveals some of the more interesting implications that follow from a relaxation of these assumptions.

Basic to the derivation of the Löschian system is a uniform, and unchanging spatial distribution of identical consumers. I do not wish to

challenge this assumption for the moment. However, it should be maintained that location decisions modeled on this basis can only refer to an intraurban, rather than a regional, environment. In any case, those consumers' preferences and demands are assumed to exhibit the following properties:

1. The demand for commodity i is *independent* of the prices for any commodity j , $j \neq i$.
2. The demand for commodity i is a function of the transportation cost *per unit* of i only, incurred to visit the market place of i most favorable to the consumer. Thus, the unit transportation cost for i is independent of the quantity demanded of i , as it is of any quantity demanded of commodity $j \neq i$.
3. The consumer's demand for i , as realized by the seller offering the best deal to the consumer, is *independent* of the location of sellers of other commodities $j \neq i$.

These assumptions will now be discussed.

Not much can be said in defense of assumption (1). Already the simple microeconomics textbook formulation of consumers' demands for different commodities shows that these demands are interdependent-- indeed, the impacts of substitution and income effects on consumers' demands are principal messages provided by standard microeconomics. However, relaxing assumption (1) and accounting for substitution and income effects will have quite forceful impacts on the spatial distribution of markets, especially if this is done together with a relaxation of (2)

and (3). This will become obvious below.

Assumption (2) is not easy to maintain as well, for in many reasonable cases the transportation costs incurred by the consumer when purchasing an additional unit of the same, or another commodity on one shopping trip are nil. Thus, there are considerable economies of scale in the quantity (and types) of commodities hauled on one shopping trip, which are disregarded in this assumption.³ In defense of it, one might be tempted to argue that the unit transportation costs considered denote the average of transportation costs incurred to obtain the entire bundle of commodities. This argument is incorrect, however, for average transportation costs can only be determined once the equilibrium quantities hauled are known; but these quantities themselves are a function of sellers' asking prices, and transportation costs.

The critique of assumption (3) finally is closely related to that of assumption (2). A simple example may demonstrate the point. Let sellers of commodities i and j be located, such that the seller of i next to our consumer will be "isolated," whereas the seller of j will be located next to another seller of i . Suppose that both sellers of i charge identical prices and that all prices are such that our consumer demands positive quantities of i and j . Lösch's assumptions (2) and (3) imply that our consumer *demands all* of commodity i from the "isolated" seller. However, relaxing assumptions (2) and (3) and allowing for joint hauling implies that this seller will realize *no demand* from our consumer. Thus, because of savings in

transportation costs, our consumer will prefer to purchase both commodities at the same location, instead of one commodity at one location each. At given prices, this will lead to *market areas of different size for two marketeers of the same commodity i*, in fact: to a smaller market area for the isolated marketeer. In addition, if we allow marketeers to adjust their prices, *it will lead prices for one and the same commodity to differ between market places*: maintaining assumption (1), the isolated marketeer will charge a lower equilibrium price; discarding assumption (1) will bring about identical equilibrium prices only by chance.

Putting the arguments together, it is due to assumption (1) that within Lösch's framework the size of the market area for one commodity can be determined independently of the prices charged for the other ones. It is due to assumptions (2) and (3) that, given the network of markets developed for the commodities, the locations of marketeers for good *j* can be determined independently of those for commodity *i*, i.e., without impacts on the shape of either market areas. All three assumptions taken together imply that there is *no incentive for sellers of commodities and services to join each other!*

Of course, what leads to the aesthetically and empirically so appealing system of central places is an arbitrary selection of systems of market areas by size (to establish some regularities across systems of market areas) and a rotation procedure which is motivated by the general objective of "minimizing the sum total of transportation costs."

This brings us to an important ambiguity in the Löschian paradigm.

That ambiguity relates to the normative versus the positive content of the central place system so derived. On one hand, the "rotation procedure" mentioned above can only be justified by an aggregate, or social objective: that of minimizing transportation costs for *all* agents participating in the economy. The other assumptions, on the other hand, are not made within that context. They reflect strictly *individual* objectives. It is thus left open whether the configuration derived under these assumptions does exhibit an *equilibrium* state of the economic system, or a state desired from a *social welfare point of view*. In view of our yardstick specified in section one, this is quite unfortunate: it is not possible to derive from the Lösch model any differences between these two states, which are of central concern to the planner in a market economy. However, making such differences explicit--if they exist--is the only justification for a public intervention into the state of affairs generated from individually motivated behavior.

It is fairly obvious that a joint relaxation of all three of the key assumptions discussed above will do away with Lösch's relatively simple analytics of deriving independent systems of sellers' locations, and in particular, of the rotation procedure by which he obtains his system of "central places." While that procedure is motivated by everyone's interest in reducing dead weight losses as much as possible, it does not provide any insight into the question of why some firms choose to locate with others, and others do not. However, this is one of the

key questions we need to answer if we want to explain and to evaluate the agglomeration of economic activities.

Modeling sellers' location decisions without making use of the implausible assumptions employed by Lösch will, no doubt, be much more complicated. It will again lead us to systems of "central places." Particularly the discussion about assumption (3) has indicated incentives for an individual marketeer to share a location with other sellers. It will be especially interesting to investigate conditions under which this incentive to concentrate will be excessive in a welfare sense, an investigation the Lösch system does not allow for.

The discussion conducted up to now hopefully has already revealed the principal lines of my critique of the Lösch paradigm. These lines can be pursued with even greater force in the discussion of the assumptions made on firms' technologies and behavior. In the Löschian paradigm, the typical one-product firm's cost of producing a commodity is a function only of the quantity produced of that very commodity. No indication is given as to what inputs are required to produce that commodity. Furthermore, the typical cost function is assumed not to vary with location, in particular not in relation to other producers' locations. It follows that the implicit assumptions on the structure of the firm's input demand are even stronger than the ones made on the typical consumer's demand, and that again there is no individual motivation to choose a joint location with other firms.

For a productive discussion it might be useful at this point to distinguish between two types of inputs, primary inputs such as land

and labor, and inputs processed by other firms. Abstracting for the moment from the former, and concentrating on the demand for the latter type of inputs, the charges made in relation to assumption (1) to (3) about consumers' demand apply in somewhat modified form. More specifically, if commodity j is an input required to produce commodity i , the cost of producing i cannot be independent of the price charged for j , as well as of the transportation cost of hauling j --provided that the latter are borne by the producer of i . The assumption relating to the economies of hauling additional quantities does not seem to play a major role in the present context. These economies are not irrelevant, however, especially if small quantities of many different inputs are to be assembled by the firm under consideration.

In any case, if due account is given to input-output relationships between producers, then the assumption that firms producing identical commodities are confronted with identical cost structures, no matter their location, cannot be maintained. If it is relaxed, then the logical result will be a spatial concentration of firms producing under these relationships, at least as long as competitive forces (e.g., in the markets for primary inputs, or for outputs) do not intervene.

Let us now briefly turn to the incorporation of primary inputs, in particular, labor.⁴ If Lösch's were a full fledged general equilibrium model, then the consumers' income spent on commodities should be generated by working in one (or more) of the firms and sharing the profits derived from the production and marketing of commodities in the entire

economy. Now an explicit incorporation of firms' demand for labor induces competition among firms about that input. This competition can be evaded by firms locating away from each other. Observe finally that similar competitive interactions may occur between firms demanding one and the same processed input.

Putting things together again, an explicit incorporation of firms' input demand and the locations at which the corresponding supply is provided will modify even more the spatial configuration of firms proposed by Lösch. Without doubt it will be of central interest to explicitly account for the forces of attraction, created by input-output relationships between firms and the increases in demand generated from joining markets at one location; and the decentralizing forces arising from competition about consumers' demand, or inputs, in particular, labor. These latter decentralizing forces are much weaker, however, once we do away with a last important assumption made by Lösch, namely that consumers/laborers are, and remain distributed uniformly in space. But such an extension would be well beyond Lösch's paradigm.

3. Hotelling's Paradigm

In contrast to Lösch's, Hotelling's principal result that marketeers, selling physically identical products, tend to concentrate in space is derived directly from assumptions on individual consumers' and sellers' behavior. The central assumptions leading to these results are that consumers' demand is price inelastic, and that entry into the spatical market is restricted to two firms.⁵

However, it is well known that Hotelling's result, as it stands, must be rejected on formal grounds: as the two firms move closely to each other, a Cournot equilibrium in locations and prices ceases to exist.⁶ Thus the result that the two firms concentrate in space can only be upheld under the additional restrictive assumption that they both sell at fixed identical prices. Furthermore, it is well known that both of the assumptions specified above are critical to that result. Even worse, they are quite unrealistic. It is easy to see that a substitution of more realistic suppositions, namely elastic demand and entry of more firms, destroys the result.⁷ Thus, we are again faced with an empirically appealing result, which is derived from unsatisfactory assumptions.

However, Hotelling's result can be obtained in slightly modified form with the much more realistic framework indicated in the last section. Instrumental to a demonstration of the spatial concentration of sellers offering close, if not perfect substitutes, is that we extend Hotelling's framework from a one-commodity to a multi-commodity one. For simplicity, consider again one product sellers, now selling commodities to consumers perceiving them as imperfect substitutes in some sense, or complements. Let sellers enter sequentially and upon entry choose the commodity offered, the location and the price charged. Then initially, sellers will choose commodities that are complementary to the ones already offered, will all concentrate at one location; and furthermore, will charge prices increasing with successive entry. The reason for spatial concentration is that with successively entering

sellers, cost advantages to consumers from improved search and/or simple joint purchase of the desired commodities will lead to an increase in the market area fetched by the marketplace and, by complement, to an increase in each seller's quantity sold. Furthermore, sellers will absorb some of the consumers' cost advantages. Now, at some point the number of consumers attracted to the marketplace may be so great that sellers even of very close substitutes, despite some competition with incumbent sellers, consider it more profitable to locate in the "large" marketplace rather than to establish a marketplace on their own. They will not do so only if competition is extremely strong.

A key feature of this more general model is that the principal forces of attraction towards a large marketplace to both consumers and firms, are made explicit, which are missing in Hotelling's paradigm. Only their explicit incorporation allows a juxtaposition to the key detractive force prominently figuring in the Hotelling model, namely spatial competition, or alternatively interpreted: competition in commodity space. Yet another feature of the model is that both these forms of competition are jointly incorporated.

4. The Weber Paradigm⁸

In comparison to Lösch's or Hotelling's model, the single firm location paradigm proposed by Weber and amended upon by many authors has the distinctive advantage that the firm's locational ties to both input and output markets are treated jointly. This location decision is embedded in a highly special environment, however, which does not allow for a unification with the other location paradigms, and more

importantly reduces its explanatory power to an extremely small number of cases observed in the spatial economy. The primary reason for this is that interactions between the plant, its suppliers of input and its demanders of output are reduced to an explicit consideration only of distance relations. This excludes, for example, an analysis of the influences on plant location decisions of inputs that are immobile from the firm's point of view, but available at many locations; or an analysis of interindustrial interactions of an oligopolistic nature between the suppliers and demanders involved. That severely limits the scope of an explanatory, as well as a welfare analysis conducted within this framework.

To be more precise, I again recall the assumptions of interest within the present context:

1. All inputs relevant for the plant location decision are available only at a few locations (sources) and may be moved at a positive but finite, constant unit cost. Similarly, all outputs produced by the plant are supplied to a few locations (destinations) only, and may be moved at nonzero but finite cost. The economic landscape otherwise is totally unstructured.
2. All inputs considered are essential in the sense that zero output would be produced if any one of the inputs could not be used.
3. Input supplies and output demands are infinitely price elastic at all sources and destinations considered. The firm is not only a price taker in all those markets, but also bears the transportation cost for all inputs shipped to the plant and outputs shipped to the marketplaces.

ad (1): As mentioned before, this assumption is very restrictive because it excludes as inputs relevant for the location decision those available at many locations but typically considered immobile from the point of view of the individual firm. A most prominent example in an interregional location context, is labor, which is an essential input to all production processes. However, the restrictiveness of this assumption is even greater in conjunction with assumption (3). This will be discussed below.

ad (2): In a modern economy, most all inputs traded are available in a great number of variants, that are imperfect, but individually in-essential substitutes as inputs in a firm's production process. As a simple example, consider a firm that needs light bulbs as inputs. Now, there are many sorts of light bulbs offered at a large number of locations. While each type (or combination of types) may be used in a more or less productive way, only the use of one sort may be absolutely necessary. My claim is that these features do play a quite important role in location decisions, especially in view of the fact that choice possibilities among these substitutes differ quite extremely between locations such as cities of different size and structure.

ad (3): As mentioned before, assumption (3) relates strongly to assumption (1). Let us get back to the latter for the moment. In these, the meaning of "sources" and "destinations" is left unspecified. Two alternative interpretations offer themselves: one that these points represent firms, and one that they represent cities. In the first

interpretation, the passive role they play in the Weber paradigm is highly questionable. By contrast, the interaction of the locator with each single firm in general involves a bilateral monopoly situation! To see this, consider the following example: Let some firms located at different points in space supply physically identical inputs with the same constant or decreasing average cost. Then for any location chosen by our firm, there is one and only one firm located most closely to it. It is the outcome of the bilateral monopoly game between our locator and this firm that determines not only the input price at which our firm is supplied, but also which one of the two firms bears (the larger share of) the transportation cost. However, both critically influence the firm's location chosen.⁹ In the second interpretation of "sources" and "destinations," the assumption of price taking behavior may be somehow justified. However, one then has to question whether the description of the economic landscape presented in assumption (1) is empirically meaningful. For instance, a classification of agglomerations into sources and markets of one particular commodity each is not quite sensible: The typical agglomeration involves mixtures of all. Furthermore, the typical economic landscape between these agglomerations is heterogeneous in many relevant instances. Think about markets for essential primary inputs, in particular labor markets.¹⁰

In putting things together, it is first of all important to distinguish between the two alternative interpretations one can give to

the economic environment as specified in the Weberian location model. In the first interpretation, a truly explanatory model must involve a more explicit interaction between the locator and firms as suppliers of input, as well as demanders of output. If the second one is chosen, then it turns out that in all relevant cases agglomerations of different size and structure will be the only candidates for the firm's location decision. The very complexity of this location decision thus may lead us to a nonspatial formulation of the location problem in which one or several firms', and indeed, consumers' interactive choice of an agglomeration specified by size and structure is explicitly considered.

5. Suggestions for Further Research

It should have become quite obvious from the discussion in the preceding sections, that even direct extensions well in line with the classical paradigms complicate matters quite substantially. It therefore seems quite difficult, if possible at all, to analyze within one general equilibrium model all the features discussed here. The question then arises as to which subsystems of the spatial economic system are most usefully analyzed, but in a form that allows for a unification of these analyses. It is this question to which I wish to address myself now.

As a first cut to divide a big pie, I propose to separate location decisions related to the *production* of intermediate, and final commodities from those related to the *marketing* of final commodities

and services. This division is not without realistic content: in the real world we rarely observe that final products are only marketed at the very locations where they are produced. In many instances, regional, if not national or international markets are served by one production plant. However, marketing activities are oriented towards an entirely different set of variables than are production activities.

A second cut involves the distinction between *intraurban*, and *interurban* location decisions (that is, location decisions within a system of cities) simply because the contexts of these decisions dramatically differ. Again, that division is not unrealistic. Empirical studies about location decisions suggest that these decisions are made sequentially, rather than simultaneously.

All models, I submit, should be framed within a multi-commodity world: only then will we be able to specify both agglomerative and deglomerative forces in production and retailing. Furthermore, possibilities should be investigated that include different agents' imperfect information in a meaningful way. Finally, all models in principle should be specified in a general noncooperative equilibrium context. In particular, the entry and exit of firms should be allowed for, simply because an evaluation of location decisions on the basis of efficiency, or equity objectives can only build on these.¹¹

Returning again briefly to a model of *intraurban* retailing decisions, we may start off from a generalization of Lösch's and Hotelling's paradigms, in which consumers' demands are derived explicitly from their preferences and thus the standard interdependencies are maintained from consumer theory. Also, due account should be given to the decreasing cost

aspect in consumers' transportation outlays obtained when search efforts or purchases are bundled in one shopping trip, which implies directly that the consumer's choice to visit a marketplace is made dependent on the total utility derived from visiting that place, rather than (as in the classical paradigms) on the unit cost of obtaining a particular commodity. Again, it is this decreasing cost aspect that draws sellers together.¹²

Turning now to an analysis of producers' intraurban location decisions, it will be useful to start from an extension of the Weber paradigm along the lines given in the first interpretation of the Weber model. In light of that discussion, it will be important to include not only bilaterally monopolistic interactions between the locator(s) and suppliers of (intermediate) inputs, but also to incorporate the urban labor market in some form. I envisage just a reversion of the Von Thünen model, with laborers' location fixed, and employment locations available. A key result will be the endogenous generation of centers of employment, provided that the agglomerative forces: savings in the transportation costs of intermediate products are stronger than the deglomerative force: competition in the labor market. To my knowledge, this question has not been discussed in the literature.

Finally, a unification of intraurban location models should involve two steps: first, an explicit consideration of the interaction between producers and retailers of commodities.¹³ Second, a reaction of consumer/laborers to the formation of employment centers and marketplaces, which links models of the type discussed here with models in the Von

Thünen tradition.¹⁴

A final remark is on models involving location decisions within a system of cities. The fundamental problem arising here is that individual producers' and retailers' locational choices within such a system of cities can only be modeled analytically if intraurban (locational) interactions are fully understood. The principal reason for this is implicit in the previous discussion: the decision to produce, or to retail within a particular urban area invariably involves some interactions which cannot be characterized as perfectly competitive. But the typical outcomes of these imperfectly competitive interactions are not analyzed as yet. Therefore, we might, meanwhile, console ourselves with a more aggregative analysis involving a system of cities.

This concludes my parforce tour through the established industrial and retail location paradigms. I once again apologize for arrogantly criticizing seminal papers, but I hope that this critique will further the development of an important branch of spatial economics.

FOOTNOTES

¹The recent revival of interest in location problems is accidental: it has more to do with the fact that Hotelling's classical location paradigm is a simplified version of Lancasterian new consumer theory, an isomorphism conveniently used in applications of that theory.

²Lösch's paradigm, as Weber's and Hotelling's, is assumed to be known. Only a cursory review is given that focuses on the respective critical points.

³It might be of interest at this point, that this assumption is *customary* in general equilibrium theory when it comes to discarding the importance of including space. In checking this assertion, consult any standard text, such as Arrow & Hahn, Debreu, or Malinvaud. In any case, it is this very assumption that unrealistically preserves convexity in a general equilibrium model extended to including space.

⁴I will, in good tradition of industrial and retail location theory, abstract from a consideration of land. This is not without a good rationale. Under the provision that the land market is competitive on both the demand (from consumers) as well as the supply side, and under the assumption that demand for land, with the exception of firms' demand is uniform in space, competitive land owners' asking prices do not differ a priori. However, in a full-fledged equilibrium model we might be confronted with the problem so interestingly posed by Koopmans and Beckmann [2].

⁵Again, the assumption of a uniform spatial distribution of consumers, and of unchanging firms' cost functions in space qualify it as an intraurban retail location model.

⁶This is demonstrated in several papers, such as in D'Aspremont, Jaskold Gabszewicz, and Thisse [1], or in Novshek [7].

⁷As to the effects of relaxing the first assumption, consult, e.g., Eaton [2], and of the second, Eaton and Lipsey [3].

⁸In the present context I shall only be interested in a positive interpretation of the Weber model, i.e., in an evaluation of its power to explain observed location decisions. I am thus not concerned with the normative question as to the optimality of plant location that the OR literature addresses itself to.

⁹Of course, the outcome of the game is very much influenced by the environment of these two firms, in particular by the locational proximity of alternative demanders and suppliers of that input. But this exactly must be the subject of further analysis.

¹⁰In passing it might be remarked that no matter which interpretation the model is given, labor as an essential input does play an extremely passive role: "sources" or "markets" are in the firm's choice set. However, labor market conditions at these points invariably differ from those at points not in the set of "sources" and "markets."

¹¹Of course, this should not imply that modeling equilibrium configurations involving a fixed number of sellers are not useful. However,

great care should be taken when it comes to an evaluation of the resulting equilibrium configurations.

¹²First efforts in this direction are made by Eaton and Lipsey [4], Stahl [9] and Stahl and Varaiya [12], within a certainty context, and by Stuart [13], Stahl [8] [10] and Wolinsky [14] within a context of imperfect consumer information, and finally by Stahl and Varaiya [11] within a context of retailers' imperfect information.

¹³This problem is discussed in Heal [5]. It is worth mentioning at this point, that a careful specification of all these models should allow for a discussion of all the questions the modern industrial organizations literature addresses itself to, such as "vertical" and "horizontal" integration, or entry preventing activities. I would claim that the results derived in the present, spatial context will quite differ from those derived in a nonspatial one.

¹⁴These models are, by and large, much better understood, which is the reason for not having them included in the present critical analysis.

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