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Journal

Institute of Urban and Regional Development

Author

Walker, Richard

Publication Date

1980-05-01

Working Paper 323

**Capital and
Industrial Location**

**Richard Walker
Michael Storper**

May 1980

**University of California at Berkeley
\$5.50**

Capital and Industrial Location

**Richard Walker and Michael Storper
Department of Geography**

Working Paper No. 323

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**Institute of Urban and Regional Development
University of California, Berkeley**

The authors thank Allan Pred, Michael Luger, and Mel Webber for their comments on earlier drafts of this paper.

Contents

Introduction

A. THE BASIC MODEL OF CAPITALIST REPRODUCTION

1. The capitalist mode of production
2. The production of capital (surplus value)
3. Capital and labor
4. The circulation of capital
5. The accumulation of capital
6. Development of the forces of production
7. Crisis and change
8. Capital space
9. Conclusion to part A

B. INDUSTRIAL LOCATION

1. Investment and location
2. Restructuring, industrial evolution and locational change
3. Circulation and linkages
4. The rule of profits and the distribution of industry
5. Factor creation and differentials
6. The labor factor
7. The changing spatial division of labor

Introduction

Traditional industrial location theory has been based on variants of neo-classical economies, whether partial equilibrium and cost minimizing (Weberian) or general equilibrium and revenue maximizing (Central Place Theory). (E.g., Weber, 1909; Lösch, 1954; Isard, 1956; Hoover, 1948; Moses, 1958; Mills, 1972). This tradition has fallen into disfavor with a wide range of geographers. (King, 1976; Massey, 1975; Vance, 1977, Tornqvist, 1977). As a result, industrial geographers have continued to push ahead with empirical research into industrial location, while searching for theoretical guidance from new quarters. (Britton, 1974, 363) Models have been built on such things as the product cycle, innovation diffusion, regional imbalanced growth, marginal decision-making organizational structure, environment-response, and linkages. These approaches are well illustrated by the literature included and/or surveyed in Hamilton (1974), Collins and Walker (1975), Keeble and McDermott (1978), Keeble (1977), Holland (1976), and Pred (1966, 1977) Such loose designations as behaviorism, Keynesianism or Schumpeterianism might be given to this rather eclectic body of thought, but the only systematic attempt to integrate the various themes has come through the application of systems theory to the industrial location problem. (Pred, 1977; Goddard, 1977; McNee, 1974) This effort falls short on a number of counts, however: principally the misspecification of the economy as an industrial system, focus on technical change as the main process at work, limited conception of economic structure in terms of linkages, and relegation of the social and the contradictory to the external environment of the system. (Storper & Walker, 1979)

An alternative source of integrative theory is marxism. Recently some industrial geographers have begun to look at Marx (e.g. Hamilton, 1979;

Holland, 1976) and Marxists have begun to look at industrial location. (Massey, 1978a & b; Dunford, 1977a & b; Castells, 1975, 1977; Castells & Goddard, 1974; Harvey, 1975a; Barnbrock, 1974; Bluestone & Harrison, 1979; Markusen & Walker, 1979; Storper, Walker & Wides, 1979; Storper & Walker, 1979) Constructing a marxist theory of industrial location does not mean rejection of all or even most insights gained by other approaches; one need not reinvent the wheel. But it does mean rejecting some principles and casting others in a comprehensive framework which often alters their standing substantially. This requires that we begin with a clear and concise model of capitalist reproduction (Part A) before applying marxist concepts to the major problems in location research (Part B). Readers familiar with Marx's Capital may wish to move directly to Part B.

The gist of marxism is that the structural requirement of capitalist society is the expanded reproduction of capital and capitalist social relations; therefore, the principal object of industrial location analysis must be that structural dynamic rather than either "industry" or "location" (space) or any single component thereof, such as the market, the firm, management decisions, technology or physical geography. Lack of space prevents us from going into many of the controversies in both marxism and location theory which are raised by our presentation. We also assume a reasonable familiarity with schools of thought in location theory on the part of the reader.

A. THE BASIC MODEL OF CAPITALIST REPRODUCTION*

1. The capitalist mode of production

The capitalist mode of production emerged in Europe in the 16th and 17th centuries. (Marx, I, 146, 336)** A mode of production is defined by its social relations of production or way of organizing social labor and extracting its surplus product. (Shaw, 1978) In the capitalist mode these relations are class relations: an amassing of the means of production under the private ownership of a capitalist class and the lack of independent means among a class of wage-laborers, who must hire out their laboring-power to the capitalists. (Marx, I, ch. 6)***

The key to historical analysis is the interaction between relations and forces of production. (Shaw, 1978; Mishra, 1979) The latter "forces" refer both to the physical means of production and to all the capabilities of the human beings who together employ these means. The relations of production establish the social context for the functions and development of the forces of production. When further advance in the latter is blocked, crisis conditions arise from which new relations of production may emerge. Before a revolutionary break occurs, however, the social relations of the existing mode will be continually perfected through improvements in economic practice

*The discussion in Part A owes a great debt to our reading of David Harvey's work, especially an unpublished manuscript on the theory of capital.

**Reference to Marx in Part A will frequently be given by chapter or part rather than by page, since it is the thrust of often lengthy arguments that we are summarizing.

***Additional necessary--but not sufficient--conditions for the emergence of capitalism are a relatively advanced development of market exchange, money, and the forces of production in hand manufacture, as well as competition and the lure of monetary gain (possessive individualism) and the accumulation of some sizeable personal fortunes. (Marx, I, Pts. 1 & 8)

and social institutions in order to sustain the basic structure of society while promoting further development of the forces of production. This dual progress within the mode of production allows great historical changes to occur without overthrowing the basic social structure. (See below, Sec. A.6.)

Marxism asserts the priority of capital in social dynamics today but this does not mean that social history is identical with capital accumulation or a mere superstructural reflection of the capitalist mode of production. (cf. Williams, 1977; LaClau, 1977; Dunford, 1977a; Walker, 1978b, 1980) In other words, the only viable use of the concept mode of production is in structural terms. That is, the functional requirements of accumulation are the necessary conditions of social reproduction, but are not sufficient to specify the nature of society and "everyday life" ~~==~~ quite apart from problems of social contradiction, mixed modes of production, and so forth.

2. The production of commodities and of capital (surplus value)

In a generalized system of exchange, all products of labor become commodities.* (Marx, I, ch. 1) Commodities have three social dimensions: value (embodied labor-time), use value (utility to consumers) and price (exchange value). (Marx, I, ch. 1) The key dimension is value. (Marx, I, ch. 2) With the development of commodity production, money grows in importance as a measure of prices, facilitator of exchange and store of value. (Marx, I, ch. 2 & 3) Over time, pursuit of money (of value) becomes the principal goal of commodity production rather than the enjoyment of use values. (Marx, I, ch. 4) The owners of money (capitalists) cannot expand their store of value

*Most non-produced objects, such as land, also take a commodity form.

through exchanges except by cheating one another, since all value comes from production. Capitalist production relations solve this problem by allowing surplus value to be generated without violating the laws of exchange. (Marx, I, ch. 5-7) Surplus value is the difference between the value of what workers produce and the value of the commodity labor-power, or what it costs to reproduce workers. (Marx, I, ch. 7)

The essence of capital production is the extraction of surplus value, but the matter is more complex than this. Capitalist commodity production involves three systems: value-relations, price-relations and use-value relations. Neither capitalists nor workers ever "see" value or surplus-value; they operate on the basis of market prices and use-values (techniques; wants and needs). Profit is the price-form of surplus value, wages the price-form of the value of labor power. Capitalist commodity production differs from simple commodity production in that prices and values diverge systematically owing to the tendency, forced by competition among capitals, toward equilization of rates of profit on capital advanced, where the capital/labor ratio (organic composition of capital) differs among branches of production. (Marx, III, Pts. 1-3)*

*Although the so-called "transformation problem" and Marx's inadequate treatment of it muddy the picture considerably, the chief insights of value analysis remain intact --e.g. that all production is social labor, that capital exploits labor within the rules of equal exchange, that labor must be allocated rationally among branches of production and that the capital-labor relation must be reproduced. (C.f. Mummy, 1979)

3. Capital and labor

The pursuit of profits long ago led capitalists to seek direct control over production. They thus command not only the product and surplus value of the working class but the labor power as well. Because of the need to control the work activity of the laborer, the organization of production is as much a social as a technical problem. (Marx, I. ch. 10, 13-15; Gintis, 1976; Braverman, 1974; Edwards, 1979) Maintaining such control is difficult because the alienation of the workers from their basic life-activity, labor, creates an antagonism between the classes. (Marx, I, 13-15) Because class conflict is inherent in capitalist production, and carries over into the reproduction of the working class outside the factory, the will, social life and practical struggles of the workers constitute a basic element in capitalist development. (Thompson, 1968; Gutman, 1977) At the same time, their subordination to the capitalist class and acquiescence to the rules of capitalist society is normally sustained by both force and "the dull compulsion of economic relations" which makes the laws of capitalism appear as the laws of nature. (Marx, I, 137; ch. 23)*

4. The circulation of capital

Capitalist circulation also begins with the commodity, which not only must be produced, but must also be sold in the market, where its value is "realized" as money. The starting point for the circulation of capital is

*In other words, while the free will of the working class is sharply bound, it is not altogether missing as some conventional thinkers would have it. The idea that capital has creative powers as a thing apart from the social labor which gives it life is a product of what Marx calls "capital fetishism." (Gurley, 1971; Walker, 1979) But because the alienation of labor is a real product of class domination, capital is able to "borrow" the power of social labor and force that labor to follow its own laws of development. (Marx, I, Preface)

not production, however; capital sets out as money, which is invested in elements of production, which are set to work to produce commodities, which are sold for money--and profits--and so on, ad infinitum. Marx's shorthand is M-P-C-M!¹ This is the primary circuit of capital. In it, capital assumes three different forms: as money capital, productive capital, and commodity capital. (Marx, II, Pt. 1, esp. 104-5) More complex ("non-primary") circulation patterns arise, however, with the need to invest in long-lived fixed capital, hold inventories, stimulate consumer spending, do product research and so forth. These activities contribute only indirectly to the immediate production and circulation of surplus value, or primary circuit of industrial capital. (Harvey, 1978; Marx, II, ch. 7)

Circulation takes time, and the speed with which capital completes its movement from M to M!¹ will affect the rate at which it can grow. In the primary circuit, "turnover time" consists chiefly of time of production and time of circulation (sale) of commodities. (Marx, II, 121; ch. 13 & 14) In non-primary circuits the turnover is normally longer. Circulation also has costs which subtract from the total surplus value produced.* (Marx, II, ch. 6, 129-32) Continuity is essential to reducing the time and costs of circulation. (Marx, II, 102; 266) Balance must also be achieved in linking together individual capitals into a coordinate flow in the absence of a social plan. (Marx, II, Pt. 3)

*No new value can be added in exchange, by definition. (Marx, I, ch. 5, p. 509) Circulation labor is thus necessary but, strictly speaking, unproductive of value. By saving capitalists money, however, it does "create" surplus value that would not otherwise be available for accumulation. Profits can also be made by capitalists investing in circulation activities; these are drawn from the total pool of surplus value produced. (Marx, III, Pts. 4 & 5)

5. The accumulation of capital

Capital in motion is surplus value being invested to produce more surplus value; it is expanding value. (Marx, I, ch. 24) Expanded reproduction of capital--capital accumulation--is the central force for economic growth in societies based on the capitalist mode of production. The drive to accumulate arises from several causes, such as the lust for personal wealth, but it is enforced primarily by the collective pressures of competition. (Marx, I, 592) Competitive advantage from cost cutting (cheapening commodities) offers capitalists the lure of surplus profits and/or greater markets, while competitive disadvantage offers the threat of eventual bankruptcy. (Marx, I, ch. 12, 316-319) Another basic driving force of accumulation is crisis, which jeopardizes all capitals (see below, sec. A.7). A third is scientific progress.*

The drive to accumulate forces capitalists to try to increase the production and circulation of surplus value.** This requires, first of all, reinvestment of profits. It also leads to development of the forces of production.

6. Development of the forces of production (technical and organizational progress

There are several methods of advancing the forces of production. Some are the results of efforts by individual capitalists and some are unplanned

*Insofar as science-bred invention assumes a logic partly independent of systematic research internalized by the modern corporation and is not simply a result of other drives to accumulate. (cf. A.6; Marx, I, ch. 15, sec. 1; Braverman, 1974; Rosenberg, 1972)

**This applies both to industrial capitalists and to those which function in the sphere of circulation only, i.e. merchants and financiers.

consequences of their collective action. For heuristic reasons, we can divide the forces into those which increase production, those which facilitate circulation, and those which do both.

Two ways of producing more surplus value are lengthening the working day (absolute surplus value) and increasing the productivity of labor (relative surplus value).* (Marx, I, Pts. 3 & 4) Historically, labor productivity has progressed through cooperation (including economics of scale), division of labor, and mechanization. (Marx, I, 12-15; Braverman, 1974) The application of machinery to the manual labor of the worker is the key to the industrial revolution. (Marx, I, ch. 15) This change in the social relations of labor puts work on a more strictly technical footing which allows the rapid development of mechanical power sources, continuous flow processing and automatic controls. (Marx, I, ch. 15, sec. 1) It also gives rise to a splitting off of conception from execution of tasks, with the refinement of the latter through science, computer systems, etc. (Braverman, 1974)

The logic of accumulation also drives capitalists to expand sales and to reduce the time and costs of circulation. There are various means to these ends, such as increasing the productivity of non-production labor, improving transport and communication systems, introducing new products, advertising, and perfecting the continuity and balance of capital's movements. (Marx, II, Pt. 2)

*The individual capitalist seeks competitive advantage by cheapening commodities (in price terms). The technical change involved need not be labor-saving in price terms, but it surely will be in physical and value terms as both Marx's theory and historical evidence indicate. (Hamer, 1973; Rosenberg, 1972) Most mechanization will be introduced not for cost reasons alone, but also for the purpose of controlling or eliminating the troublesome element in production--the workers. (Marx, I, 436; Braverman, 1974)

Marx also introduces a category of "levers of accumulation," which refers to ways of promoting rapid increase in the effective size of capital and of the labor pool. These include the centralization of capital, by such means as absorbing small competitors and forming joint-stock companies, and the creation of an industrial reserve army by the destruction of handicrafts and replacement of labor by machinery. (Marx, I, ch. 25)

Finally, there are social institutions which serve all or most of the above functions. The market system is the principal one; its present-day efficiency and scope permits larger sales, faster transactions, and production on a greater scale than ever before. The market is not only a precondition for capitalism, but something systematically developed over time by capitalist production. Three other subsystems supplement or even supplant the market; the credit system, the corporation, and the modern state.* (cf. Mandel 1975) These institutions also serve to perfect the relations of production (cf. sec. A.1) A better market, for example, makes value relations more exacting.

The modern corporation, in particular, not only concentrates a greater mass of capital but puts it under the direction of a single managerial body which can allocate it in a sophisticated way to different branches of production to maximize rates of return (divisional organization); links together materials supply and processing (backward integration); links

*The functions of credit, the state and the joint-stock company (precursor of the corporation) are mentioned frequently in Capital. But their importance has generally been missed by Marxists or thought by them to have cut the ground out from under Marx's value analysis. (Baran & Sweezy, 1966) Our position, which is akin to that of Mandel (1975) and Harvey, is quite the opposite.

production and marketing (forward integration); incorporates non-primary circulation functions, such as advertising and R&D into an organized system of production and circulation; and increasingly links together wholly unrelated branches of production (conglomeration). (Chandler, 1962)

These represent organizational solutions to problems posed in the production and circulation of capital and are logical results of the drive to promote accumulation. Thus while the corporation drastically alters the social topography, it does not negate such characteristics of capitalism as competition among capitals or crisis tendencies.*

7. Crisis and change

Capital accumulation periodically runs into barriers which, if not overcome, force the economy off a sustainable growth path and ultimately into an open crisis (recession). (Harvey, 1975a; 1978; Lebowitz, 1978)

The potential sources of crisis are as varied as the facets of capitalist reproduction, but the principal causes correspond to the main dynamic features of accumulation. First, given the drive to accumulate and the competitive, unplanned character of production, capitalists will, as a body, tend to overinvest. (Devine, 1980) Because capitalists cannot see clearly the results of their collective action, owing to the long time between investment decisions and the creation of new capacity, and because investment becomes embodied in fixed capital, the system will not be able to

*We find it astonishing that so much ballyhoo has been raised over the relatively minor achievement of large corporations in restricting price competition in certain markets. As Mandel observes, competition has many dimensions and has not been noticeably weakened world-wide (1975, 327-42) Furthermore, as Chandler points out, the corporations themselves rather quickly discovered the limits of this method of promoting accumulation after the first blush of enthusiasm over trust formation at the turn of the century wore off. (Chandler, 1962)

adjust automatically (cf. Marx, II, 186). Second, capitalists will try to develop the forces of production too rapidly, as, for example, by over-expanding the credit-system in relation to the actual capabilities of social labor to produce and circulate surplus value. (Marx, III, xxx) In either case, there will be an overaccumulation of capital relative to the possibilities for realizing profits or a falling rate of profit.* (Marx, III, xxi; Harvey, 1978)

The effect of crisis will be to devalue excess capital, especially by means of bankruptcies, and to stimulate vigorous efforts by the capitalist class to promote the production and circulation of surplus value by such means as corporate merger, state intervention, and introduction, consolidation or generalization of new technologies. (Harvey, 1978; Mandel, 1975; Marx, III, xxx) Furthermore, "every crisis is the starting point for large new investments." (Marx, II, 186) Accumulation thus follows a cyclic course of investment booms followed by (usually shorter) periods of slackened or negative growth. (cf. Abramowitz, 1977; Mandel, 1975; Schumpeter, 1939;) Each new wave of investment will, moreover, usher in a new configuration of forces of production and social institutions--or what may be called a "social structure of accumulation."

*There is no consensus on crisis theory among modern Marxists, although all would agree that crisis tendencies or barriers to accumulation arise from the internal contradictions of capital, not external disruptions. (See Wright, 1978; Mandel, 1975; URPE, 1978a; Harvey, 1978; Lebowitz, 1978; Devine, 1980) Few still cling to Marx's presentation of the falling rate of profit owing to a rising organic composition of capital. (Marx, III, Pt. 2) But most take an overly narrow view of the problem, raising this or that particular feature of capitalist production and circulation, such as the need to sell commodities or the wage-struggle, to the rank of prime mover. Our position is similar to that of Devine (1980) and Harvey, and to some extent Mandel (1975).

(Gordon, 1978b; Walker, 1980) This makes it reasonable to speak of historical evolution under capitalism as occurring in stages of accumulation.*

The relation of capital accumulation and spatial relations is a structural-dialectical one. (cf. Sec. A.1) The spatial organization of capitalist society is not the mere shadow of accumulation moving across the face of the earth. Capitalist development necessarily internalizes a spatial component. (Castells, 1977, 115; Mingione, 1977; Harvey, 1975; Walker, 1978b, 1980) One of the ways capital and space are indissolubly joined is through the necessity for most industry to take an immobile form, in the "location problem" itself. Another is the need to create a built-environment of roads, houses, etc. in addition to factories. A third lies in the spatially-based form of community which workers so often form. The result is that capitalism necessarily creates a social landscape, or "geography of accumulation," broadly consistent with the social structure of accumulation but never strictly determined by it.

9. Conclusion to Part A

Behind every theory of industrial location lie certain basic axioms regarding the economic and social processes at work creating the industrial landscape. Before entering the thicket of location theory, then, we reiterate several axiomatic differences between the preceding marxist

*Although the evidence is quite controversial, we would argue for major stages of development of roughly fifty years, combining long phases of relatively vigorous accumulation, such as the post-war period, and periods of uneasy and sluggish growth, marked by more serious crises and considerable economic restructuring, such as is occurring in the 1970s. (cf. Mandel, 1975; Schumpeter, 1939; Gordon, 1978b; Walker, 1977)

model and other approaches to industrial location, such as neo-classical economics, behaviorism and systems theory. (cf. Introduction)

* The system in question is neither an exchange economy nor industrial system, tout court, but a capitalist mode of production and capitalistically structured society which embraces both.

* The goal of capitalist production is profit-making, the structural imperative of the economy as a whole is accumulation of capital. This is not a strictly functionalist position, since (a) the paths to this end are many and the degree of behavioral or cultural freedom considerable; (b) not everything in society serves this end without contradiction; (c) the goals may not be met, in which case firms or the economy fail to reproduce themselves. A structural/dialectical analysis does not rely on strictly linear cause and effect relationships.

* Technological change, development of the productive forces does not originate outside the economic system. Although technical imperatives (i.e. laws of nature) exist, technical progress is promoted chiefly by the drive to accumulate and the direction of technical change involves human choice, and internalizes the capitalist social relations.

* The modern corporation (state, financial system, etc.) does not form the basis for a wholly new approach to the economy and location. Profit-making and competition still guide the firm. Nevertheless, models of single-plant, perfectly competitive firms are of limited relevance.

* Neither the market nor the corporation nor the industrial system is strictly self-regulating; they are subject to dysfunction. The

principal sources of contradiction and change, moreover, lie within the capitalist system, not in the exogenous stresses of external environment and technical change. In particular, neither competition nor crisis have been abolished.

* The advanced social and technical level of modern capitalist economies does not yet augur a "post-industrial", much less a post-capital, economy. The so-called "tertiary" or "service" functions refer chiefly to circulation (finance, trade, transport, advertising, etc.), management, and the reproduction of labor power (schools, hospitals, domestic service), all of which still rest on a base of commodity production. (Some, such as business services, are arguably forms of commodity production per se)

* All industrial activity and change has a social dimension. It involves the living component of social production--the worker. It does so, moreover, on the basis of social relations of class domination, exploitation and alienation.

With these axioms in mind, we can now take up more specific problems in industrial location theory, drawing out further implications of the marxist model in the process.

B. INDUSTRIAL LOCATION

The model of capitalist reproduction has been presented first for three reasons: it arms us with some key concepts and basic axioms for the analysis of location; it presents these as part of a system rather than isolated insights, in contrast to the eclecticism of so much locational analysis; and, finally, it establishes the basic priority of accumulation

over the location "problem." The latter principal is the point of departure for the second half of the paper. Using the neo-classical partial equilibrium (Weberian) model as a foil, the argument proceeds in two parts. The first half, encompassing three sections, presents the view that the geography of industry unfolds principally as a consequence of the dynamics of accumulation, rather than as a result of the static allocation of activities to their best location with respect to the distribution of markets, labor and materials. The second half, consisting of four sections, looks more closely at the role of market factors in the distribution and movement of industry, particularly that of the crucial labor factor.

1. Location and investment

Classical Weberian location theory takes the "siting decision" as the starting point for locational analysis. That is, the location problem is seen principally as one of allocation--of spatial optimization (profit maximization) with respect to the distribution of markets and factors of production. The model of capitalist reproduction outlined in Part A, on the other hand, suggests that the starting point for location theory is the commitment of money capital, i.e. the investment decision. (Sec. A.5) Furthermore, this point in time cannot be isolated or frozen: it forms a moment in the continuous circulation of capital (Sec. A.4) Investment, or the transformation of money capital into elements of production, is one phase in the circuit of industrial capital, $M-P-C-M'$. (Sec. A.4) The "location problem" arises when capital takes the form of

productive capital (P), because production typically involves a stock of fixed assets--plant, office or store and machinery--which is effectively immobile for its useful life.*

Neo-classical location theory looks at only one aspect of the full circuit, M-P-C-M'. That is, one assumes that decisions about monetary investment (M) and productive apparatus (P) have already been made and all that remains is the problem of locating a known plant profitably with respect to input and output markets (C)** This greatly over-simplifies the investment-and-location-problem. Short-run investment models, on the other hand, do focus on the M stage of the circuit by investigating the changes which will be made in the stock of productive capital in light of financial conditions such as expected rate of return, interest rate and liquidity. (Clark, 1979; Bischoff, 1971; Kopcke, 1977) But this approach ignores the specific locational requirements of different industries. Neither approach alone is satisfactory, because capital may be either stock or flow, depending on the phase of circulation. Neo-classical economics has always had difficulty handling this dual nature of capital (Harcourt, 1972)

*We ignore adjustments in circulating capital, raw materials, inventories and labor-force, even though these may often be the most important facts in accounting for short-term shifts in the location of economic activity. (Woodbury, 1957; 1953; James & Hughes, 1973)

**Given neo-classical assumptions of linear homogenous production functions and perfect substitution at the margin, the M and P stages of circulation effectively do not matter because all industries are alike and all can alter their inputs freely in response to market conditions. (see e.g. Moses, 1958; Mills, 1972) Neo-classical economics is therefore principally an exchange model. (Neill, 1973)

Location theory and investment theory must be unified because every location decision involves a prior decision to invest in fixed capital and every investment decision a subsequent decision to locate (or modify) physical plant.* Four insights flow from unifying investment and location.

First, the conditions of location are a subset of the conditions of successful investment as a whole. For example, the capitalist must reckon whether there will be ample supplies of iron at an acceptable price and quality before investing in a steel mill; the location of ore and scrap relative to a planned factory site will be one aspect of this calculation. Thus, investment models and location models involve the same variables. One adjusts location in the decision just as one might adjust capacity. (cf. Devine, 1980; Kregel, 1972; Holland, 1976) Figure 1 presents a simplified investment-location "model," or tabulation, of the major variables to be taken into consideration. It organizes systematically the many locational factors commonly mentioned in the literature.

Second, the "market factors" which classical location theory considers fundamental ("commodity capital" in Figure 1) are not the only variables affecting investment and location. One must consider other aspects of the circuit of industrial capital (see Figure 1):

(1) features of production (P-factors) which generate the demand for market factors. These will vary markedly among specific industries (see e.g. Alexandersen, 1955; Fuchs, 1962; NRPB, 1942); (2) features of

*We are grateful to Michael Luger (Luger, 1980) for leading us to this conclusion. (cf. Wood, 1978)

productive capacity, market conditions, financial opportunities, and so forth which affect the climate for investment and ability to raise funds (M-factors) (NRPB, 1942; Luger, 1980); and (3) the unity of the circuit, including both the impact of past and future on present decisions and the ability of capitalists to modify the circuit by non-market means (e.g. corporations). (Pred, 1977; Palloix, 1977; Gilmour, 1974; Keeble, 1976; Hamilton, 1978)*

A third conclusion, which follows from the two preceding points, is that the investment decision dominates over the location decision, even though in an optimizing world the two would be identical at the margin. Empirical research shows that the commitment of funds outweighs location in the minds of capitalists. The latter is normally an afterthought. (Townroe, 1971; Krumme, 1969; North, 1974; Lutrell, 1962) The reasons for this are several. Money capital (M) is the most general form of capital and hence the starting point for all movements of capital. (Sec. A.2) Locational variables are ordinarily a secondary feature of the costs and revenues affecting investment decisions. Moreover, managers are more poorly informed on locational factors than on other aspects of investment. (cf. Sec. B.4) This casts the "location problem" in a new light. The primary issues for capitalists are whether to invest and what to invest in, which products, which processes, or which firms.

*In noting the importance of the corporation, however, its structure, management and behavior are not elevated above the economic conditions they serve to organize, as in most behavioralist models. (See e.g. North, 1974; Stafford, 1974; Krumme, 1969) The corporate "decision-making process" is not freed from the imperatives of capital accumulation--even if its logical rationality is necessarily imperfect (Estall and Buchanan, 1961).

Locational outcomes will be the (imperfect) result of the "demand" for market factors generated by the investment process. Such a shift in emphasis from the neo-classical model by no means implies that the uneven distribution of market factors will be unimportant to the distribution of industry at any point in time. We will therefore have need to return to the "factor supply" problem in later sections. But first we must pursue further the implications of looking closely at industrial demand, or, put another way, the historical development of investment (accumulation) and of industrial production and organization. This is taken up in the next section.

A fourth implication of unifying investment and location within a process of capital circulation is that there are no one-time investment-location decisions. Instead, there are four kinds of investment-location processes: (1) additions or replacement of stock in situ; (60-80% of all investment according to Kuklinski (1972)); (2) locational shifts in investment, either through new facilities (branch plants) or disinvestment from old ones by non-maintenance, cutbacks or closure; (3) physical relocation of the same plant and equipment (rare). (North, 1974; Schmenner, 1978; Kuklinski, 1972; Keeble, 1976; Woodbury, 1953; NRPB, 1942; Hoover, 1948)

It should be added that changes in productive stock (fixed capital) do not necessarily fall within the boundaries of single firms. Many presentations confuse the two things (e.g. North, 1974). Firms may acquire or sell plants without changing them. Closure may accompany disappearance of the firm and new openings may come with the formation of new companies. In the latter cases, the circulation of money-capital is mediated by the financial system or the state. The complexities introduced by such mediation are not included in Figure 1.

Looked at from the perspective of capital circulation, industrial location embodies constant movement. Even in situ additions involve new investments, and most investments involve changes in production or organization. The key to understanding the present-day pattern of location, then, lies in the historical causes of changing investment patterns and the evolution of industry.

Figure 1: Economic variables affecting the single-firm, single-product investment-location decision*

a) commodity capital ("market factors")**

- i) product/outputs
markets must absorb outputs (single or multiple product) at a reasonable price, including costs of shipping and selling, with reasonable continuity.
- ii) constant capital ("manufactured inputs")
materials must be secured at a reasonable price, including costs of shipment, contracting, and quantity, quality, and reliability of delivery.
Energy supplies must be available on site or through purchase.
Equipment must be bought or leased at reasonable price, quality (productiveness and reliability in use) and be maintained over its useful life.
Buildings must be leased, or constructed and maintained.
Infrastructure such as sewerage and water supply, consumed collectively, must be available on site at reasonable price, quantity, quality and reliability.
- iii) variable capital (labor-power)
Labor-power must be secured at a reasonable wage, in needed quantity (both normal and intermittent use), with necessary individual qualities such as skill, discipline and collective qualities, such as level of unionization and political militancy.
- iv) commoditized nature (Land)
all natural conditions which have been privatized and which therefore command a rent must be bought or leased. Concerning space alone, size of parcel, location, price and prospects for appreciation will all be important.
- v) auxiliary labor-services and inputs
auxiliary to production: maintenance/repair, construction, and marketing all frequently require additional inputs, usually direct labor services.
auxiliary to management: the steps described below under productive capital, money capital and unity of the circuit, also require inputs, chiefly by direct labor services, such as outside finance, advice on financial decisions, insurance policies, architectural blueprints, patents, legal counsel.

*This outline does not attempt to deal with the complexities introduced by (1) multiple-product/firms; (2) movements of capital between firms; (3) activities other than basic production (primary circuit of capital, as defined in section A.4); (4) government regulation.

**For simplicity we assume no extra-market transactions (externalities) or free-goods (e.g. climatic factors).

***We adopt a modified "putty-clay" model of investment which assumes that the initial decision to invest in fixed capital of a certain kind is essential to future prospects. Flexibility in terms of available techniques is also limited. On the other hand, flexibility is increased by modification of equipment on the shop floor and in multi-product processes. Robinson, 1956; Salter, 1960; Solow, 1961; Piore, 1968; Rosenberg, 1972.

b) productive capital

i) choice of technique

technique chosen determines the basic configuration of production, hence type and rate of input and output (market factors)***

ii) fixed capital

fixed capital embodies both techniques of production and a commitment of value, as just noted. It also gives the firm a certain capacity, can become physically and economically obsolescent, and confines the flow of returns within certain bounds. (cf. sec. A.4 & A.7).

iii) supervision

the firm must also solve the problem of organizing the workforce and supervising the technical and social aspects of the labor process (cf. sec. A.3 and B.6).

c) money capital

i) expenditure of funds

investment decisions are made in view of such financial criteria as rates of return from existing investments, comparative rates of return in different lines of production, tax rates, etc.

ii) generation of investible funds

The most direct source of funds is the flow of returns from past investments (fixed capital in production) through sale of output. This flow will vary depending on the character of initial investment and subsequent modifications and operating decisions. Funds can also be diverted from maintenance, by wage-cuts, etc. Companies must also seek outside funds (credit) where interest rates, credit-worthiness, and portfolio mix are the chief factors.*

d) unity of the circuit

i) past, present and future

Time and continuity are factors in investment, hence the need to consider the unity of the circuit in each stage. This is clear enough when one weighs a single round of investment; extend the horizon and the problem includes future expectations in general (cf. Robinson, 1956) and the effects of all past decisions. The latter are embodied most clearly in the flow of returns from fixed capital, but also include the weight of marketing policies, research effort, and labor relations.

ii) organization

The unity of the circuit does not have to be either a mental construct of the investor or market-mediated. Institutional developments such as the corporation can be used to organize the circulation of capital by internal purchase and sales, relations of command, etc. (See sec. A.6) The corporation will thus alter the conditions of investment and location from those which would hold for a small, unintegrated firm.** (Averitt, 1968; Galbraith, 1967; Chandler, 1962)

*** See p. 22.

*Mandel (1975) indicates that most new long-term investment is done with internally generated funds, while short-run purchasing, inventory, etc. is externally financed. This would be less true of small firms.

**The credit system and state may have similar effects, not considered here. (cf. sec. A.6)

2. Restructuring, industrial evolution, and locational change

Regional and intra-urban shifts in the distribution of industry have been a basic characteristic of the U.S. economy since the industrial revolution; the reason for such movements has long been studied. (e.g. Creamer, 1935; NRPB, 1942; Woodbury, 1953; MacLaughlin & Robock, 1949; Fuchs, 1962; Perloff et al, 1960; Pred, 1966) Recent dramatic changes in Britain and the U.S. have raised anew the question why investment would be redirected to new locations (Keeble, 1976; Sternlieb & Hughes, 1976; Struyk & James, 1975; Creamer, 1968; Wheat, 1973; Hamer, 1973)

The basic neo-classical approach explains these trends in terms of factor supply differentials (in quantity, quality or price; real or expected) which exist because equilibrium has never been reached or has been disturbed by exogenous forces. The classic regional industrial change literature thus depends heavily on explanations based on the drawing power of new markets, cheap labor and raw materials (including climate) (e.g. Chinitz, 1960) This type of reasoning raises several thorny problems regarding the origins of factor-supply differentials, to which we return in section B.5. But most of all it deals with only half the issue, factor supply.

Locational disequilibrium may not be the principle force behind industrial movements (Struyk & James, 1975). Changes on the "factor demand" side of the equation must be reckoned with. Indeed, the literature on industrial shifts has made some effort to deal with this problem. One method has been to try to isolate the role of "industrial structure" (types of industries) in the growth and decline of regions. (e.g. Fuchs, 1962; Borts & Stein, 1963) The results of such "shift-share" studies

appear to undercut the role of industrial change versus factor differentials. But this result is due largely to poor application: e.g. use of overly aggregated SIC codes; attention only to manufacturing; the assumption that the presence of fast-growing industries nationally is the key aspect of changing industrial structure; failure to distinguish leaders and followers among industries; and excess aggregation at the regional level.* Fuchs (1962), for example, contradicts his own shift-share analysis by showing that the fate of states and regions for the study period were extremely dependent on the behavior of a few key industries. (cf. critiques of shift-share)

Another way of treating industrial change has been "product cycle" theory, based on the observation that historically, new products (industries) have appeared, grown rapidly and then declined as substitutes arise. (Burns, 1933) One variant of this theory is that the fate of certain regions is closely tied to the growth cycle of their basic industries (e.g. Rees, 1979); another that infant industries are bred in large cities and decentralize as they mature and become more standardized in production (Hoover, 1948); another that whole regions go through growth cycles. (Rees, 1978) The product cycle theory posits a pattern of repeating events that, while suggestive, does not account sufficiently for the uneven development of process and organizational change in specific industries.

From the discussion of investment and location in section B.1, and the model of capitalist reproduction in Part A, we conclude that

*The regional base conception suffers from a misplaced emphasis on location rather than capital (sec. B.1) and on autonomous regions, rather than linkages (sec. B.3).

investment patterns are the principal force behind locational outcomes and that those patterns are altered systematically over time by the dynamics unleashed by the drive to accumulate principally through developments in productive technology (including new and substitute products) and in business organization. (Sec. A.5, A.6, A.7) To be more precise, consider the following two aspects of micro- and macro-level relocation, which are complications of points made in section B.1 regarding the importance of investment and non-commodity factors in location.

First are the conditions which determine when and how much investment or disinvestment takes place. These involve both capacity to invest and incentive to invest; they also involve some combination of (1) individual circumstances of each firm; (2) conditions in different industries; and (3) aggregate dynamics of the national and international economy. The internal conditions of individual firms differ. For example, one ^{invest} firm may not because it suffers from excess capacity; another may not close down an old plant even though it has a low rate of return. (NRPB, 1942) Similarly, differences in the conditions of investment between whole industries, such as steel and electronics, will be substantial. Locational analysis thus requires disaggregated studies of industries and enterprises. Finally, aggregate patterns of investment in the economy can also be discerned. Investment and locational shifts appear to occur in waves, with expansion during upswings in the business cycle and disinvestment during recession periods. (Sec. A.7)* A major

*Factory investment follows a quincennial and decennial pattern of swings, office and commercial construction a twenty-year cycle. (Gottlieb, 1976)

period of economic retrenchment such as the 1970s clearly triggered many plant closings and relocations. The relation of business cycles to locational processes needs further study.

Second are the changes in products, production processes and organization involved in the development of the forces of production--the concrete form that capital takes with each investment or wave of investment. (Sec. A.6) They determine the actual factor-demands of industrial plants and open up new opportunities to exploit factor supply differentials.* In other words, not only must investment and location theory be unified, production theory (the study of technical change) and industrial organization theory must also be brought to bear on the location problem.

Production and organizational changes have been referred to as "restructuring." (Massey & Meegan, 1978) Such restructuring varies by firm and by industry, depending on the specific conditions to be found in each, but also has an aggregate dynamic. For example, corporate mergers, which raise the level of centralization in the economy and prepare the way for investments on a larger scale, have occurred in distinct waves such as the one which peaked in the years 1968-69 and which set the stage of many of the technical changes and relocations of the 1970s. (Blair, 1972) The adoption of technological innovation is also uneven, tending to be strongest in the upswing of the business cycle.**

*This shifting demand also applies to the expansion of labor-processes dealing with circulation and management.

**That technical change is an economic process, not an exogenous scientific one, is made abundantly clear by the evidence on the substantial time-lag between all major inventions and their adoption in practice (Mansfield, 1977; Rosenberg, 1972)

(Schumpeter, 1939} Although the relation between investment dynamics, fundamental changes in technology and organization, and locational shifts has not been sufficiently examined, our hypothesis is that a strong temporal correlation exists.*

The best evidence for this contention is Massey's research on locational change in the British electronics industry. (Massey, 1978a, 1978b; Massey & Meegan, 1978) She shows such movements to be motivated by external conditions of accumulation, international competition and a sagging world economy, in conjunction with the internal conditions of accumulation in different British industries and firms, such as buoyancy of demand, over-or under-capacity, technical innovation, and financial solvency. Firms in the industries studied engaged (with the help of the government) in various forms of restructuring--meaning changes in production processes, openings and closings of plants, and mergers. The latter device, or financial restructuring, was generally a prerequisite to productive restructuring, whether involving additions, subtractions or technical transformation. But it was the actual adjustments in production which generated new factor demands and altered the industrial (and employment) landscape.

Massey's findings indicate that industry-wide and world-wide dynamics are antecedent to factor-supply conditions in causing locational change,

*Schmenner (1978), for example, notes that locational shifts are usually associated with production changes.

although neither alone is sufficient to explain that change. Firms did not simply move in response to factor-supply differentials, which had, after all, existed for some time. They needed both cause and capability for undertaking the restructuring which produced a new ensemble of factor demands. (cf. Estall & Buchanan, 1961; Heal, 1974; North, 1974)

These conclusions must not be overgeneralized, of course. Locational change may not occur even with restructuring. For example, an obsolete facility may be torn down and replaced by a new one embodying quite altered production requirements, but these may still be available locally. On the other hand, locational change may occur without restructuring, owing to the ever-present drive for competitive advantage, as in the neo-classical model. Or it may take place with restructuring of production but not of organization, or vice versa.

Nonetheless, the general picture we wish to draw of locational change is not very similar to the neo-classical one, with its marginal adjustments and equilibrating tendencies in a static world. Nor is it compatible with "behavioralist" models of environmental stress, which suffer from vagueness, eclectic description of all possible "stressors," and excessive attention to the internal conditions of the corporation and to strictly technical explanations for organizational change. (e.g. Hamilton, 1974a; Rees, 1972; North, 1974; Townroe, 1972; Pred, 1967) Nor, finally, is the product cycle model sufficient so long as it stands apart from other types of restructuring, and relies on exogenous technical causality. (cf. sec. A.6, A.7, B.3)

The gist of the marxist model of capitalist reproduction is that capitalism creates a restless drive to expand, to develop the forces of production, and generally to rearrange the social structure of accumulation. (See sec. A.1, A.5, A.6, A.7) Because of this, it is forever altering the basis for the industrial space-economy, regardless of the initial distribution of factor-supplies. To simplify, the corporate survivors of each crisis and merger wave are a new breed in terms of scale and organization. Their investments are bearers of a new breed of products and processes. Conversely, old products, obsolete processes and uncompetitive plants and firms disappear, rolling up the carpet from behind, as it were.

In the long run restructuring simply means industrial evolution, i.e. alterations in product mix, organizational structure, etc., or, if the changes are dramatic enough, industrial revolution, i.e. the transformation to a new stage of development. (Sec. A.7; cf. Massey, 1978b; Dunford, 1977b; Walker, 1980) What this means for industrial geography is not only a different landscape to describe but a new logic of industrial location to comprehend.*

*For example, the conglomerate corporation, which came into being in the merger wave of the late 1960s, creates new location forces, just as the "simple" large corporation, born circa 1900, did before it. (cf. sec. B.4)

3. Circulation and linkages

In addition to investment and production (and its organization), a third basic component of capital accumulation and of the industrial location problem is circulation in terms of exchanges between industrial facilities.* The non-marxist equivalent to the study of this aspect of circulation is linkage analysis, which has become a staple of industrial location theory. (e.g. Hoover, 1948; Myrdal, 1957; Hirschman, 1958; Gilmour, 1974; ^{Britton, 1974;} Tornqvist, 1977; Pred, 1977) The gist of the linkage concept is not only that an essential consideration in industrial siting is how the facility can be linked into a geographic industrial system, but that the "exchange" between sites can take a variety of forms and that the character of the connections is a crucial parameter of location.

First, with regard to the kinds of "exchanges," linkage analysis begins with the physical movement of goods, or the transport problem--always a staple of location theory. Unfortunately, much neo-classical theory begins and ends with the transportation problem. (Chinitz, 1960; Losch, 1954; Isard, 1956; Mills, 1972) Linkage theory includes an awareness of the network of commodity exchange between plants, as well as to final consumers, and notes the determinant production relations that must be established in many "production systems"--i.e. input-output relations (which are often technically fixed in the short run).** Such production

*Circulation was introduced previously in terms of the sequential forms of capital (Sec. B.1) Here it refers to the integration of simultaneous labor processes.

**This input-output concept was revived by Leontief in the early 1950s, but goes back to Marx and Quesnay.

system relations are becoming more important as the degree of materials processing and of component-assembly type production increases over time. (Perloff et al, 1960)

Linkage analysis has been extended from commodity flows to other kinds of exchanges, or spatial ties. Financial, informational and service linkages are three types of non-material aspects of circulation. The first refers to money and credit flows. The second means essentially business communications, the vast bulk of which consists of written or electronic data on commodities and money. The third category includes repairs (commodity maintenance), business and professional services (advice to management) and exchange facilitation (brokerage, advertising, etc.) (cf. sec. A.9; B.7)

Finally, as regards the means of circulation, linkage analysis calls attention not only to the market mechanism but also to the technical capabilities of the communication-transport system and to intra-firm (non-market) transfers of materials, information, finances and services. (cf. sec. A.6)

Linkage or circulation analysis forces one to modify the partial equilibrium approach to location--to recognize the relational nature of location decisions in space. That is, the viability of a site depends both on the location of other facilities and on the media of circulation. In other words, one cannot easily define a plant's optimal position with respect to markets and factors of production when one plant's output is another plant's input or when a corporation makes internal pricing decisions. (cf. below, sec. B.5)

This idea is not new. The essence of economies of agglomeration, which have long been recognized as a powerful locational force, is the

mutually beneficial effects of spatial concentration, given historical limitations on the means of circulation, such as the transport-communications net, the corporation, and the financial system.* The heyday of agglomeration, therefore, was the late 19th and early 20th centuries (Pred, 1966; Walker, 1977)

Linkages are basically an updated version of agglomeration effects** The newer concept is more appropriate to the modern world of rapid communications and large corporations, in which industry is less concentrated in cities or particular regions. (Fuchs, 1962; Pred, 1977) In other words, linkage analysis directs attention to the capabilities of the means of circulation and how their development has reduced dependence on spatial propinquity. This trend has meant greater locational freedom or capability to choose among a wider geographic range of sites. (Keeble, 1976; Hamilton, 1978; Estall & Buchanan, 1962) This does not mean that industry is simply "footloose," because the linkages that bind capitalist production processes are still present. These now form complex, inter-regional networks, which wreak havoc with "regionalist" conceptions of growth, such as growth pole, export-base and "leading-loggng" sector theories. (See also below, Sec. B.6 and B.7) (Pred, 1977; Duncan, et al, 1960)

Linkage analysis suffers, however, from its isolation from a systematic theory of capital accumulation. First, ordinary representations

*Agglomeration economies include such things as a mutual shortening of transport and communication distances, creation of market thresholds, and sharing of specialized services (Weber, 1909; Hoover, 1948; Hoover & Vernon, 1959; Perloff et al, 1960; Pred, 1966; Estall & Buchanan, 1962; Britton, 1974; Gilmour, 1974; Holland, 1976)

**However, since linkages apply chiefly to connection between firms and plant, the concept misses some things that agglomeration effects included, such as the formation of a labor pool and the sharing of infrastructure. (Gilmour, 1974; Chinitz, 1961)

of the subject have no integrative notion of the circulation of capital and of the relation of circulation to accumulation, i.e. to production and investment. (See sec. A.4-6) The results are that (1) their "definition" of linkages usually consists of an eclectic listing of exchanges and means of exchange; (2) undue attention is given to the physical pathways defining linkages, rather than to the process of circulation; and (3) technical (or organizational) change in the means of circulation becomes an exogenous explanation for locational change.

Putting the means of circulation over the process of circulation means severing investment and location theory (cf. sec. B.1) As a result, linkage analysis is only the more sophisticated form of the neo-classical preoccupation with commodity relations and with location as a static allocation problem. The simplest way of restoring balance is to "add" investment to one's model. For example, latter day Keynesians, following Myrdal (1957), have combined investment and linkages to produce provocative dynamic models of "cumulative causation" in regional imbalance and urban concentration. (Pred, 1966; Holland, 1976; Hirschman, 1958) The big problem with such theories is that they make industrial concentration seem eternal, contradicting recent evidence on dispersal (e.g. Keeble, 1976). This failure comes from not allowing for industrial evolution, including revolutions in the mode of spatial circulation. (cf. sec. B.2 and below, this sec.) In other words, one must combine the dynamics of investment, production (and organization) changes, and circulation.

Priority must be placed on the patterns of investment and of production over those of circulation. These patterns establish the "demand" or need for certain linkages. This follows from the

conclusions of sections B.1 & B.2, that investment-production decisions as to what and how much to produce "create" a certain factor demand--and hence linkages to other producers. One way this happens is when, in the modern economy, a large corporation's decision to invest generates "linked" production at a variety of locations. (Pred, 1977) Another dimension is that production changes to lighter products, more flexible energy supplies, standardization of parts and products, and larger scale units have drastically altered the demands on the transportation-communication system and on other firms--and have contributed to the trend toward greater locational capability, mentioned earlier. Yet another development with a similar effect is the internalization of many former market transactions by the growth of the corporation, an institution which spans production and circulation. (Sec. A.6)

None of these aspects of the demand for linkages and changing linkage structure is entirely foreign to conventional writers. (e.g. Hoover and Vernon, 1959; Hamilton, 1978; Pred, 1977; Keeble, 1976; Estall and Buchanan, 1961) But the dynamics of the situation seemed to have been largely missed. Hence the widely encountered error of ascribing changes in the industrial space-economy principally to technical changes in the means of circulation. (Storper, 1980) The simplest version of this form of locational analysis is transport-technology determinism, e.g. the railroad created one kind of industrial landscape, a concentrated one, and the automobile another, a deconcentrated one. (e.g. Borchert, 1967; Chinitz, 1961) This is a sadly truncated theory of restructuring of the space-economy. The "demand" for linkages, noted above, changes over time owing to productive and organizational restructuring--industrial evolution as a whole. (cf. Sec. B.2)

Of course, the technical feasibility of all possible production and circulation patterns is by no means assured, so the limits set by technology in the process of circulation play a definite role; as those limits expand, dramatic new possibilities for capital accumulation may arise (Pred, 1980). Nonetheless, one must recognize that techniques are invented and adopted in relation to the need to solve particular social problems. Students of technical development cannot be understood without reference to the demand for innovation. But a pure demand-pull theory is no better than a single technical determinism. The answer lies in structural analysis which demonstrates how the conditions of circulation were satisfied or created barriers to accumulation which had to be swept away. (Sec. A.1, A.7, A.8; cf. B.5)

The general problem faced by capitalist circulation is to overcome the barrier of space, as any other barrier to accumulation. We should expect, therefore, that there would be a systematic tendency toward innovations that hasten the speed and lower the cost of circulation. (Sec. A.4; A.6; Harvey, 1975) This tendency will be propelled by technical linkages between production and circulation (Marx 1967, I, 384), by the profit-motives of the capitalists supplying means of circulation, and by the tendency for surplus capital from the primary circuit of accumulation to push into long term fixed capital investments in the built-environment, including means of circulation. (Harvey, 1978; Sec. A.4)

Finally, one should not expect that changes in circulation and linkage patterns come about through a gradual unfolding of technical and organizational development. Instead, the restructuring of the means of circulation and of investment-production patterns which affect the

circulation "problems" will be caught up together in the cyclical dynamics of capital accumulation. (Sec. A.7; B.2) In other words, capitalism necessarily revolutionizes the parameters of circulation over time, as well as those of production; it does so in an uneven manner; and, in so doing, it periodically transforms the logic of the geographic patterns we study.

4. The rule of profits and the distribution of industry

Neo-classical location theory concentrates on the problem of allocating firms in space given the distribution of resources, labor, markets and other "market factors." (Fig. 1, part(a)) Although several basic inadequacies of this approach have been demonstrated, this does not mean that the problem of linking different sorts of plants, uneven regional development, or locational shifts of industry to the unequal distribution of market factors is an uninteresting or unimportant question. Traditional studies of industrial distribution and geographic shifts have focussed on statistical tests or historical appraisals of the relative weight to be given various factors. Wheat (1973), for example, emphasizes the pull of markets and climate. Fuchs (1962) stresses labor differential and natural resources. North (1955) argues for natural resources as the key to economic growth. Perloff et al (1960) incline more toward agglomeration effects--a composite of factors. Hamer (1973) explains urban decentralization in terms of land prices. Lesser factors are also variously mentioned. Indeed, some two dozen or more market factors have been shown to affect location decisions. (Vaughn, 1978; Storper, 1979) But the conclusions are frequently contradictory. (See also Woodbury, 1953; McLaughlin and Robock, 1949; Creamer, 1935, 1968; NRPB, 1942; Struyk and James, 1975; Keeble, 1976)

How are we to decide which factor(s) is (are) most important in location decisions? (cf. Fuchs, 1962; Markusen & Walker, 1980) Our answer has three parts: reaffirming the rule of profits (this section); arguing that factor supplies must also be seen in terms of the dynamics of accumulation as a whole (section B.5); and concluding that the labor factor is the most important overall and becoming more so. (Secs.B.6 & 7.)

It should be immediately apparent that the problem as posed by neo-classical theory, i.e., in terms strictly of costs and revenues, has no solution: no single factor is universally more important than the rest because the mix of factors varies considerably among industries and changes over time with revolutions in production. Hence the only universal measure of rational location is profits--recalling, of course, that in a dynamic context the possibilities for profit depend on the collective action of all capitalists. (Sections A.2, B.2-5; Robinson, 1972)

Up to now the profit measure has functioned rather imperfectly. On the one hand, initial location decisions have been limited by weak procedures for site evaluation, narrow geographic scope of operations, etc. Firms have made do with various rules of thumb, such as personal acquaintance with an area. (Hamilton, 1974a; Stafford, 1972, 1974; Townroe, 1972; Krumme, 1969; North, 1974) Hence historic ties to merchant capital (initial advantage), inertia, uncertainty and chance have played a big role in location decisions. (Pred, 1966; North, 1977; Webber, 1972) On the other hand, competitive selection for rationally-placed plants has been rather imperfect, owing chiefly to spatial monopoly.

Today these barriers to ex ante judgement and ex post enforcement of the rule of comparative profits are breaking down rapidly. Since few plants are truly "footloose," this means that greater locational freedom makes location decisions harder and more exacting, not easier. (cf. Estall & Buchanan, 1961) Management now looks over a very wide range of possible sites, demands more information about their relative advantages, and has improved computer-aided techniques for weighing their virtues. (Estall & Buchanan, 1961; Business Week, 1980) At the same time,

interregional and interindustry barriers have lessened, exposing producers to greater competitive pressures from outside their region and product-line. (Pred, 1977; Rosenberg, 1972) Equalization of profits is also enforced within corporations, as may be seen from the behavior of conglomerates which have brought up profitable local companies and then demanded a level of performance comparable to alternative uses of capital elsewhere in the corporation; where that level has not been forthcoming, facilities have been closed. (Bluestone et. al, 1979) In other words, the tendency of capitalism toward perfection of the relations of production--in this case the equalization of profit rates--has a locational dimension: the elimination of geographic barriers to the circulation of capital. (cf. Sections A.1, A.6)*

5. Factor creation and differentials

Another basic problem with trying to measure the relative weight of different market factors in location decisions or regional development is that one cannot assume that the distribution of factors is independent of the distribution of industry. In other words, factor supply must also be integrated with the dynamics of accumulation as a whole. This does not mean simply that the demand for factors changes, as for example, where process innovation in primary metals allowing the use of a previously uneconomic low-grade ore results in a shift in plant location. Such

*This does not, however, reverse the fact that locational optimization is subordinate to many other concerns in the firm's strategy of accumulation, particularly technical progress. (cf. Secs. B.1, A.6; Mandel, 1975) The same is true as regards the labor factor, treated below. (sec. B.6)

effects are already covered by the analysis in section B.2. It means, instead, that both the location and the condition of factor supplies and markets can be altered by the action of capitalists and effects of capital in general. This idea has already been touched on in the section on linkages, but the process is more general than implied there. Capital may be able to create appropriate conditions for location where they did not exist before or destroy the favorable conditions which attracted firms to a region in the first place. Such creative actions can be very direct and conscious, such as recruiting immigrant labor to new factory sites (Piore, 1979) or pressuring local government to relax pollution laws. (Storper, Walker & Widess, 1979) They may also be quite indirect and unplanned, as in the case of the distant effects of U.S. and Russian agricultural expansion on the world grain market in the 19th century, which undercut European farmers and promoted emigration to America. (cf. Harvey, 1975, 1978; Marx, 1967, I, ch. 25; Walker, 1978a)

Marx's great insight on the demand and supply of labor-power is that capital works at both ends. (Marx, 1967, I, ch. 25) What, then, is cause and what is effect, the demand or the supply of factors? While the precise interaction of the two in space remains a serious research task in locational analysis, and while we would emphasize the role of demand, simple cause and effect is not necessarily the issue. Either can be actively altered by capital. The structural requirement is only that they come together if capital accumulation is to proceed. In other words, the problem is not principally to discover how this or that factor determined industrial siting decisions, particularly in light of the complex of

factors which any plant requires (cf. sec. B.1; B.4), but rather to discover how an appropriate geography of accumulation as a whole has been forged at each stage of capitalist development through adjustment in both supply and demand (Sec. A.1; A.8; B.3; Harvey, 1975)

Given this warning, one can continue with the search for the relative importance of various market factors for location. Confining ourselves to the three biggest factors--labor, markets, and materials, some basic observations are in order. First, most observers agree that natural resources are no longer a major factor (except perhaps for climate)*, owing to more efficient processing, available substitutes, the expansion of assembly-type production over processing, and the rise of office-based activities. (Perloff et al, 1960; Creamer, 1935; NRPB, 1942; Wheat, 1973; but cf. Fuchs, 1962) Most material inputs are now produced commodities.

Second, the reverse proposition is that over half of all output is sold to other businesses (NRPB, 1942)--i.e., involves inter-industry linkages (cf. Sec. B.3). As noted previously, this undermines partial equilibrium notions of market causality, because markets are created by the collective actions of capitalists. Add to this the fact that most final consumers are employees of private industry and the whole theory of market-pull in industrial location becomes exceedingly shaky. (Fuchs, 1962) One way of getting around the naivest forms of market-causality (e.g. Wheat, 1973) is to isolate leading sectors from dependent activities, as in export-base models. (North, 1955; Hoyt, 1962) But this

*Chiefly for reasons connected with production, not life-style.

approach still founders on the problem of partiality (in a big enough area, there are no exports) and the overlap between internal and external linkages. (cf. Sec. B.3)

These remarks on materials and markets support, in a preliminary way, the case for labor as the most important locational factor. But before taking that argument further (see below, sec. B.6), the problem of factor differentials must be taken up with respect to agglomeration and dispersal trends.

Agglomeration theory, including cumulative causality models, makes a convincing case that urban concentration itself is generative of growth: this argument is made even stronger by including the role of the labor pool and labor migration, shared use of infrastructure, access to information and innovation, etc. (Vernon & Hoover, 1959; Pred, 1966) One must conclude that during the heyday of small manufacturing in the late 19th and early 20th centuries, agglomeration was the single most important locational factor, with the result that most industrial activity ended up in large cities and most large cities in core manufacturing belts. (Perloff et al, 1960; Pred, 1966; Creamer, 1935; NRPB, 1942; Fuchs, 1962) Over the course of this century, however, transportation improvements, the large corporation, and so forth have created the potential for a more dispersed space-economy--a fundamental change in the logic of industrial location. (See sec. B.3)

But the capability of locating in a more dispersed pattern is not sufficient cause for doing so.* Factor differentials must obtain

*We have elsewhere made a similar distinction between "capability factors," which give the firm the possibility of choosing a general area, and "specification factors," which direct it to a specific spot. (Storper, Walker & Widdess, 1979)

between former locations which could be expanded and new locations at the urban, interurban, national or international "periphery." While this appears to return to the neo-classical way of understanding locational change (see above, sec. B.2), it does so only after considerable amendment in previous sections, and also does not take factor differentials to be exogenous to the process of capital accumulation. Here again, capital to a large degree creates its own factor supply conditions, which offer a barrier to accumulation, on the one hand, and an opportunity to higher profits, on the other. Referring only to the labor factor and to dispersal from urban centers, the past concentration of industry has created areas with the most experienced, skilled, well organized, high cost, and militant labor force; as a result many industries, not only those which are labor intensive, have found it advantageous to seek out greener pastures in the suburbs, small towns, the south and beyond. (Walker, 1980; Gordon, 1977; Estall & Buchanan, 1961; Hurley, 1959; Stuart, 1968; Dickson, 1948 ; De Vyver, 1951)*

The combination of increasing locational capability and the contradictions of concentration have combined to produce a steady trend of industrial dispersal from the core cities and regions of the U.S. since at least 1900. (Creamer, 1935; Fuchs, 1962; Creamer, 1968)

*This sort of factor differential, or diseconomy of agglomeration, is only slightly related to the physical scale of cities, however, as all those who have tried in vain to determine the optimal scale of cities have always discovered to their chagrin.

6. The Labor Factor

In terms of its effect on the relative profitability of different locations, the labor factor has always been a primary consideration for industry. But its role was frequently overshadowed in the past by the pull of natural resources, final markets, or agglomerative forces.* The trend today toward greater locational capability appears, however, to be making the labor factor even more important than in the past. This view is borne out by behavioral studies which show the various facets of labor supply to be preeminent in capitalists' minds when they are making location decisions. (Townroe, 1972; Moriarty, 1979; Luttrell, 1962; Stafford, 1974; But cf. McLaughlin & Robock, 1949; Ellis, 1949) However, since all such studies are based on firm-by-firm interviews, their partial and behavioralist analysis cannot be taken as conclusive as regards aggregate and economic processes. (cf. Secs. B.3, B.5) Further theoretical and empirical backing is required. Keeping in mind prior caveats about the rule of profits, factor creation and the general dynamics of accumulation, we believe that a strong argument can still be made for the primacy of labor over all other market factors influencing industrial location. This argument rests on three characteristics of the labor force: cost, control and reproduction. Only one of these--costs--falls within the compass of neo-classical price theory. (cf. sec. B.4)

*Though not so much as some commentators, particularly the market-pull school of regional change, have thought.

costs: Labor is still the largest single factor affecting production costs on the average for all industries. This claim needs some clarification, however, since it is well known that the share of wages in total costs has decreased in basic manufacturing, owing to progress in mechanization.

(Luger, 1980) There are two aspects of labor costs to be considered. On the one hand, wage costs remain a significant item across all industries.

(Lynch, 1973; Moriarty, 1979) The decline in the wage-bill has not been as precipitous as might appear from the general level of technical advance, owing to offsetting forces such as the creation of new labor-intensive activities (e.g. electronics assembly), a rising value of labor-power (wage-standard), and the simultaneous decline in unit costs of other inputs, such as machinery, natural resources and land. Furthermore, for "industry" as a whole, including all non-manufacturing activity, the share of labor has not declined noticeably in the long run thanks to the ability of a more productive manufacturing base to support increased circulation and management functions. (Kuznets, 1960; Crum & Gudgin, 1977; cf. sections A.4; A.8)

Furthermore, the wage-bill is not all that counts in costing out the labor factor. The cost of labor (unit costs), as opposed to labor-power (wage costs) also includes the relative productivity and intensity of the workers, which have several aspects (Marx, 1967, I, Ch. 19). The aspect most directly related to cost is skill. Other

aspects include control and reproduction, which are discussed separately below.

The important point is that the quality of labor-power is a locational factor (see Figure 1).

It has long been known that skill differences made core regions and most large cities more attractive for certain industries than other locations (e.g. Hoover, 1948; Pred, 1966; Weber, 1909; Hoover & Vernon, 1959; Cohn, 1951; Massey & Meegan, 1978). What is more, "skills" are important not only in industries of an obvious craft nature. High-technology industries frequently require considerable learned or acquired knowledge for specific aspects of production, such as design, construction and maintenance of facilities. (Storper, Walker, & Widess, 1979) Nonetheless, one finds innumerable empirical studies of location that seriously underestimate the role of labor costs by using limited measures of labor force differences such as wages and unionization rates or by presuming that "labor-oriented" firms are only those with a high proportion of wages in total costs or a demand for unskilled labor. (e.g. Fuchs, 1962; Wheat, 1973) Even the inclusion of skills, however, leaves much to be desired by its simplification of differences in job content and the human factors involved in defining the "quality of labor power." (See below.)

control: Labor-power stands out among the constituents of production because it alone is alive, conscious and antagonistic to the domination of capital. (sec. A.3) The wage rate, intensity of work, continuity of production (work stoppages), and the general difficulty of organizing production will depend on worker militancy. The latter, in turn, derives from community socialization, work experience and unionization, especially cultural values

about what sort of work, intensity and standard of living are acceptable.* (Gordon, 1978b; Gintis, 1976; Edwards, 1979; Sabel, 1978) Labor control, whether it is called "tractable labor," "labor climate," or something else, is thus a basic factor of location.** (Gallie, 1979; Goldthorpe and Lockwood, 1968; Durand, 1972; Mandel, 1975; Estall & Buchanan, 1961; Gordon, 1977b; Walker, 1980; Massey & Meegan, 1978; McLaughlin & Robock, 1949; de Vyver, 1951; Fuchs, 1962; Schmenner, 1978)

Moreover, labor control remains virtually as important in capital-intensive or highly mechanized industries as it does in labor-intensive ones. Indeed, worker cooperation and prevention of industrial sabotage are even more essential to productivity and continuity of production than in less sophisticated lines of industry. Furthermore, worker resistance to production restructuring, particularly where it affects job content, is an obstacle to technical change. Job content and skill are inextricably entwined with control over the conception and execution of the task. Deskilling, in particular, implies loss of such control and its transfer to management. (Braverman, 1974; Stone, 1974) Since competitive advantage flows increasingly from technical innovation, this aspect of the relation to labor is of great importance to capitalists and their location

*McLaughlin & Robock (1949) report that it is not unionization, per se, which is important to labor climate in management's eyes, but rather union militance.

**Marxist analysis shows that the social relations of the workplace determine the actual level of output for a given labor input and technology of production. The production function cannot be technologically determined. Neo-classical economic theory, on the other hand, dismisses the concrete social characteristics of the work situation. It posits a specific output level according to capital-labor ratio and labor utilization. The intensity and quality of work are said to be automatically reflected in the price paid for labor.

decisions.* Indeed, one may draw a connection in some cases, between the urge to deal with "labor trouble" by introducing labor-saving innovations and by relocating. (cf. Marx, 1967, I., 436)

reproduction: Except for labor, land and natural resources, all industrial inputs are true commodities, industrially produced and reproduced. (Sec.A.2; B.5) The consequence is that produced inputs (and markets for produced commodities) are more susceptible to a geographic leveling or homogenization process as the forces of production and circulation are developed. Hence locational differences in price, quantity and quality of produced goods has diminished over time, and this lessening of differences obtains regardless of the relative cost share of non-labor inputs and transport. Two results follow. On the one hand, there is greater location freedom for industrial plants, as previously noted. (Sec. B.4, B.5) On the other hand, competitive advantage in location can be gained only by exploiting differences in labor supply--differences which remain more significant than for true commodities because labor-power has yet to be reproduced on a strictly industrial basis.**

*This consideration leads us to divide relocating industries into two categories. The key dividing point is not whether they are labor-intensive or capital-intensive, but whether they are in the process of mechanizing further. That is, do they compete by means of searching out cheap labor, holding technology constant, or by technical innovation to reduce labor or materials costs. In either case, labor will be the main factor of location, but not for the same reason.

**The same is true of natural resources and land. The number of industries depending on unprocessed or weighty semi-processed raw materials has declined significantly (see sec. B.5), but there will still be a few obvious cases of resource-dependent location. Land remains significant on an intra-urban basis. In fact, one might say that industrial location on a national basis is approaching the state long realized within cities, in which land and labor have long been the decisive factors in decentralization of industry. (Schmenner, 1978)

Probably the greatest cause for labor-force differentiation lies in the way workers are reproduced outside the plant in their home, families and communities. This certainly has the effect of making labor a less mobile factor than other commodities, since the ties to a place are not easily severed. But more than this, the life-experience of workers is bound to working class communities which evolve in particular places. The character of these communities deeply affects the cultural values involved in workplace conflict, as well as political and other forms of activity outside the factory that have an impact on capital. (Piore, 1979; Sabel, 1978; Castells, 1977) In terms of our earlier discussion in Section B.5, then, labor-power may be called "the least creatable market factor." One indication of this is the persistence of significant wage and unionization rate differentials across locations right up to the present. (Segal, 1960; Varaiya, n.d.; Kearney, 1980; Bureau of Labor Statistics, 1979)

Nevertheless, labor-force reproduction is by no means independent of the accumulation of capital (sec. B.5). The latter has "creative" powers through such means as recruitment of migrant labor and the shaping force of job experience on working class communities. Indeed, the thrust of recent literature of labor markets has been on explaining general features of the labor force by industrial labor demand rather than the characteristics of the workers (Piore, 1979; Doeringer & Piore, 1975; Gordon, Edwards, and Reich, 1975; Edwards, 1979). But this reverse-form of monocausal explanation cannot explain everything and hence these writers recognize, implicitly

or explicitly, the critical impact in certain instances of community (Piore, 1979) and unionization (Edwards, 1979) on hiring practices and job structures.

Although none of the above arguments supports an absolute priority for labor among all market factors in the allocation and movement of industry, their combined weight leads us to conclude that capitalists, as they strive for competitive advantage or otherwise respond to the drives of accumulation (Sec. A.5), increasingly find the labor-factor to be the chief differentiating condition among regions and localities. This conclusion is diametrically opposed to most thinking on trends in industrial location. (e.g. Estall & Buchanan, 1961; Wheat, 1973; McLaughlin & Robock, 1949; Creamer, 1935)

What constitutes an "appropriate labor force" for any facility, however, is a thorny problem which cannot be answered apart from an investigation of the specific needs of different industries and enterprises and the characteristics of potential work forces. (cf. Markusen & Walker, 1980; Massey & Meegan, 1978; Bluestone & Harrison, 1979) It depends on a combination of technical conditions of production and characteristics of an industry, such as the stability of demand and competitive structure, which, in turn, generate a demand (or job structure) for labor of various sorts, combining skills, wages, reliability, and so forth. (Piore, 1979; Scherer, 1970; Bain, 1968; Reich, Gordon & Weisskopf, 1979)

7. The Changing Spatial Division of Labor

An important idea in the location literature is that which links the process of deskilling through standardization of mass production facilities to decentralization of industry from urban cores with a large component of skilled labor to urban, national or international peripheries with unskilled labor. A spatial division of labor thus emerges among workplaces at different stages in the mechanization and deskilling process including non-manufacturing establishments. This view is common both to "product cycle" and marxist approaches. (e.g. Hoover, 1948; Chinitz & Vernon, 1960; Massey & Meegan, 1978; Schmenner, 1978) Onto this basically sound germ of a theory, we should like to add some refinements, since the model as stated is overly simplified.

First, technological process does not always mean deskilling, as new, "revalued" jobs are constantly being created, such as supervision and maintenance of highly automated production systems. (Gallie, 1979; Braverman, 1974; Touraine, 1965; Mandel, 1975; Durand, 1972; Estall & Buchanan, 1961) (Such jobs will likely come under attack if their mass or expense grows, however) A further complication in locating an appropriate labor force is that the labor demand of a typical large plant will include workers from several skill levels and labor market segments. Therefore, such a plant will draw on different local communities. This is true, for example, in semi conductor production, where both high-technology designers and unskilled manual laborers are needed. As it turns out, securing the former

is the crucial locational factor, since the latter are more universally available in the form of female labor. (Saxenian, 1979)

Second, skill is not a sufficient index of job content, as was indicated above. (Sec. B.6)

Third, labor control adds another dimension to the distribution of industry. This is clear in the case of decentralization to small towns, which may offer a better labor climate in the eyes of employees, regardless of the kind of industry.* (Hurley, 1959; Stuart, 1968; Dickson, 1949; McLaughlin and Robock, 1949) (cf. Section B.5) Locational shifts away from big cities have been especially noticeable in case of production restructuring, because workers in former sites refused to accept lower skill and wage levels. (Hareven, 1977; Dawley, 1978; Massey & Meegan, 1978; Massey, 1978b) Neither of these advantages of small towns over big cities today--costs or control--can be taken as inevitable. In the late 19th century small towns probably came to have a disadvantage in terms both of control and wages. (Gordon, 1977; Walker, 1978a)

The key aspect of the relation between workplace and community is the process of change. Stable communities of workers appear to breed resistance and higher standards of acceptable work, and capitalists have an interest in avoiding such opposition by such means as outside recruitment, dividing the labor force by ethnic origins, or by relocation. (Piore, 1979; Hareven, 1976). Another instance of control as a locational variable can be found

*Another advantage of small towns in the U.S. today is a growing semi-proletarian small farmer class, whose costs of reproduction and wages are lowered by reliance on part-time farming by the household.

in the policy which many companies have followed since the 1930s of constructing "parallel plants" to do the same task, so that a chain of interlocking production processes cannot be broken at its weakest link by labor militance. (Bauer, 1979; Bluestone et al, 1980)

Finally, the geography of industry is more accurately described as a "mosaic of unevenness" than as a center-periphery system today. (Walker, 1978b) This mosaic is coming to be based primarily on differences in the reproduction of labor-power. (cf. Castells, 1977) Pockets of segmented labor are distributed and reproduced in space by the interplay of groupings of industries with similar labor demands and communities with institutions and cultures appropriate to the wants and needs of a certain segment of workers. (Harvey, 1975b; Walker, 1980; Piore, 1979) But this mosaic is not a static creature of a given industrial structure. It is, rather, a combined product of industrial evolution and the locational strategies of an ever-changing industry in relation to the conditions and struggles of labor. (Friedmann, 1977)

Conclusion

Industrial location research and marxist theory have both undergone a revival in the 1970's. It is time they were joined. The task for marxists is to avoid repeating basic principles and to confront the results of empirical research by industrial geographers for the purpose of developing a better explanatory approach to industrial location. This paper is obviously only a step in that direction. The challenge for non-marxists,

on the other hand, is to confront the theoretical hodge-podge produced by the collapse of neo-classical hegemony in the field and its replacement chiefly by inductive conclusions from a mass of research. Product cycles, behaviorism and similar partial approaches are not a satisfactory answer to the need for synthetic theory in economic geography.

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