RR-76-4

THE INTERURBAN TRANSMISSION OF GROWTH IN ADVANCED ECONOMIES: EMPIRICAL FINDINGS VERSUS REGIONAL-PLANNING ASSUMPTIONS

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March 1976

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PREFACE

One of the major long run tasks of the Human Settlements and Services Research Area at IIASA is Human Settlement Systems: Development Processes and Strategies. The purpose of this task is to establish and use a framework of functional urban regions to provide a better understanding of the impact of public policies on population distribution and economic activity. Although evaluations have been made of such policies, there is a lack of comparable data sets among countries. Moreover, the validity of conceptual models from which human settlement policies have taken their orientation is highly questionable. In particular, these models have neglected the role of multilocational organizations in the transmission of growth within systems of cities. This study by Allan Pred represents a significant contribution to our understanding of how growth processes actually operate within urban systems.

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Papers in the IIASA Series on Human Settlements and Services: Development Processes and Strategies.

1. Peter Hall, Niles Hansen and Harry Swain. "Urban Systems: A Comparative Analysis of Structure, Change and Public Policy." RM-75-35, 1975.

2. Niles Hansen. "A Critique of Economic Regionalizations of the United States." RR-75-32, 1975.

3. Niles Hansen. "International Cooperation and Regional Policies Within Nations." RM-75-48, 1975.

4. Peter Hall, Niles Hansen and Harry Swain. "Status and Future Directions of the Comparative Urban Region Study: A Summary of Workshop Conclusions." RM-75-59, 1975.

5. Niles Hansen. "Systems Approaches to Human Settlements." RM-76-37, 1976.

ABSTRACT

It is proposed that the disappointing record of growth-center and growth-pole policies in advanced economies is in some measure attributable to mistaken assumptions concerning interurban growth transmission. The reasoning behind the hinterland and hierarchical diffusion assumptions of interurban growth transmission is outlined and briefly criticized. The relationships between the spatial structure of organizations and interurban growth-transmission are sketched and organizational spatial structure data for seven metropolitan complexes of the western United States are presented. These data, and the summarized findings of other recent research projects, consistently point to the inaccuracy of the growth-transmission assumptions held by many regional planners and academics in advanced economies. Consequently, certain realities that need to be considered in regional development policy formulation are enumerated.

I. INTRODUCTION

It is often observed that "on the whole most countries have fallen short of their (regional policy) objectives, even when the policies have been pursued over decades" (Emanuel, 1974). This is true for post-industrial and highly industrialized countries and for less advanced economies. In particular, growth-center and growth-pole strategies designed either to stimulate regional development in lagging and depressed regions, or to hinder the expansion of major metropolitan complexes at best have met with limited success given the scale of efforts made. The dismal performance of the growth-center policy implemented by the Economic Development Administration in the United States is well known (e.g., Hansen, 1973). Similarly, the achievement record of growth-center and related policies in Australia, Canada, France, Great Britain, Japan, and in other advanced economies is far from impressive (e.g., Penouill, 1969; Kabaya, 1971; Walker, 1975).

In any advanced economy there are numerous and often complex reasons for the failure or modest attainments of growth-center and growth-pole policies. However, the evidence put forth in this report would seem to indicate that, in the great majority of instances, a substantial portion of the blame can be traced to grossly mistaken assumptions concerning the channels of interurban growth transmission that occur in economically advanced systems of cities. Thus, a brief critical look at these assumptions is necessary before examining the city-system interdependencies created by private-sector multilocational organizations headquartered in selected metropolitan complexes of the western United States, and before summarizing some related interurban growth-transmission findings recently presented by other researchers.

II. GROWTH-TRANSMISSION ASSUMPTIONS OF REGIONAL PLANNING

Most of the implicit and explicit assumptions made by practicing regional planners, academic consultants, and interested scholars regarding the spatial transmission of growth or the flow of multiplier effects and employment creation within systems of cities fall into two interrelated categories. First, there are those who contend that any significant investment or expansion of economic activity at a growth center or at a spatially defined growth pole will lead to a concentration of spread effects within the target center itself and its trading hinterland or zone of influence (e.g., Boudeville, 1966). More explicitly, most of those adhering to this Perroux-influenced school of thought assume that propulsive manufacturing activities, or lead firms, will always generate sizable employment-growth impacts in close proximity to the location of their operations as a consequence of the creation of backward and forward linkages and employee income expenditures (Hermansen, 1972; Erickson, 1972, 1974, 1975). Put somewhat differently, this group of planners and academics implicitly or explicitly assume that the interurban transmission of growth within economically advanced

city-systems is largely or totally confined to the flow of multiplier effects from cities of a given size to less populous nearby centers. The possibility that sizable nonlocal multiplier leakages occur to more distant urban places of larger, comparable, or smaller size is usually ignored.

The second category of commonly occurring growth-transmission assumptions is phrased in hierarchical diffusion terms derived from Christallerian central-place theory. According to Berry (1972, 1973), Lasuén (1971, 1973), and others, economic growth spreads on an interurban basis as a result of the filtering, or trickling down, of innovations downward through the urban hierarchy. In other words, economic innovations supposedly are initially adopted without exception in the largest metropolitan complex of a national or regional system of cities, and their subsequent paths of diffusion are determined by the size order of cities. Likewise, once economic innovations are intentionally introduced in a regional growth center they, or their growth impulses, presumably sooner or later will descend downward through the regional urban hierarchy, with the population rank of hinterland centers dictating the locational sequence of adoptions or felt growth impulses. The possibility of interurban growth transmission occurring from a city of given size to places of comparable or larger size is therefore also denied--at least implicitly--by diffusion proponents of growth-center planning.

Both the propulsive industry, or hinterland, and the diffusion views of interurban growth transmission are characterized by numerous shortcomings. Insofar as the propulsive industry version of growth transmission is inseparable from applied growth-pole theory, it is subject to the wide range of criticisms directed toward that so-called theory (e.g., Darwent, 1969; Jansen, 1970; Kongstad, 1974; Monstad, 1974; Pred, 1973a, 1974a; and Todd, 1973). To argue that growth transmission is mostly or fully restricted to the hinterland of a growth center is to maintain that regional or subregional city-systems have a very high degree of closure, i.e., a low degree of interaction and interdependence with urban units situated elsewhere in the national city-system. This position refutes the fact that the national system of cities of any advanced economy is a type of complex social system which, by definition, is distinguished by the extremely intricate interdependence of its component units (cf. Bourne, 1974). It also ignores the great likelihood that a large propulsive industrial unit will belong to a multilocational organization with a variety of extra-regional intra-organizational and interorganizational linkages (Krumme, 1970a, 1970b; Pred, 1974b, 1975c). Thus, Erickson has observed (1972, p. 431):

> The foremost problem encountered in economic growth based on backward directed (linkage) impulse(s) is the openness of most regional economies. Such openness would suggest that backward-directed pressures of demand by a lead firm may (not be met in a growth

center or its hinterland but instead) result in imports of necessary intermediate goods (or services) into the region.

The unrealistic nature of the assumption that a growth center and its zone of influence constitute a more or less closed system is perhaps best illustrated by the detailed input-output analyses carried out for large metropolitan complexes such as Philadelphia (Isard and Langford, 1971), Seattle-Tacoma (Beyers, 1974), and Stockholm (Artle, 1965). These analyses have consistently demonstrated that many of the most important goods and service linkages, or growth-transmission channels, of any given sector occur with nonlocal units. For example, despite its highly diversified economy, the Philadelphia metropolitan complex secures nearly 50 percent of its consumed goods and services from other locations. Likewise, despite greatly varied local demands, the Philadelphia metropolitan complex exports roughly 50 percent of its goods and service output. Even more significantly, the backward and forward linkages of Seattle-Tacoma's economic sectors on the whole are strongest with regions beyond the borders of the state of Washington, i.e. with regions lying outside the hinterland of that metropolitan complex. From findings such as these it may be concluded that the extra-regional interdependence of the smaller and less economically diverse cities typically selected as growth centers is normally considerable. Further support for this conclusion is provided by the organizational spatial structure data to be presented on later pages.

Hierarchical diffusion interpretations of interurban growth transmission rest on rather shaky empirical underpinnings. The small number of empirical studies attempting to link diffusion with the spatial spread of economic growth have centered mostly on innovations that are artifacts of growth, such as TV-ownership, rather than on growth-inducing innovations, such as new products and services, new production and communications technology, and new ways of performing or structuring the operations of business and government organizations. More importantly, it has been demonstrated at length (Pred, 1971, 1973a, 1974a, 1973b, 1975a) that inasmuch as hierarchical growth diffusion assumptions rest on Christallerian central-place theory, they are not defendable from either a logical or an empirical standpoint. Given its length and ready availability elsewhere, reasoning of how hierarchical growth-transmission arguments ignore the complexity of those intermetropolitan, economic and information-circulation relationships that channel the diffusion of growth-inducing innovations is not repeated here. However, it must be emphasized that while central-place theory is frequently invoked by regional planners, this theory is largely inappropriate as a basis for interurban growth-transmission assumptions. This is so because central-place theory is basically concerned with optimizing the convergence of consumers at points of supply, or with market-area and city-hinterland relationships, while the interurban transmission of growth in economically advanced economies is

largely the consequence of both input-output relationships and intraorganizational job-control and decision-making relationships. Finally, to the extent that a central-place hierarchical perspective on growth transmission is wedded to a growth-pole "theory" approach to the question (e.g., Hermansen, 1972), it is also susceptible to many of the broadsides aimed at that latter school of thought.

III. INTERURBAN GROWTH TRANSMISSION AND THE SPATIAL STRUCTURE OF ORGANIZATIONS

There are considerable obstacles to the empirical delineation of interurban growth transmission at a large scale. In advanced economies there is generally a paucity of data pertaining to the physical expression of interurban multiplier effects, or of data relating to the movement of goods, services, and monetary payments. Even where available, such data are usually inadequate in some aspect, such as precision or locational detail (Thompson, 1974). Input-output analysis, another theoretically possible means of specifying city-system interdependencies and growth-transmission channels, is highly impractical in reality. Input-output studies of the variety carried out for the Philadelphia, Seattle-Tacoma, and Stockholm metropolitan complexes are expensive and extremely time-consuming. Furthermore, such studies provide little locational information, only describing the relationships of an urban complex with "the rest of the world" or, at best, "the rest of the state". Thus, in order to secure details sufficient enough to outline growth transmission channels at a large scale (i.e., to specify sectoral input-output relationships between several urban regions of a national city-system) it would be necessary to undertake a project of unprecedented dimensions. And, even if it were feasible to carry out such a large-scale project, its results and utility would still be open to the criticisms (e.g. changing input and production coefficients) often directed toward much more modest input-output analyses (e.g., Richardson, 1973).

With flow-data and input-output options closed, probably the best means of gaining insight into the economic interdependencies and channels of growth transmission operating within the city-system of any advanced economy is by examining the spatial structure of multilocational organizations. The primary justification for doing this lies in the fact that the economy of countries such as Australia, the Federal Republic of Germany, Japan, Sweden, Switzerland, and the United States is dominated by large private-sector corporations and government organizations that are multilocational in character, i.e., comprised of a number of spatially separated and functionally differentiated units. A plentitude of revenue, asset, and employment data show that the relative and absolute economic might of multilocational organizations has burgeoned since the Second World War (e.g., Ahnström, 1973; Pred, 1974b; and Rogerson, 1974). Multilocational governmental organizations have grown in size owing to the assumption of new and expanded functions. Multilocational private-

sector organizations have swelled in size owing to intense merger and acquisition activities, the expansion of existing units, and the investment of capital in completely new units (e.g., Blair, 1972). For example, in 1974, 150 business enterprises answered for 88 percent of Sweden's total exports and, partly as a result of foreign operations, the country's 200 largest domestically headquartered business organizations had aggregate revenues that exceeded the gross national product (GNP) (Veckans Affärer, 1975). In short, insofar as multilocational organizations control the lion's share of any advanced economy, they are overwhelmingly the most important propagators of flows of goods, services, economic information, and capital; hence, the predominant source of interdependencies within the national city-system, and hence the most important generators of interurban growth transmission.

When the spatial structure of a multilocational organization can be specified, i.e., when the location, function(s), and relative size of its headquarters and other component units can be determined, it is possible both to make some fairly firm observations on the interurban growth-transmission channels created by intraorganizational relationships and to hazard some guesses concerning the interorganizationally generated flow of multiplier effects from city to city. Likewise, when data on the spatial structure of all significant locally headquartered multilocational organizations are aggregated for a city or for a large urban complex, it is possible to make some gross generalizations about the total pattern of intraorganizationally and interorganizationallly propagated growth-transmission channels associated with that particular city or urban complex.

Although the headquarters units of multilocational firms and corporations grant varying degrees of discretionary authority to their subservient regional or divisional administrative units, marketing offices, sales outlets, plants, or research centers, etc., (Pred, 1975c) they almost always retain certain minimal functions in order to cope with the diversity and instability of the economic, technological, and political environment. These include determining and coordinating strategic objectives, planning on a long term, resolving interunit or interdivisional conflicts, granting approval of projects involving major commitments of capital and manpower, and allocating funds and resources among competing operating divisions or subunits (Williamson, 1970; Lorsch and Allen, 1973). Whether or not the head office of a multilocational organization takes much responsibility for routine operational activities, there are virtually always important decision-making, information-flow, and service-provision linkages connecting an organization's headquarters and its subservient units--be they spatially proximate or distant (cf. Britton, 1974; Krumme, 1970; and Krumme and Hayter, 1975). Moreover, "as organizations grow, so does the need for internal co-ordination" (Goddard and Morris, 1974, p. 109). Therefore, any sizable employment or activity increase at an organizational subunit should result in some employment or activity increase at

organizational headquarters, or in the transmission of growth from the subunit city to the headquarter's metropolitan complex.

Some, but by no means all, of the interorganizationally based transmission of growth impacts from urban complex to urban complex can be surmised from organizational spatial structure data because of the limited-search and uncertainty-reduction syndromes of organizational decision-making behavior. These syndromes normally come into play whenever organizations make implicit locational decisions of the type that definitionally engender the flow of goods, services, information, and multiplier effects from place to place. (Every purchase of goods and services, every award of a contract or subcontract, and every allocation of capital is an implicit location decision insofar as it involves one or more places rather than others.) In spite of the obviously important ramifications of most implicit (and explicit) locational decision making, it has been repeatedly shown that multilocational organizations typically examine only a few decision options when considering new forms of action (e.g., Cyert and March, 1963; North, 1973). The limited search syndrome normally is ascribed to a number of factors; the most crucial is the time and cost expenses that would be incurred if highly salaried management and administrative personnel performed extensive search for each of the many decisions that multilocational organizations constantly must reach on such issues as labor relations, pricing, and public relations, as well as implicitly locational matters. Regardless of the factors underlying limited search, it frequently should result in the identification of familiar locational alternatives. This is so because limited search usually uncovers the most easily accessible information, and this information should originate from or near the location of the organization's already existing intraorganizational and external contacts. In sum, to the extent this is true, organizational spatial structure statistics can shed some light--however dim--on the interurban transmission of growth associated with interorganizational relationships.

The tendency for multilocational organizations to make implicit locational decisions that are influenced by their existing spatial structure (as well as by their existing interorganizational contacts) is reinforced by the commonplace desire of organizational decision makers to reduce uncertainty and avoid risk. In particular, large corporations are known to seek uncertainty reduction frequently by choosing alternatives that are viewed as similar to those opted for in the recent past by the corporation itself or by other organizations of which it is aware. The temptation to repeat the selection of alternatives previously chosen by the corporation itself may be further compounded by the possibility of obtaining scale economies, or lower per-unit purchase costs.

In a similar manner, the limited search and uncertainty reduction syndromes also affect the explicit locational decision-

making behavior of multilocational organizations. The somewhat more precise means by which explicit locational decision making, or the selection of locations for completely new organizational units, is affected by existing interurban information and growth-transmission channels, (which in turn, influences such intraorganizational and interorganizational channels in later time periods) has been explained in a model presented elsewhere in a number of versions (Pred, 1973a, 1974b, 1975a, 1975b, 1975c). The model and its associated arguments are not repeated here in part because they are not essential to an appreciation of the empirical materials that follow.

IV. EMPIRICAL EVIDENCE FROM SELECTED METROPOLITAN COMPLEXES OF THE WESTERN UNITED STATES

During the latter part of 1974 and the early months of 1975 an effort was made to ascertain the spatial structure of all the private-sector multilocational organizations employing 400 or more people that were then locally headquartered in eight metropolitan complexes of the western United States, as well as in Vancouver, Canada. A simple three-step procedure was used to elicit the virtually complete data for the seven metropolitan complexes covered in Tables 1 to 5 and Figures 1 to 9. First, a questionnaire was mailed out to the organizations requesting them to indicate the location of each of their US and Canadian units or any of their wholly-owned subsidiaries; the primary function(s) of each unit; and the number of people employed at each unit. Second, those organizations that either failed to respond or to provide adequate data were contacted by telephone. Finally, personal visits were paid to those firms and corporations that either exhibited reluctance or had supplied totally unusable data. Because of the well-known difficulty of obtaining financial statistics from business organizations, and because of a desire to obtain as complete a picture of city-system interdependencies as possible, the data requested concerned employment rather than revenues, assets, or purchase origins and sales destinations. Organizational job-control, or employment data were also sought since the research was undertaken with, among other things, a number of regional-planning policy questions in mind; moreover, the ultimate objective of so much regional planning in advanced economies is the creation and maintenance of new job opportunities.

When the data summarized in Tables 1 to 5 and Figures 1 to 9 are jointly considered, at least four generalizations emerge that are central to the question of interurban growth transmission within advanced economies.

Generalization 1. Despite the considerable distances separating the selected metropolitan complexes from the major part of the US-Canadian system of cities, the aggregate strength of nonlocal intraorganizational linkages created by their multilocational business organizations is considerable (Table 1). (In view of the limited search and uncertainty reduction arguments

outlined above, this should also be true of the nonlocal interorganizational linkages fostered by the multilocational firms and corporations in question.) Given the populations of the seven metropolitan complexes as of 1970,[1] only the San Diego SMSA has a less than impressive number of jobs controlled nonlocally (and locally) by multilocational private-sector organizations headquartered within its limits. In all seven cases the total volume of nonlocal intraorganizational linkages suggested by Tables 1 to 4 is considerably understated, in part owing to the exclusion of linkages involving partly-owned subsidiaries, and the omission of linkages involving joint ventures. For example, the 4,400 San Diego employees of National Steel and Shipbuilding have not been taken into account because the company is owned 50 percent by Kaiser Industries (based in Oakland) and 50 percent by Morrison-Knudsen Co. Inc. (based in Boise City). Were the company included, the nonlocal job-control totals of the San Francisco-Oakland-San Jose metropolitan complex and the Boise City SMSA would each be enhanced by 2,200. The aggregate volume of nonlocal intraorganizational linkages would be further enlarged if some account was taken of the job control of local divisional or subsidiary head offices belonging to corporations with elsewhere located organization-wide headquarters. (Job-control figures for the San Francisco-Oakland-San Jose metropolitan complex, for example, do not include the almost 100,000 employees of Pacific Telephone, despite the presence of its head administrative unit in San Francisco. Pacific Telephone is a subsidiary of the New York-based American Telephone & Telegraph Co.)

The San Diego exception with respect to nonlocal intraorganizational job control arises in some measure because of the leading part played in its economy by the federal government, especially the military establishment. That is, a very substantial portion of the linkages originating and terminating in the San Diego metropolitan complex are associated with public-sector multilocational organizations rather than with private-sector multilocational organizations. Moreover, as with the other selected metropolitan complexes, a large share of the local San Diego job-market and economy is directly tied into multilocational business organizations based in other metropolitan centers such as St. Louis, General Dynamics Corporation; Detroit, Burroughs Corporation; and San Francisco-Oakland-San Jose, Safeway Stores and Bank of America (see Table 4).[2]

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[1]The 1970 populations of the San Francisco-Oakland-San Jose, Seattle-Tacoma, Portland, Phoenix, Honolulu, and San Diego metropolitan complexes are given in Table 4. In 1970 the Boise City Standard Metropolitan Statistical Area had a population of 112,230.

[2]For 1972 data on the control of Phoenix SMSA manufacturing jobs by elsewhere headquartered multilocational business organizations, see Pred (1975c). For 1965 data on the nonlocal control of manufacturing jobs in the San-Francisco-Oakland-San Jose and Portland metropolitan complexes, see Pred (1974b, 1975a).

The San Diego case is counterpointed by the situation prevailing in the Boise City SMSA where, on a per capita basis, the level of nonlocal job control approaches that for the New York City metropolitan complex, which in turn accounts for roughly 33 percent of the job control associated with all US multilocational business organizations.[3] Boise's very high relative level of nonlocal intraorganizational linkages is mainly the product of four organizations: the Boise Cascade Corporation (forest-products conglomerate with 29,000 domestic and foreign employees); Morrison-Knudsen Co. Inc. (diversified heavy construction and engineering firm with 21,000 employees, mostly overseas); Albertsons Inc. (retailing concern with over $1 billion in sales during 1974, and about 14,000 employees), and J.R. Simplot Company (food processing and fertilizer mining and production, about 6,000 employees).

Generalization 2. Despite the exclusion of relationships involving partly-owned subsidiaries, joint ventures, and divisional or subsidiary head offices, the overall pattern of interurban growth transmission stemming from the spatial structure of multilocational organizations is complex in several senses. The spatial distribution of intraorganizational job-control linkages for most metropolitan complexes exhibits either limited distance decay, as in the San Francisco-Oakland-San Joe, Seattle-Tacoma, Portland, Boise City, and San Diego cases (Figures 1 to 4, 6, 7, and 9), or virtually no distance decay, as in the Phoenix SMSA example (Figure 5).[4] The distance decay of Honolulu's intraorganizational job-control linkages (Figure 8) is not an unanticipated exception, given both the extreme physical and time-zone distance separating that island metropolis from the eastern US and Canada, and the relatively recent and cautious entry of its major conglomerates (AMFAC, Castle & Cooke, Dillingham Corp.) into the operation of mainland retailing, production, and engineering units.

The complexity of the intermetropolitan pattern of intra-organizationally induced growth transmission is also ascribable to the number of these linkages radiating from individual centers. Multilocational business organizations based in the San Francisco-Oakland-San Jose complex, for example, control units in 234 other US and Canadian metropolitan centers. And, multilocational business organizations headquartered in Seattle-Tacoma operate offices, plants, and establishments in 144 other US-Canadian metropolitan complexes; the multilocational corporations based in the much less populous Boise City SMSA function in no fewer than 108 other metropolitan complexes scattered across the entire US-Canadian economic landscape.

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[3] Based on computations using employment data from Dun and Bradstreet Inc. (1974).

[4] For figures showing the spatial distribution of Seattle-Tacoma job-control linkages, see Pred (1975c).

Many linkage-pattern details are additionally complex in the sense that they are unexpected from a gravity-model perspective; this may be seen from the following examples:

a) the most important job-control linkages of the Phoenix SMSA are with the Chicago metropolitan complex, rather than with the comparably sized but physically much more proximate Los Angeles metropolitan complex (Figure 5);

b) the intraorganizationally generated interdependencies between San Francisco-Oakland-San Jose and the eastern Tennessee centers of Knoxville and Kingsport-Bristol are of greater importance than those with such metropolitan complexes as Detroit, Cincinnati, and Indianapolis, which lie at similar distances from northern California but have much larger populations (Figure 1); and

c) the leading job-control linkages of Seattle-Tacoma are with the Wichita SMSA and Philadelphia metropolitan complex rather than with larger and more locationally accessible metropolitan centers (Table 4).

The job-control distribution peculiarities and eccentricities of specific metropolitan complexes often lose much of their mystery once one is familiar with the nature of the corporations that dominate the local headquarters scene. Phoenix's pattern of intraorganizational linkages with other metropolitan complexes (Figure 5) becomes somewhat clearer because the Arizona center houses the headquarters of the Greyhound Corporation (bus transportation and manufacturing conglomerate with about 55,000 employees). Likewise, the Seattle-Tacoma pattern of intraorganizational growth-transmission ties with other metropolitan complexes is greatly influenced by the Boeing Company (aircraft production and aerospace activities with about 68,000 employees). Also the Portland pattern of job-control linkages with nonhinterland smaller cities and towns (Figure 4) is highly affected by three corporations with a total of over 67,000 employees (Georgia Pacific, Louisiana Pacific, and Evans Products), and by several smaller organizations that are primarily associated with forest products activities. In the context of previously mentioned limited-search and uncertainty-reduction observations, whenever a metropolitan complex has a major corporation, such as Boeing, operating on a large scale in an "unexpected" metropolitan center, such as Wichita, normally it also has several other multilocational organizations controlling units in the same center.

Generalization 3. Whatever the irregularities shaped by very large multilocational organizations, the total array of nonlocal intraorganizational growth-transmission linkages of business organizations based in any particular metropolitan complex is highlighted by ties with other metropolitan complexes. That is, the most important nonlocal intraorganizational (and, by extension,

interorganizational growth-transmission channels of any single metropolitan ccomplex do not extend between that urban unit and smaller places situated within its traditionally defined retail-trade, or central place, hinterland. In fact, for the seven centers covered here, the percentage of nonlocal intraorganizational linkages involving other metropolitan complexes ranges from 45.1 to 79.3, while the percentage of intraorganizational interdependencies involving hinterland locations is clustered between 2.9 and 21.2, with the exception of Honolulu (Table 2). More significantly, again with the exception of Honolulu, the ratio of nonhinterland metropolitan linkages to all hinterland linkages varies from a low of 2.3:1 to a high of 25.4:1 (Table 5).[5] Incomplete data indicate that generalization 3 is also true for the intraorganizational growth-transmission linkages generated by multilocational corporations and firms headquartered in the Los Angeles metropolitan complex.

Generalization 4. In every instance nonhinterland smaller towns and cities constitute an important element in the overall pattern of interurban growth-transmission channels of intraorganizational origin (Table 2 and Figures 2, 4, and 7). For five of the seven metropolitan complexes under discussion, the absolute number of jobs controlled by locally based multilocational organizations is greater for nonhinterland smaller towns and cities than it is for the hinterland as a whole. This is also true for the San Francisco-Oakland-San Jose metropolitan complex if its hinterland is circumscribed in a less than liberal manner (Table 2).[6] As a consequence of the magnitude of job-control interdependencies involving nonhinterland smaller towns and cities, the ratio of all nonhinterland linkages to all hinterland linkages is 3.7:1 or greater (Table 5).

As indicated earlier, it is not possible to exactly specify the means by which the intraorganizational transmission of growth between cities is related to the interorganizational transmission of growth between cities. Nevertheless, the above generalizations--and especially generalizations 3 and 4--would seem to indicate that the assumptions normally made by regional planners concerning the spatial transmission of growth are both grossly incorrect and overly simple. If the data presented here are at all representative of the interdependencies to be found in economically advanced systems of cities, and if the ratio of all nonhinterland linkages to all hinterland linkages elsewhere is also

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[5]The unusually great relative importance of the Honolulu SMSA's hinterland linkages is once more relatable to the traditional plantation-agriculture functions of its leading corporations and the metropolitan center's time-zone and physical distances from the continental US.

[6]The failure of the statement to hold true for the Honolulu SMSA is understandable; see footnote 5.

typically 3.7:1 or more, then any assumption that the nonlocal growth impact of large-scale investments or propulsive industry expansion in a growth center will be mostly or totally concentrated in the center's hinterland is likely to be very wrong. On the contrary, Figures 1 to 9 not only underline the significance of nonhinterland linkages in general, but also more precisely indicate that nonlocal multiplier-effect leakages can frequently involve head-office metropolitan complexes situated at considerable distances of a thousand miles or more.

The incompatibility of Christallerian central-place theory, or hierarchical diffusion growth-transmission assumptions with the above presented empirical materials can be summarized in a number of ways.

First, we can give the hierarchical diffusion assumption an extremely free interpretation, allowing it to mean that growth can be directly transmitted from a center of given size to any other urban place occurring within its hinterland, or to any less populous metropolitan complex outside its hinterland--regardless of the distance involved and of the existence of intervening larger metropolitan complexes.[7] Even under these relaxed circumstances, 41.8 to 80.1 percent of the job-control, or growth-transmission, linkages for the here observed metropolitan complexes go unaccounted for (Table 5, column I).

Secondly, we give the hierarchical diffusion assumption a strictly literal interpretation, disallowing the possibility that growth can be transmitted to any metropolitan complex located beyond the borders of a specific center's physically contiguous retail-trade hinterland. Now the spectrum of linkages unaccounted for is shifted upward considerably, spreading from 56.8 to 97.1 percent (Table 5, column II).

Thirdly, because of their importance, we focuse solely on intermetropolitan linkages, allowing the hierarchical assumption to mean that growth can be transmitted from a metropolitan center of a given size to any other metropolitan complex that is not of comparable or larger population--regardless of whether it occurs within the center's hinterland. Under these comparatively loose constraints, between 33.7 and 100.0 percent of the intermetropolitan job-control linkages associated with the seven studied metropolitan complexes cannot be accounted for (Table 5, column III).

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[7]The direct transmission of growth to nonhinterland smaller towns and cities is not permitted here because it is presumed, in accord with Christaller-based diffusion hypotheses, that such urban places can only receive direct growth impulses from those metropolitan complexes within whose sphere of influence they are located.

Finally, a strictly literal interpretation of hierarchical diffusion is applied, requiring intermetropolitan growth transmission to be confined to hinterland metropolitan complexes. The percentage of unexplained intermetropolitan linkages now reaches impressively high levels that fall between 80.4 and 100.0 percent (Table 5, column IV).

If we consider the magnitude of observed deviations under any of these four alternatives, it seems safe to suggest that only under unusual conditions can there be a firm foundation for the assumption that growth is transmitted solely via hierarchical diffusion from cities of a given size to less populous nearby centers.

V. OTHER RECENT FINDINGS ON INTERURBAN GROWTH TRANSMISSION

Recently, several researchers posing questions somewhat different from those raised here have produced a variety of evidence that also points to the inaccuracy of the interurban growth-transmission assumptions generally made by planners and academics in advanced economies. Only some of the most cogent of these findings are summarized below.

Finding 1. Based on data acquired "from a sample of manufacturing establishments located within 40 miles of downtown Montreal," Gilmour, (1974) found that the most important input-output linkages, or growth-transmission channels, occurred outside the local metropolitan complex. In particular, only 27.3 percent of all sales and 31.6 percent of all purchases resulted in intrametropolitan linkages. More notably, large establishments with 100 or more employees aggregately made "over half of all their transactions" outside of the Province of Quebec, or well outside the hinterland of the Montreal metropolitan complex. It is also relevant that Gilmour was able to attribute some of the "spatial expansiveness" of Montreal's manufacturing linkages to the economies obtained from interacting with distant units belonging to the same corporation or firm.

Finding 2. Britton's service-linkage study (1974) of 87 Ontario manufacturing plants reveals that key auditing, legal, and financial services are usually procured from Toronto and more distant non-Ontario metropolitan complexes if, as in most instances, the observed factory is part of a multilocational organization. The services obtained from Toronto or from more distant metropolitan locations apparently involve economies of scale which are either provided intraorganizationally, i.e., by divisional or organization-wide headquarters, or interorganizationally, i.e., by service firms serving a head office and many or all of its dependent units. In either case, such nonlocal service acquisition is synonymous with multiplier-effect leakages, or growth transmission, upward rather than downward through the urban hierarchy. Growth is transmitted to nonhinterland locations when service multipliers leak to Toronto and to other large North American metropolitan complexes either from the London or

St. Catherines-Niagara Falls metropolitan areas or from lesser Ontario urban places.

Finding 3. A detailed analysis of the input linkages and income generated by the Boeing Company of Seattle-Tacoma has led Erickson (1975) to conclude that the hinterland spread (or growth-transmission) effects of "propulsive" manufacturing activities "may be more illusory than real". While some local impact of the wage and salary expenditures of Boeing employees was discovered, the total impact of Boeing's interorganizational purchases on hinterland economic activities was comparatively small. As of 1967, nearly 90 percent of Boeing's purchases originated from beyond the Seattle-Tacoma hinterland, and "the firm's interindustry linkages generated income in the hinterland equal to only 0.003 percent of total hinterland value added". Furthermore, the most important metropolitan suppliers to Boeing's Seattle-Tacoma activities fell into three categories, none of which is in keeping with hierarchical diffusion interpretations of interurban growth transmission. The major input providers were located in the smaller but distant nonhinterland metropolitan complexes of Hartford (Conn.) and Rockford (Ill.), in the larger metropolitan complexes of Los Angeles, New York, Detroit, and Cleveland-Akron, and in the San Diego, Phoenix, and Dallas-Fort Worth metropolitan complexes--all of which belong to the same general population size category as Seattle-Tacoma.[8]

Finding 4. Moseley's investigations (1973a, 1973b) into the growth-transmission impacts of growth centers in East Anglia and Brittany have led him to observe that "severe doubts must be cast on the notion that 'growth impulses'...trickle down" to smaller places. With respect to Haverhill and Thetford, two East Anglian growth centers, it could be stated that expansion "has improved the choice of employment and presumably the prosperity of many residents of the small towns and villages surrounding them, but in terms of the generation of supplementary economic activity, such impulses appear to have 'trickled up'". For example, in 1971 roughly 93 percent of the material inputs of the large Haverhill and Thetford factories came from beyond East Anglia and Essex. Furthermore, most of the intraregional growth transmission resulting from industrial purchases terminated at larger urban units, particularly Cambridge and Norwich. With respect to Rennes, the leading metropolitan center of Brittany, trend surface analyses showed that the transmission of growth to hinterland locations was probably largely confined to places within a commuting radius of a mere 20 to 25 kilometers.

Finding 5. Research involving the Central Clydeside Conurbation, or Glasgow metropolitan complex, and other parts of Scotland further confirms the leakage of multiplier effects to

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[8] See footnote h in Table 5 on the size-category assignment of the Phoenix SMSA.

nonhinterland metropolitan complexes (Eirn, 1974; Lever, 1974). Approximately 80 percent of the 1970-71 purchases made by 24 glass, electrical machinery, paper, tool, paint, and clothing factories involved centers outside of Scotland, i.e., nonhinterland locations (Lever, 1974). Here too, the nonhinterland transmission of growth is intimately related to the spatial structure of organizations. Most of Scotland's manufacturing capacity belongs to multilocational organizations whose primary administrative and headquarters functions are carried out in London, elsewhere in the United Kingdom, or overseas. Non-Scottish headquarters units frequently make decisions concerning the procurement of materials, semi-finished goods, and services. "Economies of scale in transport and information collection" give these head-office units "an advantage in identifying and using more distant (non-Scottish) suppliers" (Lever, 1974).

Finding 6. Similarly, a number of other British studies (e.g., Moseley and Townroe, 1973; Salt, 1967) indicate that the input linkages of branch plants associated with elsewhere based multilocational corporations typically "extend over wide geographical areas". At the same time the local and hinterland component of suppliers is virtually always unimportant.

Finding 7. Several Swedish studies provide additional vivid illustrations of both nonhinterland and nonhierarchical interurban growth transmission (e.g., Bylund and Ek, 1974; Erson, 1974; Fredriksson, Riksson and Lindmark, 1974; and Herlitz, 1974). For example, over 52 percent of the physical inputs acquired nonlocally in 1970 by manufacturing units located in Malmö--a metropolitan complex with a population around 450,000--were found to originate in nonhinterland metropolitan centers, cities, and towns belonging to smaller population categories. Yet another 27 percent of such purchases were made from the larger nonhinterland complexes of Stockholm (population about 1.45 million) and from Gothenburg (population about 725,000). The corresponding figures for nonlocally secured business services are equally impressive: over 47 percent from smaller nonhinterland urban places, and over 44 percent from the more populous Stockholm and Gothenburg. Comparable evidence based on 1970 input and output flows exists for Borås, Skellefteå, and Borlänge-Falun, "metropolitan areas" with populations ranging from 81,000 to 190,000.[9]

Finding 8. An examination of wholesaling, correspondent banking and other statistics has allowed Borchert (1972) to contend that "the major US metropolitan centers are less important as regional capitals, (i.e., as hinterland-oriented complexes) than they are as major components in the national system of labor, entrepreneurship, and capital".

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[9]For additional data with English commentary see Pred (1975c).

VI. CONCLUSIONS

In the context of the new and reviewed materials on interurban growth transmission presented here, it should come as no surprise that growth-center and spatial growth-pole policies in advanced economies have constantly fallen short of expectations. Yet, when repeated in the literature with frequency by well-known authorities, academic and planning-theory myths tend to become accepted as verities and therefore die slowly. Thus, both the "propulsive" industry, or hinterland-contained, and the hierarchical diffusion assumptions of interurban growth transmission continue to enjoy widespread currency among Western European and North American planners; at the same time empirical evidence consistently emphasizes the overriding significance of nonhinterland and nonhierarchical input-output linkages and employment-multiplier channels. Thus planners and policy-makers in advanced economies should take certain realities into consideration if their future regional development schemes are to generate employment at desired locations. These realities are at least three in number; their nature is such that they should be deliberated regardless of any factors other than mistaken growth-transmission assumptions that may underlie the disappointing performance of specific growth-center or growth-pole policies of the past.

First, and most essentially, it must be acknowledged that no regional planning policy is likely to be either goal consistent or as successful as anticipated unless its formulation is preceded by studies establishing the peculiar underlying structure of growth-transmission interdependencies within the concerned regional and national system of cities. Unless mistaken assumptions are cast aside and major existing channels of interurban growth transmission are identified, investments and resource allocations made by private- and public-sector organizations at specific places are apt to lead to income and employment multipliers at other unanticipated places--perhaps even at places where the desired objective is dampened growth. The achievement of some basic comprehension of the predominant linkages of interurban growth transmission is especially crucial because of the known long-term stability of such linkages (e.g., Pred, 1973a, 1973b; Simmons, 1974b). At the very least regional planners can gain some crude insight into the pertinent major channels of growth transmission by undertaking a survey of intraorganizational job-control linkages. Such basic research regarding both public-sector and private-sector multilocational organizations can be carried out relatively economically by using the simple procedure reported in this article.

As a corollary, regional planners cannot continue to operate under the premise that income and employment opportunities will automatically expand rapidly in a growth center and its surrounding region merely as a consequence of the implementation of explicit locational decisions, such as the growth-center assignment of a new manufacturing facility or government office.

Instead, because of the high degree of interdependence found within a modern post-industrial system of cities, and in particular because of the scale of nonlocal growth transmission that normally follows from any major investment or activity expansion, where possible, there should be some minimal coordination of the explicit and implicit locational decision making of both private corporations and government organizations. That is, the attainment of regional income- and employment-creation goals requires that there be some effort to directly influence the interurban growth-transmission linkages that come into being as a result of goods and service purchases, contract and subcontract awards, and miscellaneous capital allocations.

Finally, because of the shifts in occupational structure occurring in advanced economies, and especially because of the increasing relative importance of information processing office and service activities, the growth-center and the growth-pole schemes cannot continue to focus on the manufacturing sector and on the input-output linkages it supposedly generates in nearby areas. In short, much growth-pole and regional development planning needs to be reexamined in terms of information linkages rather than physical input-output linkages. In this connection, the Boise City SMSA is of some interest. The conventional wisdom shared by regional planners and academics often says that the smaller and intermediate-size metropolitan complexes usually selected as growth centers are too small to provide the external economies and services necessary for the successful operation of high-level administrative and management functions. If four large business organizations with nationally dispersed units and foreign operations can cluster their headquarters in the Boise City SMSA, with its comparatively remote location in the US-Canadian system of cities, why is it not possible to concentrate important private- or public-sector office functions in designated growth centers that fall into the 100,000 to 250,000 population range?

Note for Figures 1-9:

Circles are proportional to the number of jobs. Unavoidably, there were some dissimilarities in the quality of data provided by the surveyed organizations. In some instances it was necessary to make place-by-place employment estimates based on criteria such as output, sales, and production capacity. Consequently, there is a margin of error of 100 or more for some of the larger employment totals shown in Figures 1-9 and in Table 4.

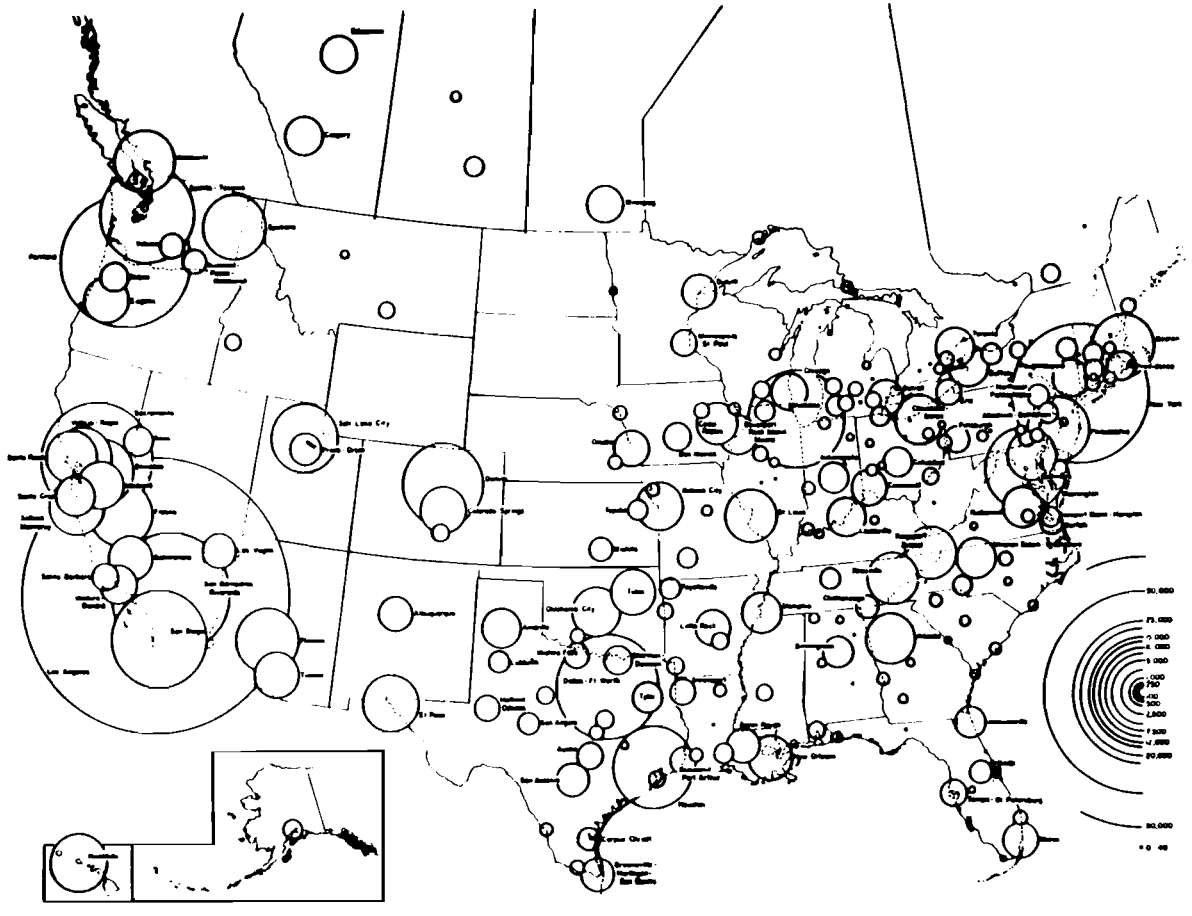
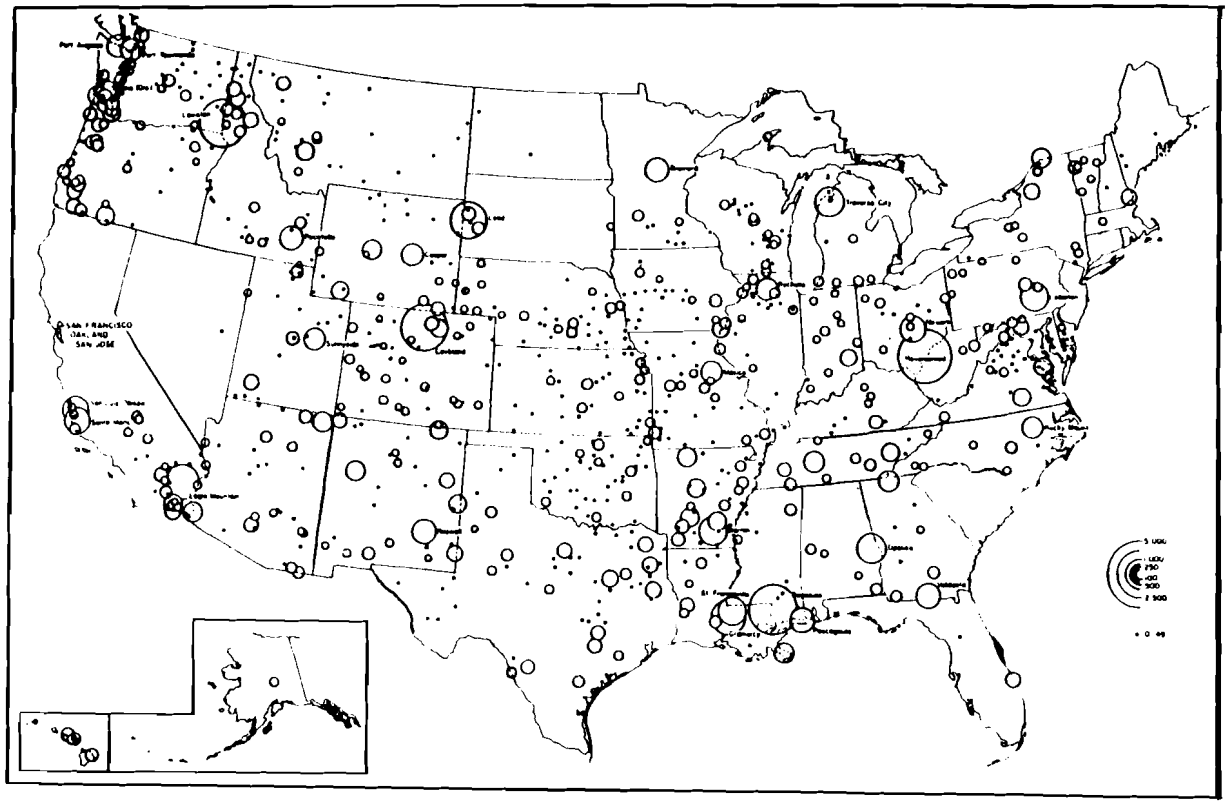


Figure 1. US and Canadian metropolitan complexes with jobs controlled by multilocational business organizations headquartered in the San Francisco-Oakland-San Jose metropolitan complex, 1974-75.



Note: To maximize the detail of this map, the hinterlands of the Seattle-Tacoma and Portland metropolitan complexes have not been "nested" into that of the San Francisco-Oakland-San Jose metropolitan complex (cf. footnote e, Table 2). 10,581 jobs occurring in non-metropolitan urban places scattered throughout Canada are not shown.

Figure 2. Jobs controlled in nonhinterland smaller cities and towns by multilocational business organizations headquartered in the San Francisco-Oakland-San Jose metropolitan complex, 1974-75.

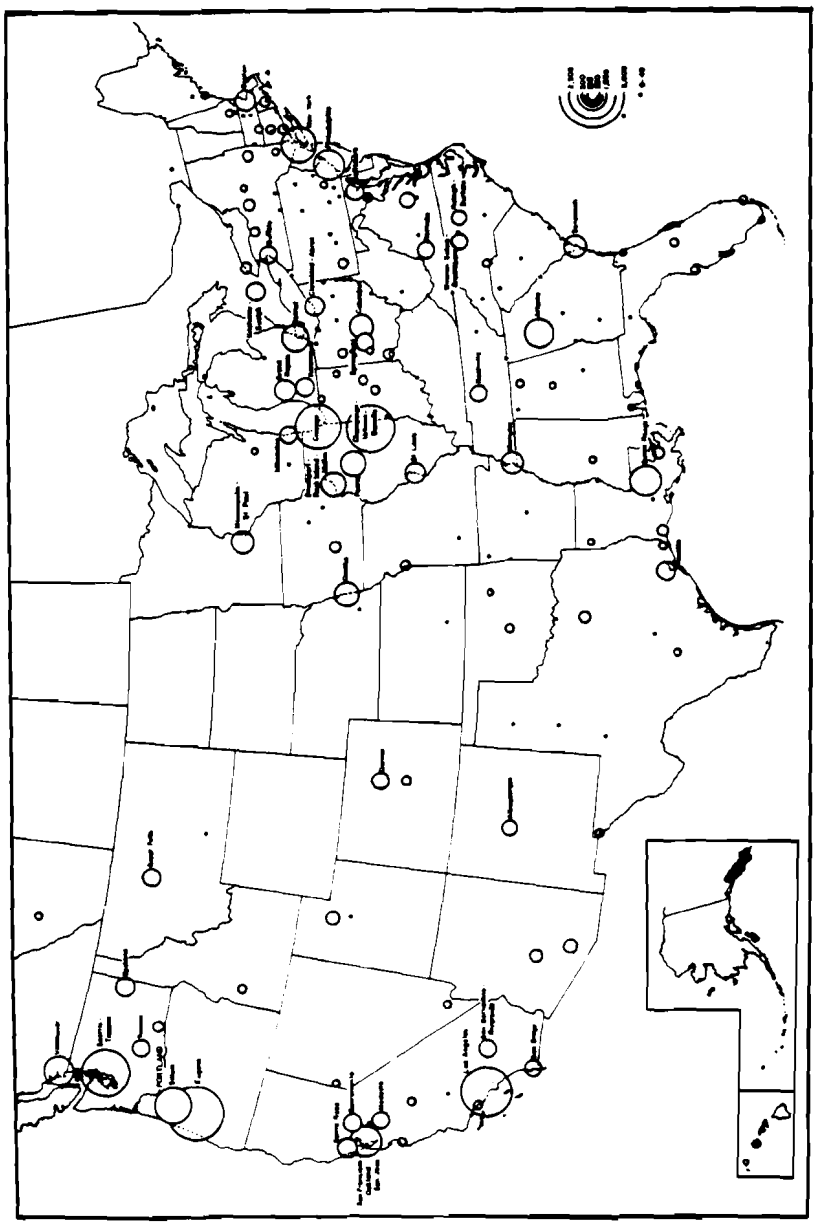
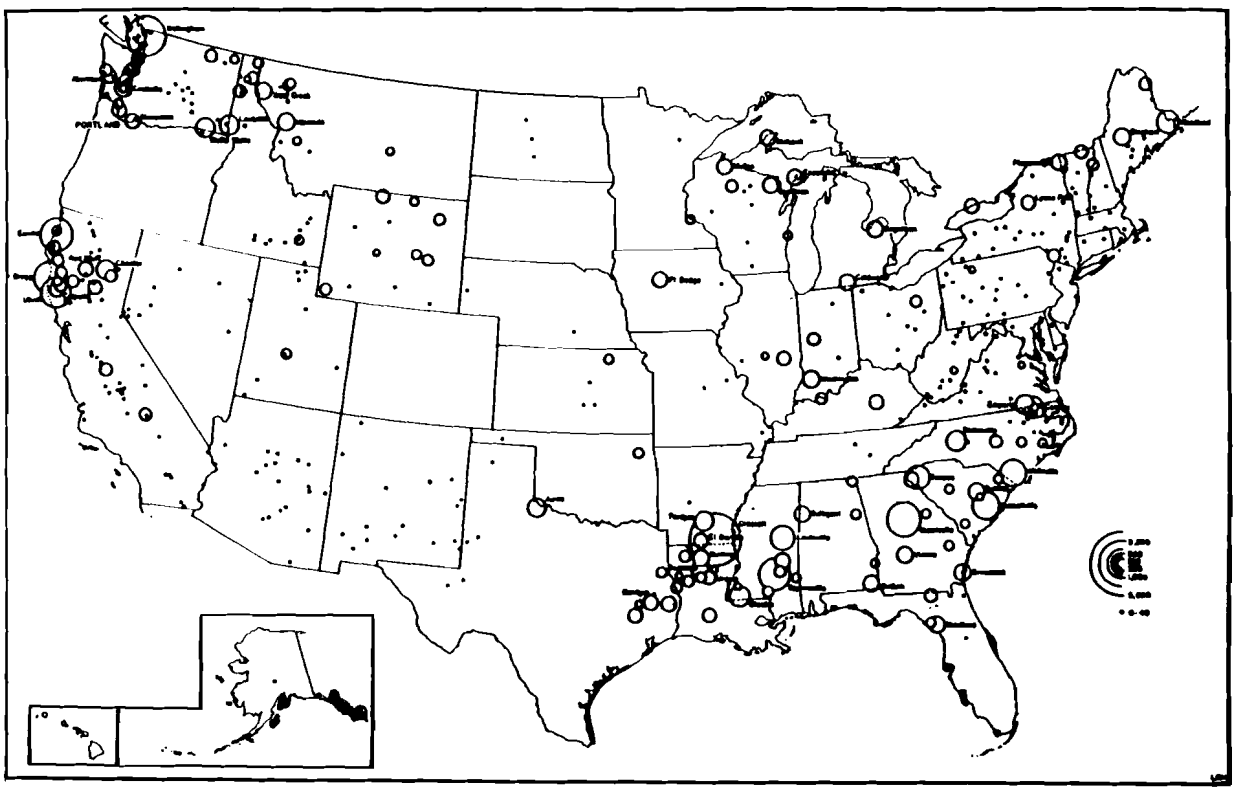


Figure 3. US and Canadian metropolitan complexes with jobs controlled by multilocational business organizations headquartered in the Portland SMSA, 1974-75.



Note: 1,617 jobs situated in smaller cities and towns throughout Canada are not shown.

Figure 4. Jobs controlled in nonhinterland smaller cities and towns by multilocational business organizations headquartered in the Portland SMSA, 1974-75.

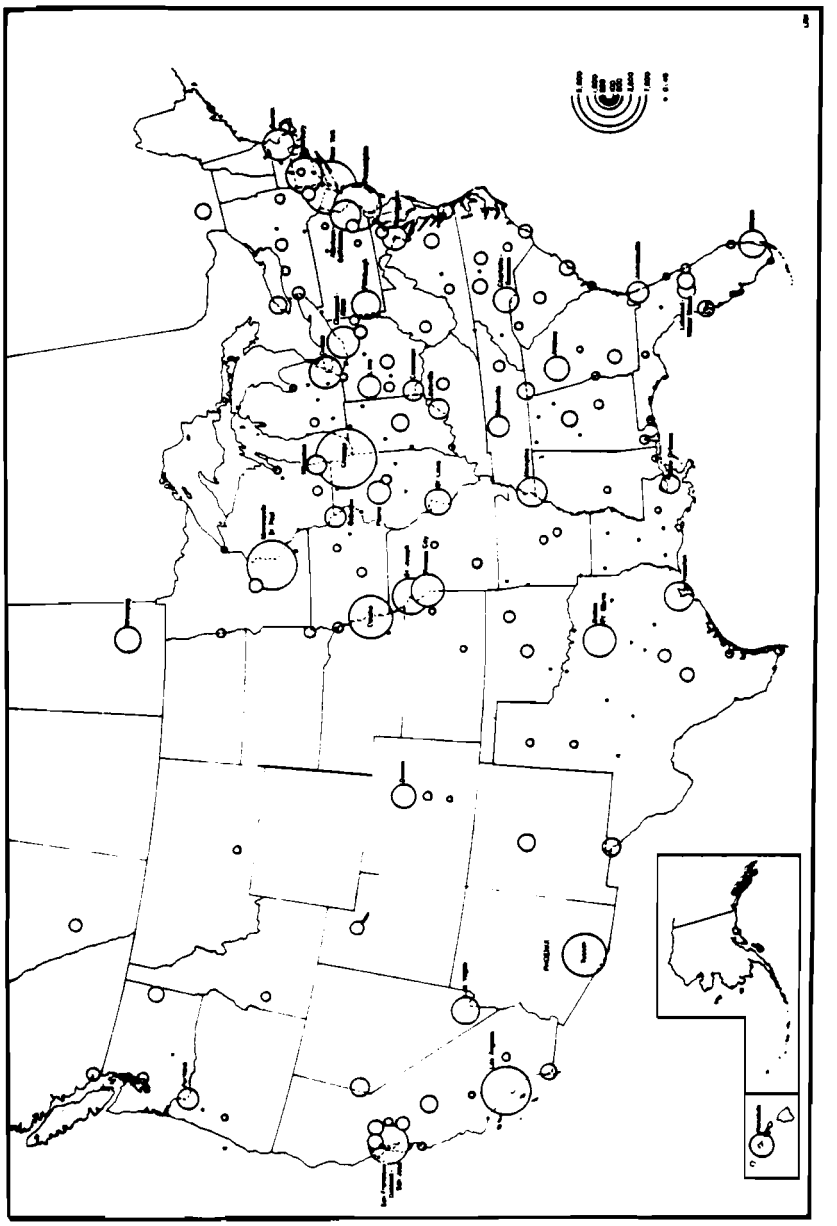


Figure 5. US and Canadian metropolitan complexes with jobs controlled by multilocaltional business organizations headquartered in the Phoenix SMSA, 1974-1975.

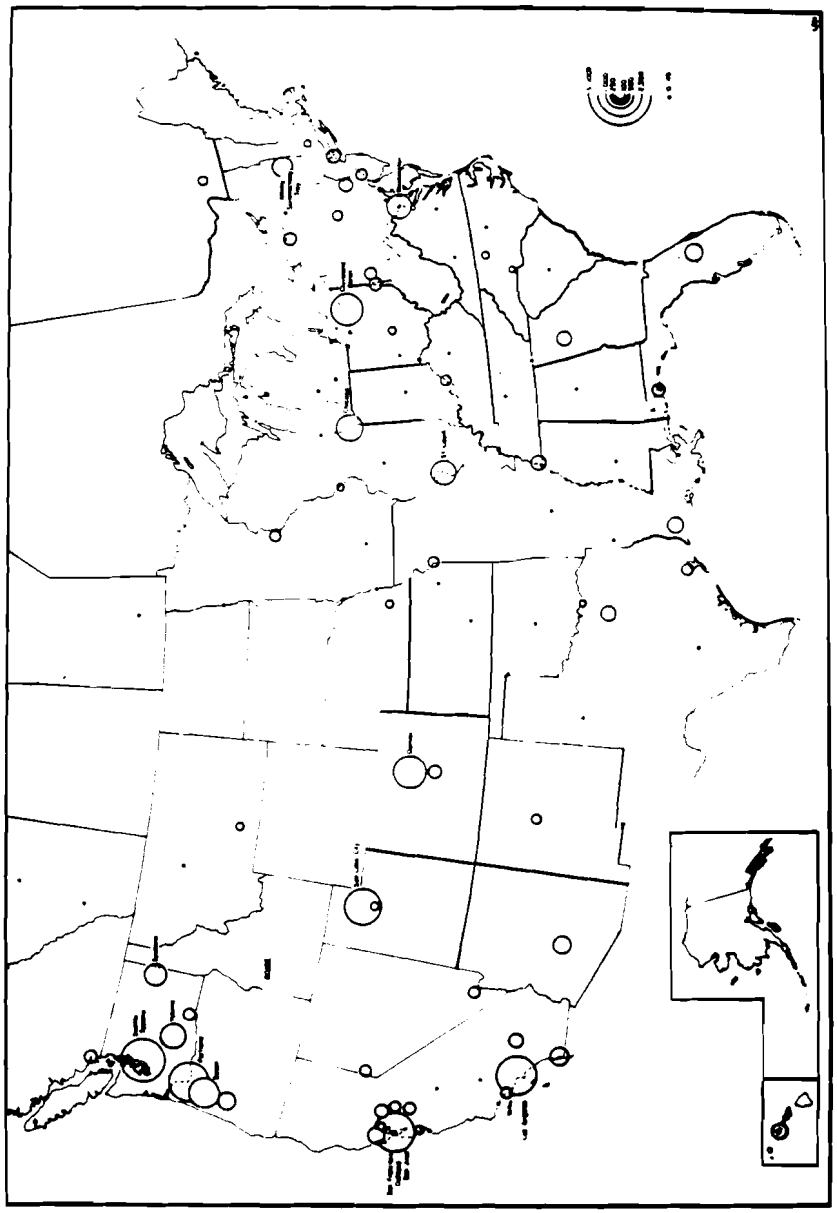


Figure 6. US and Canadian metropolitan complexes with jobs controlled by multilocational business organizations headquartered in the Boise City SMSA, 1974-75.

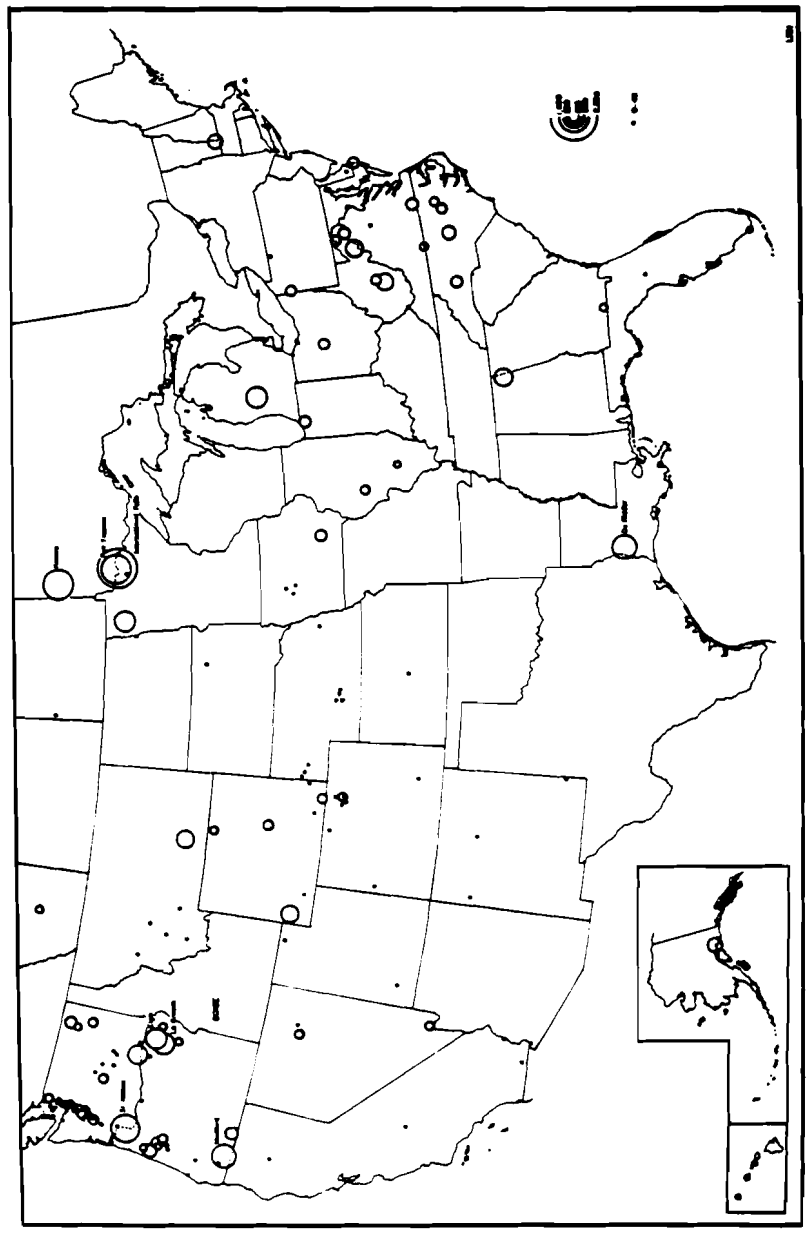


Figure 7. Jobs controlled in nonhinterland smaller cities and towns by multilocational business organizations headquarteredin the Boise City SMSA, 1974-75.

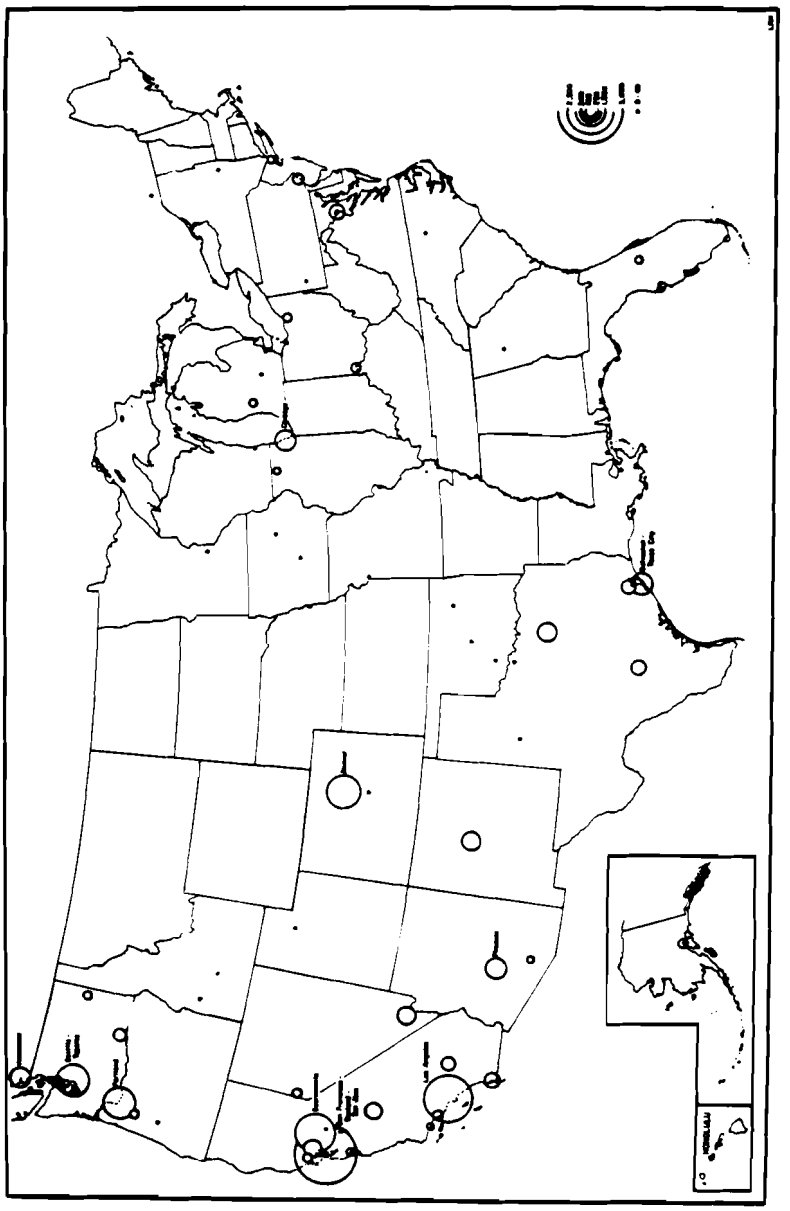


Figure 8. US and Canadian metropolitan complexes with jobs controlled by multilocational business organizations headquartered in the Honolulu SMSA, 1974-75.

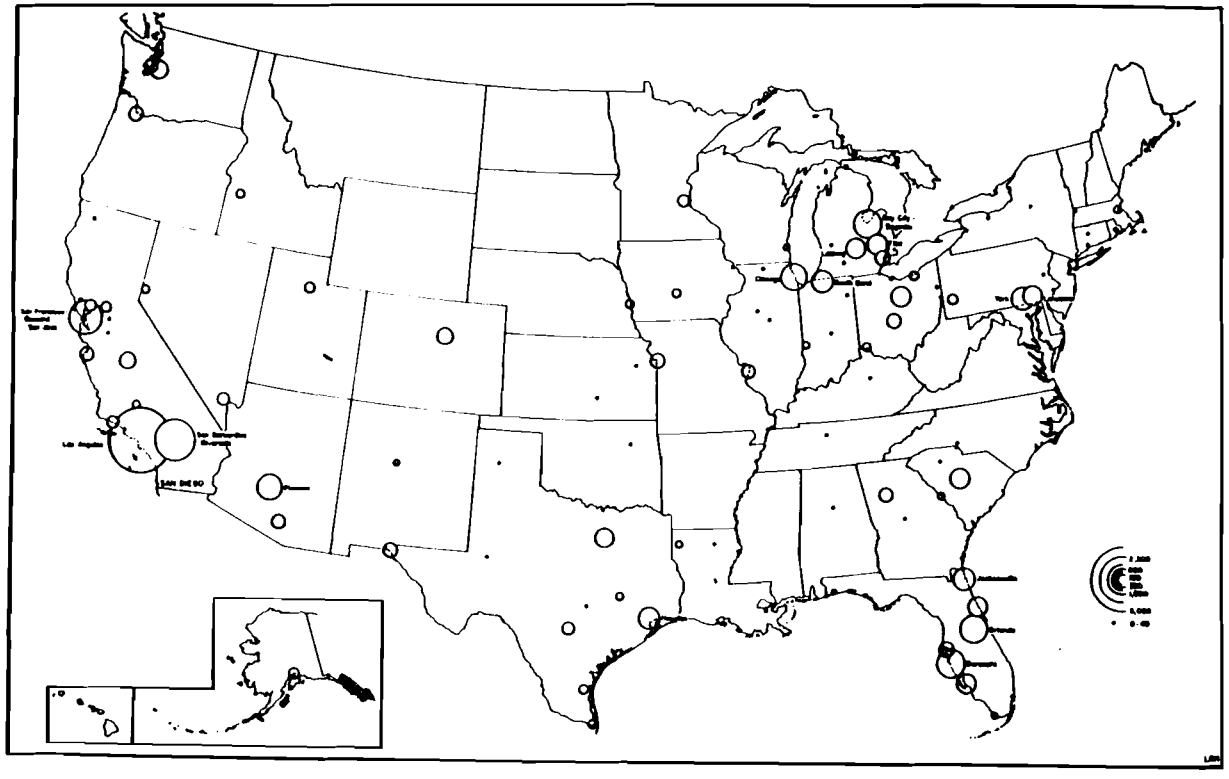


Figure 9. US and Canadian metropolitan complexes with jobs controlled by multilocational business organizations headquartered in the San Diego metropolitan complex, 1974-75.

Table 1. Aggregate job-control characteristics of multilocational business organizations with headquarters in selected metropolitan complexes of the western United States, 1974-75.

	Metropolitan Complex						
	San Francisco-Oakland-San Jose	Seattle-Tacoma[b]	Portland SMSA	Phoenix SMSA	Honolulu SMSA	Boise City SMSA	San Diego SMSA
Number of multilocational organizations[c]	181	53	50	24	19	12	25
Total estimated employment[d]	1,001,527	204,411	164,073	126,685	92,656	78,302	69,276
Employment accounted for by survey:	974,175	203,511	164,073	124,946	92,656	77,232	68,075
local	244,983	90,551	44,699	24,212	19,839	5,590	29,019
percent	(25.1)	(44.5)	(27.2)	(19.4)	(21.4)	(7.2)	(42.6)
foreign[e]	157,930	5,841	14,708	2,659	27,065[f]	14,265	2,189
percent	(16.2)	(2.9)	(9.0)	(2.1)	(29.2)	(18.5)	(3.2)
Nonlocal within the US-Canadian system of cities[g]	571,262	107,119	104,666	98,075	45,752	57,377	36,868
percent	(58.7)	(52.6)	(63.8)	(78.5)	(49.4)	(74.3)	(54.2)

See following page for footnotes.

Table 1 footnotes:

[a]San Francisco-Oakland SMSA plus San Jose SMSA.

[b]Seattle SMSA plus Tacoma SMSA.

[c]Includes all locally based organizations with approximately 400 or more employees; does not include organizations having divisional or subsidiary head offices in the selected metropolitan complexes, but elsewhere located organization-wide headquarters.

[d]Not including employment associated with joint ventures and partially-owned subsidiaries.

[e]Exclusive of Canada. See footnote g below.

[f]Most of the comparatively large number of foreign jobs controlled from Honolulu involve plantation agriculture--the initial primary function of AMFAC, of Castle & Cooke, and of other major Hawaiian corporations before they became highly diversified conglomerates.

[g]The US and Canada are treated here as having a single system of cities, despite the somewhat retarding effect the border between the two countries has on urban-economic interaction (Simmons, 1974a). This gesture is largely based on the fact that US-based corporations own a larger share of the assets of all Canadian manufacturing, petroleum and natural-gas, and mining and smelting activities than do organizations based in Canada itself. The volume of highly business-oriented air-passenger traffic between Toronto and New York is comparable to that between Toronto and Montreal, Canada's two largest metropolitan complexes. Likewise, the air-passenger traffic between Vancouver--Canada's third-ranking metropolitan complex--and Toronto and Montreal is comparable in size to that between Vancouver and the Los Angeles and San Francisco Bay Area metropolitan complexes.

Table 2. Location, by general category, of US and Canadian jobs controlled by multilocational business organizations with headquarters in selected metropolitan complexes of the western United States, 1974-75.

	Estimated number of employees				
	A	B	C	D	E
	All other metropolitan complexes	Metropolitan complexes outside of hinterland[a]	Hinterland[b]	Nonhinterland smaller towns and cities	Nonlocal total within US-Canadian system of cities
San Francisco-Oakland-San Jose[c]	452,904	407,868	63,397	99,992	571,262
(percent)	(79.3)	(71.4)	(11.1)	(17.5)	(100.0)[d]
		364,020[e]	121,196[e]	86,041[e]	571,262
(percent)		(63.7)	(21.2)	(15.1)	(100.0)
Seattle-Tacoma[f]	65,451	62,225	21,287	23,607	107,119
(percent)	(61.1)	(58.1)	(19.9)	(22.0)	(100.0)[d]
Portland SMSA	47,259	41,248	18,140	45,278	104,666
(percent)	(45.1)	(39.4)	(17.3)	(43.4)	(100.0)[d]
Phoenix SMSA	73,881	71,278	8,206	18,591	98,075
(percent)	(75.3)	(72.7)	(8.4)	(19.0)	(100.0)[d]
Honolulu SMSA	22,082	22,082	19,780[g]	3,890	45,752
(percent)	(48.3)	(48.3)	(43.2)	(8.5)	(100.0)[d]
Boise City SMSA	28,104	28,104	11,412	17,861	57,377
(percent)	(49.0)	(49.0)	(19.9)	(31.1)	(100.0)[d]
San Diego SMSA	27,330	27,330	1,076	8,462	36,868
(percent)	(74.1)	(74.1)	(2.9)	(23.0)	(100.0)[d]

See following page for footnotes.

Table 2 footnotes:

[a]Metropolitan hinterlands defined with the assistance of Borchert (1972) and other sources in accord with central-place theory principles.

[b]Encompasses some metropolitan complexes included in column A. The Honolulu, Boise City, and San Diego hinterlands contain no metropolitan units.

[c]San Francisco-Oakland SMSA plus San Jose SMSA.

[d]Percentage total arrived at by summing the percentages listed under columns B, C, and D.

[e]Based on the inclusion of jobs controlled by San Francisco Bay Area business organizations in the hinterlands of Seattle-Tacoma and Portland. The nesting of the Seattle-Tacoma and Portland hinterlands into that of San Francisco-Oakland-San Jose is based on inter alia, the smaller population class, or lower order, of the Washington and Oregon metropolitan complexes. This results in an extremely liberal delineated hinterland for San Francisco-Oakland-San Jose; one reason for this is that the Seattle-Tacoma hinterland has been defined as encompassing Alaska as well as all of the state of Washington (except for Clark County which belongs to the Portland SMSA), northern Idaho, and northeastern Oregon.

[f]Seattle SMSA plus Tacoma SMSA.

[g]Predominately composed of plantation agriculture employment. Most of the comparatively large number of foreign jobs controlled from Honolulu involve plantation agriculture--the initial primary function of AMFAC, of Castle and Cooke, and of other major Hawaiian corporations before they became highly diversified conglomerates.

Table 3. Location, by size of metropolitan complex, of US and Canadian jobs controlled by multilocational business organizations with headquarters in selected metropolitan complexes of the western United States, 1974-75.

	Estimated number of employees					
	First and second order national centers (pop. > 2.6 million)[a]	Third-order national centers (pop. 1.0-2.6 million)[a]	Intermediate-sized metropolitan centers (pop. 500,000-999,999)	Intermediate-sized metropolitan centers (pop. 250,000-499,999)	Lesser metropolitan centers (pop. < 250,000)	Metropolitan total
San Francisco-Oakland-San Jose[b]	152,585	132,897	54,782	62,448	50,192	452,904
(percent)	(33.7)	(29.3)	(12.1)	(13.8)	(11.1)	(100.0)
Seattle-Tacoma[c]	20,615	13,631	4,603	13,158	13,444	65,451
(percent)	(31.5)	(20.8)	(7.0)	(20.1)	(20.5)	(100.0)
Portland SMSA	11,238	10,580	4,953	5,975	14,513	47,259
(percent)	(23.8)	(22.4)	(10.5)	(12.6)	(30.7)	(100.0)
Phoenix SMSA	22,698	16,495	12,704	10,196	11,788	73,881
(percent)	(30.7)	(22.3)	(17.2)	(13.8)	(16.0)	(100.0)
Honolulu SMSA	9,337	6,891	2,353	1,543	1,958	22,082
(percent)	(42.3)	(31.2)	(10.7)	(7.0)	(8.9)	(100.0)
Boise City SMSA	8,022	9,505	3,847	1,830	4,900	28,104
(percent)	(28.5)	(33.8)	(13.7)	(6.5)	(17.4)	(100.0)
San Diego SMSA	8,247	6,754	2,044	6,918	3,367	27,330
(percent)	(30.1)	(24.7)	(7.5)	(25.3)	(12.3)	(100.0)

See following page for footnotes.

Table 3 footnotes:

[a]See Borchert's (1972) definition of "first", "second", and "third-order" US metropolitan centers. Metropolitan complexes assigned to size categories on the basis of 1970 (US), and 1971 (Canada) populations.

[b]San Francisco-Oakland SMSA plus San Jose SMSA.

[c]Seattle SMSA plus Tacoma SMSA.

Table 4. Jobs controlled at 70 major metropolitan complexes by multi-locational business organizations based in seven western US metropolitan complexes, 1974-75.[o]

	1970 population	Estimated number of employees controlled from[a]: San Francisco-Oakland-San Jose[b]	Seattle-Tacoma[c]	Portland SMSA	Phoenix SMSA	Boise City SMSA	Honolulu SMSA	San Diego SMSA	Total for selected centers
New York[d]	16,894,371	23,537	2,180	1,430	3,837	227	66	98	31,375
Los Angeles[e]	8,452,461	92,346	3,603	3,392	3,301	2,124	3,161	5,383	113,265
Chicago[f]	7,612,314	11,863	564	2,470	4,837	929	542	843	22,048
Philadelphia[g]	5,317,407	4,918	7,115	1,076	2,978	155	121	42	16,405
Detroit SMSA	4,431,390	1,517	179	746	1,395	39	4	207	4,087
San Francisco-Oakland-San Jose[b]	4,174,235	xxx	6,428	1,314	2,237	2,141	5,079	1,454	18,653
Boston[h]	3,388,795	4,760	110	536	1,223	28	7	64	6,728
Washington D.C. SMSA	2,908,801	8,326	111	103	785	823	254	35	10,437
Cleveland-Akron[i]	2,743,433	2,923	96	479	1,407	1,342	70	85	6,402
Montreal[j]	2,743,208	342	2	25	318	100	3		790
Toronto[j]	2,628,043	2,005	227	146	380		5	36	2,799
St. Louis SMSA	2,410,163	3,397	768	493	904	801	44	211	6,618
Pittsburgh SMSA	2,401,245	820	48	96	1,099	177	3	98	2,341
Dallas-Fort Worth SMSA	2,377,979	13,213	654	156	1,417	308	462	462	16,672
Baltimore SMSA	2,070,670	3,176	114	370	171	2	5	3	3,841
Houston SMSA	1,999,316	8,561	180	419	1,116	165	211	555	11,207
Minneapolis-St. Paul SMSA	1,965,159	876	410	640	3,374	150	4	169	5,623
Miami[k]	1,887,892	1,645	641	108	1,006	26	3	9	3,438
Seattle-Tacoma[c]	1,832,896	11,445	xxx	2,895	387	2,469	1,435	397	19,028
Cincinnati[l]	1,611,058	1,539	376	132	577	39	97	87	2,847
Atlanta SMSA	1,597,816	3,187	919	987	803	267	7	219	6,389
Milwaukee[m]	1,574,526	1,652	79	306	503	32	3	57	2,632
San Diego SMSA	1,357,854	11,516	247	316	349	448	274	xxx	13,150
Buffalo SMSA	1,349,211	2,206	50	338	182		38		2,814
Kansas City SMSA	1,271,515	4,588	1,679	91	1,442	158	41	260	8,259
Denver SMSA	1,228,801	8,105	608	315	795	1,469	1,468	343	13,103
Riverside-San Bernadino SMSA	1,143,146	18,282	124	369	83	257	226	2,154	21,505
Indianapolis SMSA	1,109,882	1,121	78	84	387	28		36	1,728
Tampa-St. Petersburg SMSA	1,088,549	855	113	55	332	28		257	1,640
Vancouver[j]	1,082,352	4,583	1,669	1,112	245	210	505	17	8,341
New Orleans SMSA	1,045,809	4,137	261	143	507	10	32	39	5,129
Columbus SMSA	1,017,847	1,035	121	676	232	76	247		2,387
Portland SMSA	1,009,129	21,939	4,046	xxx	590	2,129	1,220	266	30,190
Phoenix SMSA	967,522	5,019	250	192	xxx	392	540	830	7,223
Rochester SMSA	961,516	484	75	140	92	192		49	1,032
Providence SMSA	905,558	983	58	103	41			26	1,211
San Antonio SMSA	888,179	1,385	21	58	282	6	261	192	2,205
Louisville SMSA	867,330	1,766	62	33	583	137			2,581
Hartford[n]	866,120	433	81	75	62		26	25	702
Dayton SMSA	850,266	154	12	66	127	6			365
Memphis SMSA	834,006	2,016	67	538	1,161	288	21		4,091
Sacramento SMSA	800,592	16,020	429	422	317	214	2,144	132	19,678
Albany-Schenectady-Troy SMSA	777,793	475	48	126	114	505	2		1,270
Birmingham SMSA	767,230	1,270	39	54	300	2		4	1,669
Toledo SMSA	762,741	437	232	28	73	2			772
Greensboro-Winston Salem SMSA	723,304	2,016	193	252	282	68			2,811
Salt Lake City SMSA	705,458	5,761	648	224	241	1,724	43	144	8,798
Nashville SMSA	699,144	497	1,151	310	577	24		22	2,581
Oklahoma City SMSA	698,180	2,908	42	81	210	2	22		3,265
Norfolk SMSA	687,576	618	13	244	297	6		49	1,252
Syracuse SMSA	636,507	315	74	147	187	2			725
Honolulu SMSA	629,176	4,134	416	67	750	290	xxx	38	5,695
Northeast Pennsylvania SMSA	621,830	589	68	46	50				753
Jacksonville SMSA	621,519	1,239	227	52	649	19		628	2,814
Allentown-Bethlehem SMSA	594,124	521	16	45	1,295	263		36	2,176
Charlotte SMSA	557,785	419	120	71	858	57		49	1,574
Tulsa SMSA	550,835	2,495	27	52	166		7	2	2,749
Winnipeg[j]	548,573	1,740	55		910	2			2,707
Richmond SMSA	542,242	1,977	33	243	297	2			2,552
Springfield-Holyoke SMSA	541,752	479		58	27				564
Omaha SMSA	540,142	1,621	143	722	2,531	12	19	90	5,138
Grand Rapids SMSA	539,225	332	58	492	93	2	70	24	1,071
Orlando SMSA	453,270	636	113	85	350	372	60	981	2,597
Lansing SMSA	424,271	221			26			499	761
Raleigh-Durham SMSA	418,841	220	811	258	191	45	1		1,526
Fresno SMSA	413,053	5,183	176	82	423	41	354	342	6,601
Knoxville SMSA	409,409	3,360	29	43	149				3,582
Wichita SMSA	389,352	698	8,768	45	60	2		36	9,609
Mobile SMSA	376,690	373	8	50	110	2			543
Baton Rouge SMSA	375,628	1,488	8	1,180	59				2,735

See following page for footnotes.

Table 4 footnotes:

[a]US and Canadian metropolitan complexes with jobs controlled by multilocational business organizations headquartered in the San Francisco-Oakland-San Jose metropolitan complex, 1974-75.

[b]San Francisco-Oakland SMSA plus San Jose SMSA.

[c]Seattle SMSA plus Tacoma SMSA.

[d]New York-New Jersey SCA plus Bridgeport SMSA plus Norwalk SMSA plus Stamford SMSA. The combination of metropolitan areas into larger metropolitan complexes in Tables 1 through 4 is based upon heavily overlapping commuting patterns and the sharing of major airport facilities.

[e]Los Angeles-Long Beach SMSA plus Anaheim-Santa Ana-Garden Grove SMSA.

[f]Chicago-Northeastern Indiana SCA.

[g]Philadelphia SMSA plus Wilmington, Del., SMSA.

[h]Boston SMSA plus Brockton SMSA plus Lawrence-Haverhill SMSA plus Lowell SMSA.

[i]Cleveland SMSA plus Akron SMSA.

[j]1971 population datum.

[k]Miami SMSA plus Fort Lauderdale-Hollywood SMSA.

[l]Cinncinnati SMSA plus Hamilton-Middletown SMSA.

[m]Milwaukee SMSA plus Racine SMSA.

[n]Hartford SMSA plus New Britain SMSA.

[o]See also note to Figures 1 to 9(p. 18).

Table 5. Deviation of job-control linkages from central-place-theory and hinterland assumptions of interurban growth transmission: based on multilocational business organizations headquartered in selected western US metropolitan complexes, 1974-75.

	Percentage of all nonlocal job-control linkages within the US-Canadian system of cities unaccounted for by Christallerian central-place theory		Percentage of metropolitan job-control linkages within the US-Canadian system of cities unaccounted for by Christallerian central-place theory		Ratio of nonhinterland metropolitan linkages to all hinterland linkages	Ratio of all nonhinterland linkages to all hinterland linkages
	I[a]	II[b]	III[c]	IV[d]		
San Francisco-Oakland-San Jose[e]	44.2 41.8[f]	88.9 78.8[f]	33.7 33.7[f]	90.0 80.4[f]	6.4:1 3.0:1[f]	8.1:1 3.7:1[f]
Seattle-Tacoma[g]	53.9	80.1	52.3	95.1	2.9:1	4.0:1
Portland SMSA	64.1	82.7	46.2	87.3	2.3:1	4.8:1
Phoenix SMSA[h]	58.9[h]	91.7	53.0[h]	96.5	8.7:1	10.9:1
Honolulu SMSA	49.1	56.8	84.2	100.0	1.1:1	1.3:1
Boise City SMSA	80.1	80.1	100.0	100.0	2.5:1	4.0:1
San Diego	63.7	97.1	54.8	100.0	25.4:1	33.5:1

See following page for footnotes.

Table 5 footnotes:

[a]Based on all jobs controlled in nonhinterland smaller towns and cities (see column D, Table 2), plus jobs controlled in all nonhinterland metropolitan complexes belonging to the same or larger population size classes (see appropriate columns, Table 3).

[b]Based on all jobs controlled in nonhinterland smaller towns and cities plus all jobs controlled in every size class of non-hinterland metropolitan complex (see columns B and D, Table 2).

[c]Based on all jobs controlled in metropolitan complexes belonging to the same type of larger population size classes (see appropriate columns, Table 3).

[d]Based on all jobs controlled in every size class of non-hinterland metropolitan complex (see column B, Table 2).

[e]San Francisco-Oakland SMSA plus San Jose SMSA.

[f]Based on the inclusion of jobs controlled by San Francisco Bay Area business organizations in the hinterlands of Seattle-Tacoma and Portland. The nesting of the Seattle-Tacoma and Portland hinterlands into that of San Francisco-Oakland-San Jose is based on inter alia, the smaller population class, or lower order, of the Washington and Oregon metropolitan complexes. This results in an extremely liberal delineated hinterland for San Francisco-Oakland-San Jose; one reason is that the Seattle-Tacoma hinterland has been defined as encompassing Alaska as well as all of the state of Washington (except Clark County which belongs to the Portland SMSA), northern Idaho, and northeastern-most Oregon.

[g]Seattle SMSA plus Tacoma SMSA.

[h]During the early 1970s the Phoenix SMSA probably had the most rapid relative growth rate of all major US metropolitan complexes. By 1974 it had an estimated population of 1.2 million. For this reason Arizona's largest metropolitan center was assigned to the "third-order national center" size category (Table 3) when computing columns I and III. Had the Phoenix SMSA been assigned to the 500,000-999,999 size class on the basis of its official 1970 population (967,522), then the percentage of deviating linkages would have risen to 71.9 in column I and 70.2 in column III.

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