DECONCENTRATION WITHOUT A "CLEAN BREAK"

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August 1978

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Preface

The Human Settlement Systems Research task has had as its initial objective the delineation of comparable functional urban regions within the industrially advanced countries. Following the completion of these delineations and the computation of population numbers for the included spatial units for three or more years, a comparative analysis of economic and demographic structure and development is possible.

This paper is one of those comparative studies. It seeks to determine whether contemporary changes in settlement patterns are a continuation of the outward expansion of metropolitan areas or whether new settlement systems are emerging. The evidence seems to be on the side of the former notion.

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August 1978

Abstract

This report reviews recent papers which argue that urbanization trends in the U.S. show a reversal of past patterns. The review suggests that a reversal is not obvious and may simply appear as a result of a statistical artifact: urbanization which has spilled over metropolitan boundaries may simply be more of the same outward growth but would show up as a metropolitan to non-metropolitan growth shift. A new data file for eighteen other developed countries is examined. These data are suitable for computations of various versions of the Hoover index of population concentration. Such calculations suggest that the eighteen countries examined are experiencing more traditional urban outward expansion. This adds to scepticism of the reversal or 'clean break' hypothesis.

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Deconcentration without a "Clean Break"

A number of recent papers have argued that settlement patterns in the U.S. may be characterized by a clear "reversal" of past trends, by "significant changes" and even by "a clean break with the past". Much less has been written about the other developed countries. This paper looks to a new data file to describe recent settlement trends in Europe and Japan. In so doing, we register some scepticism of the "clean break" thesis.

BACKGROUND

While scholars interpret the U.S. evidence with varying certitude, most conclude that we are witnessing fundamentally new phenomena and that the "shift" occurred either in the later 1960s or the early 1970s. Berry and Dahmann note that

> ...for the first time the growth rate of metropolitan areas has dropped below that of non-metropolitan areas. More significantly, the long term inflow of persons from non-metropolitan areas has been reversed; as recently as the 1960s there was a net flow of migrants from non-metropolitan areas. Since then, however, these areas have added residents largely as the result of increased out-migration from metropolitan areas... While the total population increased 13.3 percent during the 1960s, the number of individuals residing in metropolitan areas increased 16.6 percent, a rate of metropolitan increase that was 25 times the rate for non-metropolitan areas. Since 1970, however, a reversal has occurred; nationwide statistics for the first half of the 1970s indicate that population has increased 6.3 percent in non-metropolitan areas and only 3.6 percent in metropolitan areas. (Berry and Dahmann, 1977, p 444.)

Vining and Kontuly (1977) have suggested that the "new" patterns of settlement can also be detected in other economically advanced countries. However, in documenting declining in-migration into core areas, spatial units as large as 20 to 30 percent of each nation's territory were chosen. This was done in order to contain most spread effects of the populations from central cities. Yet, this approach cannot detect if *intra* metropolitan relocations are of increasing length and evermore exurban, as a "wave theory" of development might predict.

The fact that there are bound to be major measurement problems is significant. It suggests that the issue is not really resolved. Zelinsky admits that "what is abundantly clear is that our attempts to understand the turnaround phenomenon have been straining our factual and theoretical resources to their limits". (Zelinsky, 1978, p. 15.)

The data which we present in this paper contains evidence which supports the wave theory as an alternative hypothesis to the clean break. The wave theory has been around for some time and it suggests that we might be observing more of some very traditional trends: growth takes place at the centers of smaller cities and is evermore removed from the center as the city gets larger. The diseconomies of agglomeration are not simply to be associated with bigness but can be *located* in older central cities.

We are not the first to suggest that the U.S. data, which most often underlines clean break reports, is unable to really test the hypothesis of a reversal against the idea of continued spillover growth (Wardwell, 1977). Yet, it is the ambiguity of the U.S. results which underlines our interest in the new data file. We shall argue that since the U.S. data cannot defeat the wave hypothesis and since the new data file does support it, the notion will have to stand for a while longer.

Rural to urban population shifts are a trend of long standing through most of the world. Thus, it would certainly be intriguing to find that this process has suddenly been reversed. Yet, it should be obvious that metropolitan to non-metropolitan movements, using the U.S. Census Bureau definitions,

1. do not necessarily imply urban to rural movements, and
2. can just as readily reflect a continuation of outward growth.

We need only imagine that the large metropolitan areas are continuing their long established outward growth and that this growth has now extended beyond the formally defined current boundaries of the Standard Metropolitan Statistical Areas (SMSAs). It thus shows up as non-metropolitan growth. We need further imagine that urban development continues in the smaller cities and within their metropolitan boundaries. It must be mentioned that clean break advocates have entertained the possibility of a continued wave effect but have rejected it by noting that the most dramatic net migration changes have taken place in those U.S. counties that are non-adjacent to the metropolitan areas. (Morrison, 1977). However, arranging the U.S. data in terms of a locational breakdown of non-metropolitan growth (Table 1), reveals that in the most recent years, annual growth is greatest in those non-metropolitan counties which are most linked to the metropolitan centers. Annual net in-migration rates *diminish regularly* as we move away from SMSAs (see also Tucker, 1976). Thus, the U.S. data does not rule out the wave theory and statements such as, "clearly the migration reversal cannot be explained away as just more metropolitan sprawl or spillover because it is affecting distinctly remote and totally rural non-metropolitan areas, *as well as those adjacent to metropolitan centers*" (Morrison, 1977, p. 6) are not really conclusive. In fact, the most compelling position is probably that of Wardwell who underlines the complexity of recent trends as well as our inability to interpret them unequivocally. Wardwell cites the fact that 63 percent of in-migration to non-metropolitan counties takes place in those non-metropolitan counties that are adjacent to metropolitan counties and says that "this suggests that the spillover effect of continued deconcentration of metropolitan centers is a substantial force in producing the observed patterns of non-metropolitan county growth." He also reports that the growth rate of counties classified as non-metropolitan in 1970 but reclassified to metropolitan in 1974, "is substantially greater (10%) during this period than that of counties which retained their non-metropolitan classification" (Wardwell, 1977, p.159).

Berry and Dahmann report that,

> In the South....the central cities of metropolitan areas with less than one million residents have gained population... In the West the largest gains have been occurring in central cities of metropolitan areas with less than one million residents. (Berry and Dahmann, 1977, p.450.)

All of these observations are consistent with the simple wave theory outlined above.

Obviously, there is something going on in the non-adjacent counties which demands attention. Wardwell suggests that this growth can be explained by new propensities to retire and recreate *and* that these new phenomena can be analyzed on top of the wave effect rather than in its place.

The most stirring of the reversal reports is the one by Vining and Strauss who say that

> Non-metropolitan counties well removed from the commuting range of 250 or so SMSAs are growing at a significantly higher rate than the SMSAs themselves, *though at a somewhat lower rate than the non-metropolitan counties adjacent to these SMSAs.* This fact represents a clear and unmistakable break with past trends of long duration. (Vining and Strauss, 1977, p.75.)

We have added the italics to emphasize a possible non sequitur. Vining and Strauss go on to look for evidence from a source other than the migration data; they process population stock data through the well known Hoover index of population dispersion.* Interpreting trends in the index in a novel way, the authors conclude that a wave effect can be rejected, and that a clean break is, in fact, observed.

In describing the pre-1970 U.S. settlement changes, the authors note that the Hoover index, calculated for various levels of spatial aggregation, moves in opposing directions. They view this quirk in the index as a "resource". Previously,

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*The Hoover index is given by $H_t = \frac{1}{2} \sum_i^k |p_{it} - a_i| 100$, where p_{it} refers to the proportion of a country's population residing in area i at time t; a_i refers to the proportion of that nation's area taken up by subarea i. The index varies from 0 to 100, or from a reading of perfectly uniformly distributed population to perfect concentration.

Table 1. Locational breakdown of the U.S. population growth

Population Category	Provisional 1975 Population (000s)	Annual Population Change Rate		Annual Natural Increase Rate		Annual Net Migration Rate*	
		1960-1970	1970-1975	1960-1970	1970-1975	1960-1970	1970-1975
UNITED STATES TOTAL	213,051	1.3	0.9	1.1	0.7	0.2	0.2
METROPOLITAN							
Total, all SMSAs**	156,098	1.6	0.8	1.1	0.7	0.5	0.1
>1.0 million	94,537	1.6	0.5	1.1	0.6	0.6	-0.2
0.5 - 1.0 million	23,782	1.5	1.0	1.2	0.8	0.4	0.3
0.25 - 0.5 million	19,554	1.4	1.3	1.2	0.8	0.2	0.5
<0.25 million	18,225	1.4	1.5	1.2	0.8	0.2	0.7
NONMETROPOLITAN							
Total, all nonmetropolitan counties	56,954	0.4	1.2	0.9	0.6	-0.5	0.6
In counties from which:							
≥20% commute to SMSAs	4,407	0.9	1.8	0.8	0.5	0.1	1.3
10%-19% commute to SMSAs	10,011	0.7	1.3	0.8	0.5	-0.1	0.8
3%- 9% commute to SMSAs	14,338	0.5	1.2	0.9	0.6	-0.4	0.6
< 3% commute to SMSAs	28,197	0.2	1.1	1.0	0.6	-0.8	0.5
*Entirely rural counties*** not adjacent to an SMSA*	4,661	-0.4	1.3	0.8	0.4	-1.2	0.9

Source: Unpublished preliminary statistics furnished by Richard L. Forstall, Population Division, U.S. Bureau of the Census; and Calvin L. Beale, Economic Research Service, U.S. Department of Agriculture.

*Includes net immigration from abroad, which contributes newcomers to the U.S. as a whole and to the metropolitan sector, thereby producing positive net migration rates for both.

**Population inside Standard Metropolitan Statistical Areas (SMSAs) or, where defined, Standard Consolidated Statistical Areas (SCSAs). In New England, New England County Metropolitan Areas (NECMAs) are used.

***"Entirely rural" means the counties contain no town of 2,500 or more inhabitants (reproduced from Morrison, 1977).

for example, the index would turn up when the spatial units were U.S. counties indicating urbanization. At the same time, the index would turn down when the units were states, indicating a movement of the population to the less populated Midwest and West. Thus, a clean break is announced when the index, computed for *all* levels of aggregation turns down, as it does for the most recent years. However, computations of the Hoover index for small spatial units can show a downturn and still be consistent with the wave effect. Table 1 underlines this view: the small or lightly populated non-metropolitan counties and the smaller SMSAs are the major gainers; looking at *where* the major non-metropolitan growth is taking place, we are back to spillover effects. In other words, if we were to compute the Hoover index for U.S. spatial units which combine metropolitan areas with adjacent counties, Table 1 suggests that we may not get a downturn after all.

Most of the evidence that has been cited to this point has been from the works of the clean break advocates. Clearly, neither side has proven its case. The problem lies with the way in which the data is reported. The U.S. Census Bureau divides the country into two population concentrations: metropolitan and non-metropolitan areas. The former are made up of a central city and a suburban area. Any additional large cities within the metropolitan areas are included as part of the central city. Non-metropolitan areas include all the area outside metropolitan areas. Unfortunately, this way of reporting data is not "functional". Since SMSA boundaries tend to be county boundaries, the exact or near exact limit of the commuting field is usually not adequately approximated. The same applies to temporal change in the labor market area. Thus, as the wave of development spreads outward and spills over SMSA lines, a "reversal" is percieved though none may have occurred.

> Cliff and Robson report that since most reporting units ... are defined as distinct physical nucleations rather than in functional terms, then in studying changes over time, the researcher is caught on the horns of two dilemmas: whether to use an unchanging areal definition of each town or to alter the definition so as to match most closely the changing form of

> the town at successive dates, *and* whether to use a fixed or fluctuating number of towns throughout the period. (Cliff and Robson, 1978, p.163.)

The ambiguity of the U.S. data arises precisely because of these two dilemmas.

Yet, we do not want to continue to plumb the U.S. data, having maintained that it cannot hold the answer. Rather, we want to look at a new data file for some indication of what transpired in the recent experience of Europe and Japan.

THE DATA FILE AND DEFINITIONS

In an effort to initiate wide ranging comparative investigations of patterns of urban growth and decline as well as to test the effects of various national policies on urban growth, a network of scholars from the International Institute for Applied Systems Analysis and from collaborating institutions in a number of countries have joined to define comparable sets of urban areas for seventeen nations in Western Europe and Eastern Europe and Japan. To date, population, employment and area data have been stored for these countries for the years 1950, 1960 and 1970, with post-1970 data available for five countries. The actual delineations have emphasized urban core areas, their hinterlands and the residual rural areas. The core areas and their associated hinterlands make up "functional urban regions" (FURs). These are defined so that commuting across FUR boundaries is minimal. In that sense, they are similar to the U.S. Bureau of Economic Analysis (BEA) regions and represent functional labor markets.

The most useful aspect of this data file is consistency and comparability between the various nations. Enough data is available to compute a variety of Hoover indices for many regional sets and subsets. For this we adopt the following notation:

$H_i(t)$ is the Hoover index computed for some nation over the set of regions i, for year t;

$H_{ij}(t)$ is the Hoover index computed for a nation over the *union of* the set of regions i and j, for year t.

It should be noted that the index will be computed for sets of regions which are exhaustive as well as for subsets of regions. Vining and Strauss looked at Hoover indices for a variety of regional delineations for the U.S.; yet all of these were exhaustive delineations. If the set of regions for which we compute the index is exhaustive then the proportions of population and area are defined with the national totals of denominators. If, however, the set is some subset, such as the set of all *urban* areas, then the denominators used in computing percentages refer to total *urban* area and population. The reason for this convention is that we wish to observe trends in H_i which are not affected by trends in other subsets of regions. We hope to show that this modified version of the Hoover index renders it a more powerful tool.

We denote:

- u as the set of all urban core areas;
- h as the set of all hinterland areas;
- r as the set of all rural areas;
- s as the set of all functional urban areas, each of which is u + h;

uhr, sr are exhaustive unions of regional subsets.

A compact way of representing Hoover index trends for eighteen developed countries over the twenty-year span 1950 to 1970 is the array of index changes, or concentration changes, as shown in Table 2. Post-1970 performance is shown in Table 3 for some countries. Overall population concentration is measured by looking to the behavior of the first two indices which are defined over exhaustive sets of areas. We note that three groupings are possible. Since far more data is available for the years up to and including 1970, those results are examined first. An obvious grouping of nations can be seen. The group A countries show increasing concentrations of their populations for all spatial levels of aggregation; most growth took place in the most populous spatial units.*

The group B countries are of interest because they show increasing concentration of the population *except* with respect to urban cores. The straight column of minuses for H_u, group B, shows that the smaller urban cores are getting more of the growth than the larger urban cores. This should be linked with the pluses in the next column. In fact, across groupings and for as many as sixteen of the eighteen countries, the larger hinterlands grew faster than the smaller ones. If we recall that large urban cores are associated with the larger hinterlands, then spillover growth is suggested. In fact, for the twelve countries which have minus signs for the change in H_u *along with* plus signs for the change in H_h, it seems that the diminishing importance of the largest urban core areas and the concurrent increasing importance of the large hinterland areas is strong evidence of a wave effect and reinforces scepticism as to the clean break. The group C countries show deconcentration in light of the signs on Hoover index changes computed for exhaustive sets of areas. In other words, the overall figures are heavily weighted by the effect noted for the urban cores.

Of course, post-1970 data is more interesting because the alleged reversals are a recent phenomenon. Unfortunately, that data is limited to five countries. Table 3 shows that Japan continued to concentrate at all levels of aggregation. Yet, the actual numbers show that the rate of increase in Hoover index values falls for each year between 1970 and 1975. Perhaps, Japan will soon be in group B. Denmark is the clearest example

*Actually, the index only allows change towards more or less dense settlements to be detected. Yet, the strong correlation between size and density allows us to use the more useful size characterizations.

Table 2. Population Concentration Trends Indicated by Direction of Hoover Index Changes, 1950-1970.*

	H_{uhr}	H_{sr}	H_u	H_h	H_s
GROUP A					
Spain	+	+	+	+	+
Japan**	+	+	+	+	+
Finland	+	+	+	+	+
Italy	+	+	+	+	+
GROUP B					
Norway	+	+	-	+	+
Sweden	+	+	-	+	+
Denmark	+	+	-	+	+
Portugal	+	+	-	+	+
France	+	+	-	+	+
Ireland	+	+	-	+	+
Hungary**	+	+	-	+	+
F.R.G.**	+	+	-	+	+
GROUP C					
Great Britain	-	-	-	+	-
Netherlands	-	-	-	+	-
Switzerland	-	-	-	+	-
Belgium	+	-	-	+	n.c.
Austria**	n.c.	-	-	-	-
Poland**	-	-	-	-	-

*Except Japan and Hungary, 1960-1970 and Finland 1955-1970.
**Delineated in terms of urban cores and hinterlands only; there are no non-hinterland rural areas.

Table 3. Post-1970 Population Concentration Trends for those Countries for which FUR Data are Available.

		H_{uhr}	H_{sr}	H_u	H_h	H_s
Poland	(1970-73)	+ (R)	n.c.	+ (R)	+ (R)	n.c.
Japan	(1970-75)	+	+	+	+	+
Hungary	(1970-75)	+	n.c.	-	+	n.c.
Finland	(1970-74)	+	+	n.c.	+	+
Denmark	(1970-75)	- (R)	- (R)	-	+	- (R)

(R) indicates a reversal from the pre-1970 trends shown in Table 2.

of transition from group B to group C, suggesting that there may be a natural evolutionary sequence.

The case of Poland is the most difficult to decipher. The raw data suggests that there is a decline in the relative importance of the large cities yet within that set, growth is skewed towards the larger urban cores.

PROBLEMS OF INFERENCE

As mentioned, the delineations on which our data file is based for functional urban areas, are defined by commuting patterns for 1970. The hinterland is usually defined as an area from which at least 15 percent of commuting is to the central city. Obviously, areas which were functional spatial units in 1970 might not have been so for 1950 or for 1960. Thus, a similar bias as that which we have discussed with respect to the U.S. data is built into our sample. The crucial difference is that the definitional units differ. Hinterlands are much more spatially extensive than the U.S. metropolitan suburban areas. Thus, our computed Hoover index over the set of hinterland areas would be akin to looking at some suburban and some adjacent as well as some non-adjacent but linked counties for the U.S. sample. It is this crucial difference which causes us to believe that this sample permits analysis that is surely possible with the U.S. data but is not practiced because of the convenient availability of standard reporting units, (metropolitan vs non-metropolitan).

We should also consider the extent to which the fixed boundaries of our sample have biased our own computations. Looking at the definition of the Hoover index, we find that all the P_{it} certainly changed over time while constant values for a_i were used. Yet, a_i should also have a 't' subscript because the boundaries of the functional areas certainly advance with population growth. In fact, if the FUR boundaries advanced such that areal proportions kept exact pace with population changes, then the Hoover index would remain constant. This could not occur in a situation such as the Vining-Strauss investigation because of their use of fixed administrative boundaries, but it is very much a problem when the regional definitions are supposedly functional and encompass a subset of regions. We recognize this problem of possible bias in our fixed area regions and counter by asserting that over the relatively short time span considered, it is likely that population changes were much greater than areal changes. As such, the calculated indices should certainly change, although the rate of change may be overstated in our results.

Cliff and Robson suggest the obvious: any sort of functional regions which are studied over time must be made up of constituent units for which data is available so that recalculations can be made for alternative areal units. Zelinsky does precisely this in his study of Pennsylvania settlement systems. Of course, this procedure brings on new problems of *how to* reclassify the smaller spatial units. In spite of this, Zelinsky gets closer to events than many of the other cited studies and comes out on the side of a wave effect. He concludes that what is observed in the U.S. is "a reconcentration of people within distances of some 25 to 35 miles of the metropolitan center" (Zelinsky, 1978, p.37).

CONCLUSION

Our survey of some of the evidence presented for U.S. settlement patterns suggests that there is cause for scepticism of a clean break. For the eighteen countries of our sample, we have been able to look at developments beyond the metropolitan areas and these suggest that a continuing wave effect is taking place rather than a clean break. Since there is no reason to expect that settlement patterns in Europe, Japan, and America evolve in opposite fashion, the findings from the FUR file lend some support for the wave effect conclusion in the U.S. In that event, we side with Wardwell's judgement that the U.S. record alone is too complex to denote a clean break with the past.

Yet, the Hoover index values that have been computed are perhaps also suitable for the testing of some demoeconomic hypotheses. Human settlement patterns, it has been suggested, change in response to new technologies, a new age structure of the population, and new social arrangements especially with regard to pensioning and retirement practices. We have data on some of these changes and can test the effect that they have on changes in our population concentration indices.

It should be noted that in the new field of demoeconomics, there is a shortage of widely accepted theory. For this reason, theoretical arguments on behalf of direct as well as on behalf of inverse causation can often be found; we often use two-tailed tests in evaluating statistical results.

The standard urban economic models of Alonso and Mills suggest that rising incomes and declining travel costs explain flatter bid rent curves and eventual expansion of the metropolis. Indeed, some regression results in Tables 4 through 7 show consistent minus signs and widespread significance of the income-type variables, bearing out that theory.

Other urban and regional economic theories, of various degree of formality, are available in support of the wave effect. A preference for small-town life has long been used to explain suburbanization. The data seem to suggest that this trend is as strong as ever and that it is taking place at ever greater distances from central cities, especially if these central cities are large. Wardwell concludes that people are showing "a clear desire for living in smaller sized places within commuting radius of the metropolitan center, *and* for smaller sized places beyond that radius in preference to living within the center itself" (Wardwell, 1977, p.176, italics added).

None of this is really new. Commuting radii are growing as usual. Central city decline, as W. Thompson suggests, is a cause *as well as* an effect. For example, if we detect central city growth in the smaller cities and peripheral growth in the larger cities we may hypothesize that agglomeration diseconomies emerge *in central locations* when the metropolis is mature. Wardwell quotes Thompson's detailing of this hypothesis: Thompson suggests that large urban areas are the natural incubus to new

Table 4. Logit regression results explaining variation in Hoover indices (signs of coefficient above t-values in parentheses).

	H_u	H_h	H_s	H_r	H_{uh}	H_{uhr}	H_{ur}	H_{hr}	H_{sr}
National Population 1974	(deleted, highly collinear with GDP.)								
Annual % growth of national population 1964-1974		+ (1.65)	+ (2.83)		+ (1.72)	+ (1.56)		+ (1.79)	+ (1.74)
Per Capita Income			- (2.35)		- (1.47)	- (1.91)		- (2.41)	- (2.03)
Gross Domestic Product 1974		- (2.42)	- (2.90)		- (2.02)			- (1.43)	
Growth of GDP 1970-1974 @ constant prices			- (2.57)		- (1.48)	- (1.65)		- (1.95)	- (1.81)
Percent of population 60 years old or over in 1970			+ (2.37)			+ (1.87)		+ (2.06)	+ (2.09)
Percent of population economically active in 1977			+ (1.87)					+ (1.70)	
Percent of population economically active 65 years or older, 1977		- (1.76)	- (2.48)		- (1.68)				
Percent of population economically active 60-64 years old, 1977							+ (1.46)	+ (2.89)	+ (1.76)
Percent of labor force in agriculture, hunting, forestry and fishing		- (1.60)	- (2.02)		- (1.38)				
R^2		0.62	0.73		0.57	0.53	0.54	0.75	0.66

Table 5. Logit regression results explaining variation in Hoover indices (signs of coefficient above t-values in parentheses).

	H_u	H_h	H_s	H_r	H_{uh}	H_{uhr}	H_{ur}	H_{hr}	H_{sr}
National Population 1974	+ (2.72)	+ (1.60)	+ (2.94)		+ (3.30)	+ (1.51)			
Annual % growth of national population 1964-1974	- (1.61)		- (1.78)	- (1.67)					
Per Capita Income	+ (1.67)		+ (1.82)						
Gross Domestic Product 1974	(deleted, highly collinear with national population)								
Growth of GDP 1970-1974 @ constant prices			- (1.92)			- (2.05)	- (1.43)	- (2.17)	- (1.99)
Percent of population 60 years old or over in 1970			- (1.97)						
Percent of population economically active in 1977									
Percent of population economically active 65 years or older, 1977				+ (1.62)					
Percent of population economically active 60-64 years old, 1977	+ (1.51)		+ (1.77)						
Percent of labor force in agriculture, hunting, forestry and fishing	+ (1.53)			+ (2.14)					
R^2	0.62	0.58	0.75	0.74	0.75	0.51	0.28	0.52	0.46

Table 6. Logit regression results explaining variation in Hoover indices; modified Hoover index (signs of coefficient above t-values in parentheses).

	H_u	H_h	H_s	H_r	H_{uh}	H_{uhr}	H_{ur}	H_{hr}	H_{sr}
National Population 1974	(deleted, highly collinear with GDP.)								
Annual % growth of national population 1964-1974				- (1.57)					
Per Capita Income									
Gross Domestic Product 1974			+ (1.44)		+ (1.54)	+ (1.47)			
Growth of GDP 1970-1974 @ constant prices		- (2.41)	- (2.10)		- (2.51)	- (2.04)		- (1.54)	- (1.98)
Percent of population 60 years old or over in 1970									
Percent of population economically active in 1977									
Percent of population economically active 65 years or older, 1977		+ (1.55)							
Percent of population economically active 60-64 years old, 1977									
Percent of labor force in agriculture, hunting, forestry and fishing.					+ (1.65)				
R^2		0.71	0.51	0.60	0.53	0.50		0.51	0.46

Table 7. Logit regression results explaining variation in Hoover indices; modified Hoover index (signs of coefficient above t-values in parantheses).

	H_u	H_h	H_s	H_r	H_{uh}	H_{uhr}	H_{ur}	H_{hr}	H_{sr}
National Population 1974			+ (1.46)		+ (1.58)	+ (1.51)			
Annual % growth of national population 1964-1974				- (1.58)					
Per Capita Income									
Gross Domestic Product 1974	(deleted, highly collinear with national population)								
Growth of GDP 1970-1974 @ constant prices		- (2.41)	- (2.10)		- (2.52)	- (2.05)		- (1.55)	- (1.99)
Percent of population 60 years old or over in 1970									
Percent of population economically active in 1977									
Percent of population economically active 65 years or older, 1977		+ (1.56)							
Percent of population economically active 60-64 years old, 1977									
Percent of labor force in agriculture, hunting, forestry and fishing					+ (1.68)				
R^2		0.72	0.51	0.61	0.53	0.51		0.52	0.46

industry formation and innovation only as long as their industries are centrally located. As soon as plants begin to decentralize, as they inevitably do at their stage of maturity, the centers of the larger cities lose this important function and begin to decline.

This is related to the Vernon hypothesis (1960). The latter suggests that central cities are hospitable to innovation and new industrial processes because they are the scene of external economies. Yet, as plants grow, they seek scale economies rather than external economies and, therefore, seek cheap lands in the peripheral areas. Thus, they leave the center and add to its decline in two ways: by not being there and by no longer providing external economies to newcomers.

The theory that is available on behalf of a reversal thesis (see, for example, Friedmann, 1973) is much slimmer.

Obviously, more theory building and more testing is required. Working across an international cross section with the aid of a small sample does not guarantee definitive results. Yet, policy issues such as whether planning ought to be done at metropolitan levels or not depend, in part, on whether metropolitan areas are expanding or whether they are becoming ever less important.

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