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CHAPTER 7

Long National Residential Building Cycles

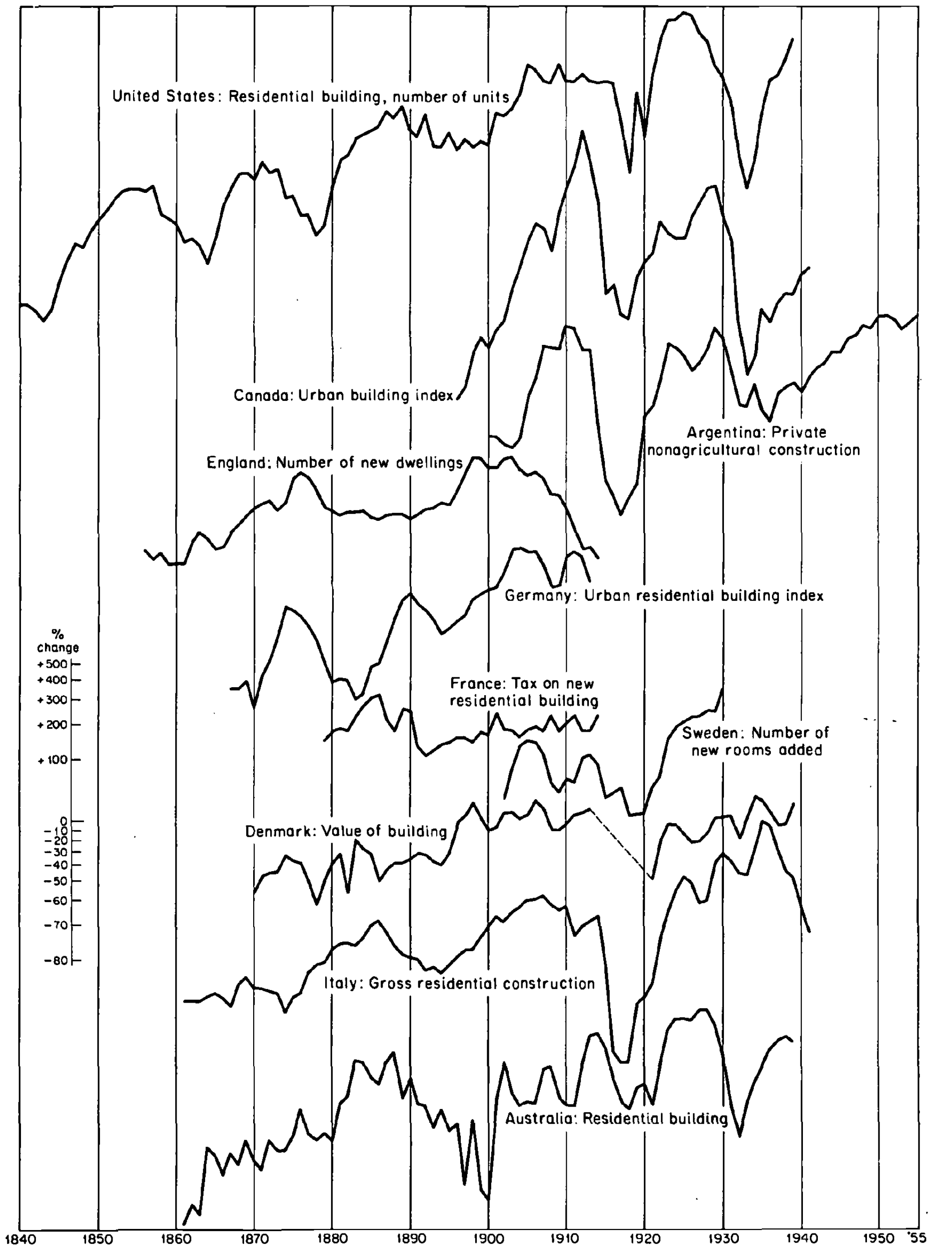
A. LONG CYCLES, TEN COUNTRIES, AND AVERAGE CYCLE PATTERNS

Our inquiry until now has concentrated primarily upon the local cycles. The theater of action was an urban community or region inclusive of rural environs and representing an area over which building resources could move with some facility. In this theater we encountered the influences and mechanisms making for long waves in urban residential building, real estate market activities, and demographic movements. These influences and mechanisms are, in the first instance, local and depend upon the structural lags and leads built into the real estate market and its characteristic responses to demand stimuli, its supply elasticity, and the prevailing state of expectations. But at many points these influences and mechanisms join with their counterparts elsewhere, resulting in a broader nationwide movement, which has affected markets for capital, building labor, building materials, and manufactured goods.

We shall now see that this broader nationwide movement has involved long waves in urban building. Chart 7-1 shows time series of residential or related categories of building for ten countries, spanning the larger part of the nineteenth century and reaching well into the twentieth. In Chart 7-2 is a pair of series tracing the use of strategic building materials in England back to the early 1700's.

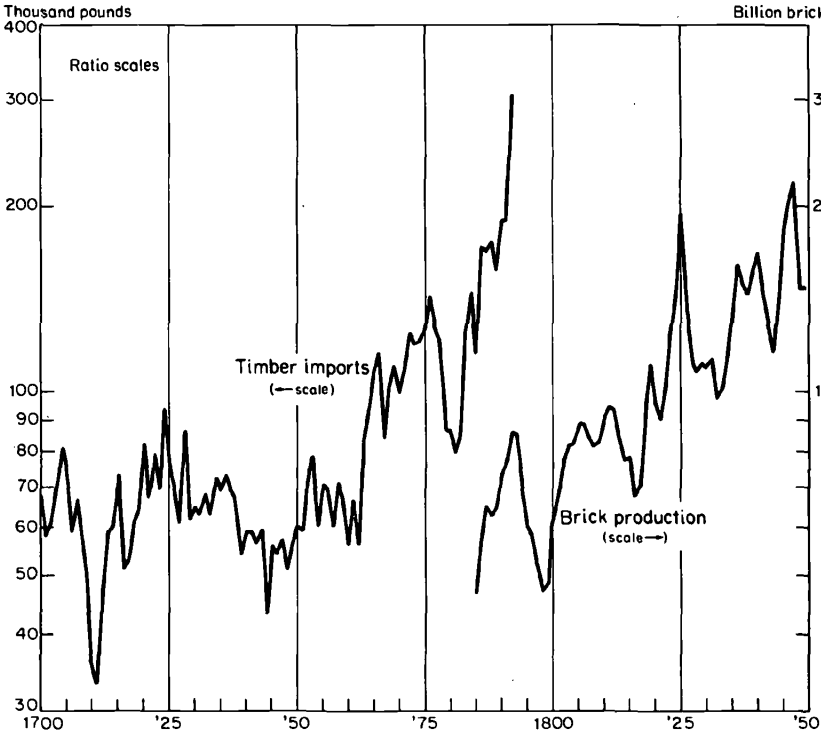
Inspection of Charts 7-1 and 7-2 discloses a widespread tendency for building to fluctuate in the longer rhythm which we found characteristic of local building and related real estate activities. Only the Danish series is free from perceptible long swings, which however emerge in rates of growth for the same series. The French and Swedish series were too short to permit a

CHART 7-1
Residential or Building Construction, Ten Countries, 1840–1955



SOURCE: Appendix B, 0057, 0062, 0049, 0055-0056, 0037, 0140, 0155.
Appendix H, 0018.

CHART 7-2
Building, England and Wales, 1700–1849



satisfactory rendering of cycle patterns out of the crude data of experience.[1]

The Canadian graph is an attempted measure of central city residential building experience, as indicated by building permits.[2]

The time series spread out over Charts 7-1 and 7-2 depict the patterns of fluctuation as they occurred on a year-to-year basis. In Charts 7-3 and 7-4 these patterns are distilled from historic experience using the technique of the nine-stage cycle pattern which has become so familiar in this work. The graphic patterns are supplemented by tabular summary measures presented in Table 7-1. To clearly indicate the degree of conformity that was embodied in these average patterns they are drawn as a zone bounded by the mean deviations of the individual cycle standings from the average standings, those "bleak symbols"—as Mitchell once called them—of intracyclical variability.

This variability arises in part out of the basic fact that the

CHART 7-3

Average Long Specific Cycle Patterns, Three Countries, 1711–1941
(Cycle Relatives Charted Plus and Minus Mean Deviations)

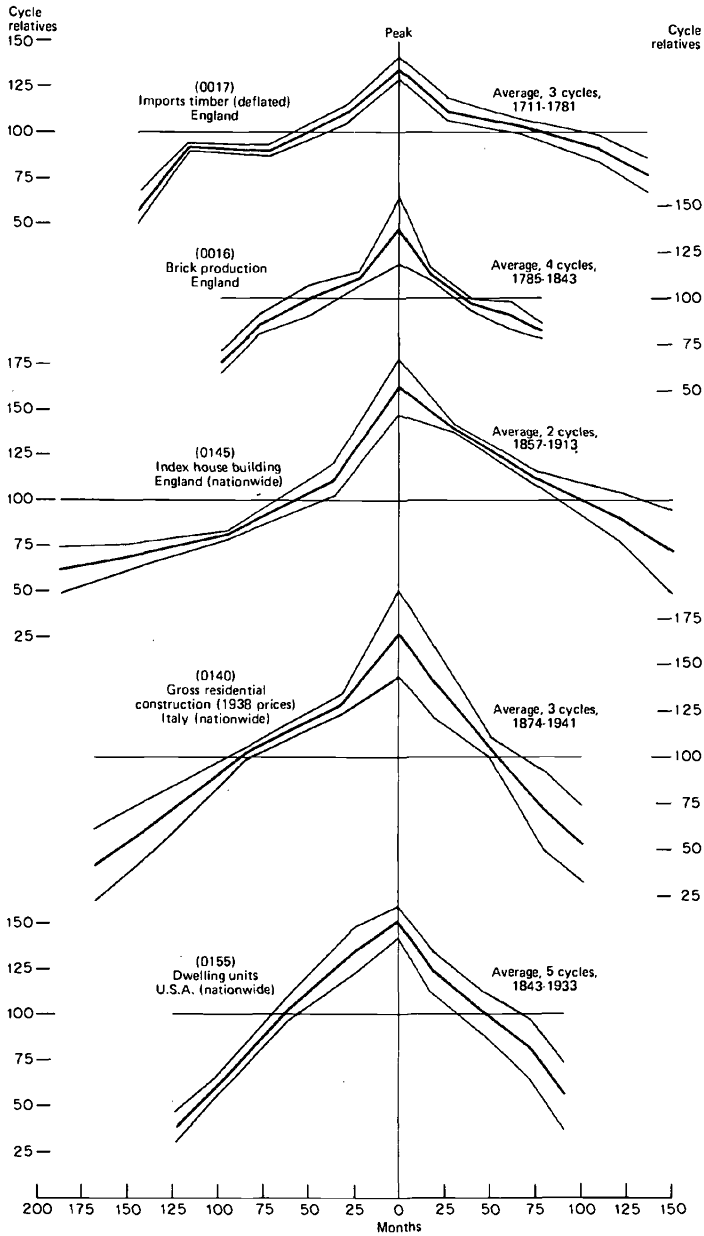


CHART 7-4

Average Long Specific Cycle Patterns, Five Areas, 1867–1933 (Cycle Relatives Charted Plus and Minus Mean Deviations)

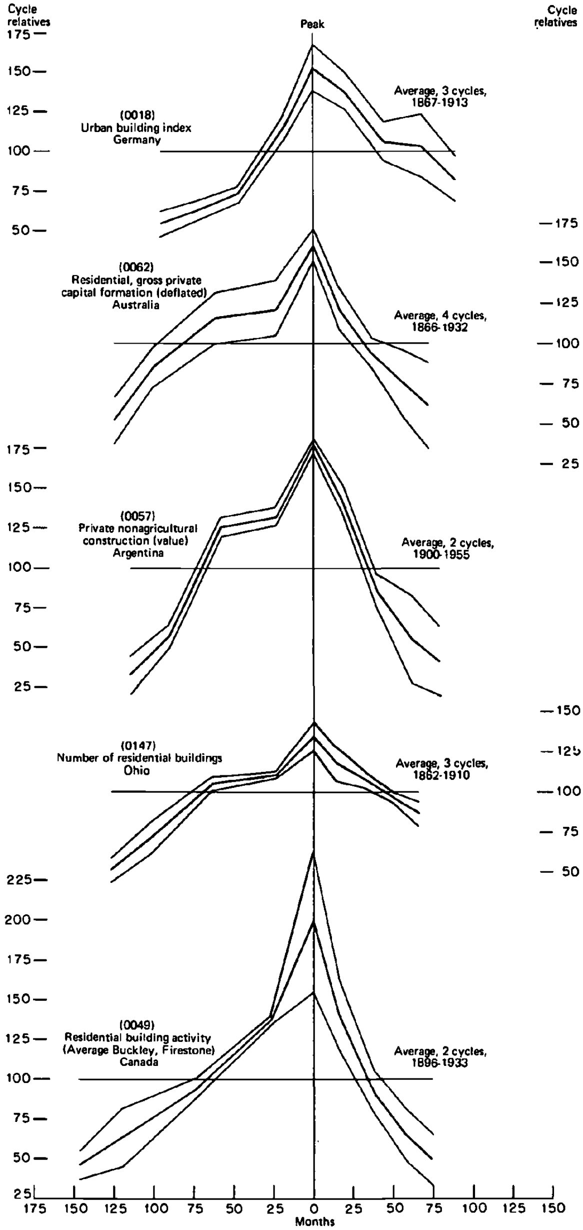


TABLE 7-1
Summary Measures, 31.5 Specific National Long Cycles, Building Activity, Seven Countries

A. Identification and Duration

Country	*Series No.*	*Item*	*Years*	*Number of Specific Cycles*	*Mean Duration (Years)*
Great Britain	0016	Brick production	1785–1849	4	14.5
	0017	Timber imports	1711–1781	3	23.3
	0145	House building	1853–1914	2	28.0
Germany	0018	Urban residential building	1867–1913	3	15.3
Canada	0049	Residential building, urban (Buckley)	1896–1941	2.5	16.7
	0050	Building activity (Firestone)	1896–1941	2.5	17.5
Argentina	0057	Nonfarm building	1900–1955	2	16.5
Australia	0062	Nonfarm gross residential capital formation (deflated)	1861–1939	4	16.5
Italy	0140	Gross residential capital formation (deflated)	1861–1941	3	22.3
Ohio	0147	Number of residential dwellings	1857–1914	3	16.0
U.S.	0155	Number of residential dwellings	1840–1939	5	18.0
U.S.	0271	Value of residential building	1843–1939	5	18.0

B. Amplitude, Secular Measures

Country	Series No.	Amplitude Specific: Total: All Years	Amplitude Specific: Total: Per Year	Amplitude Specific: Per Year Fall	Secular Weighted Average Growth Rate Per Year Short Cycles	Average Per Year Per Cent Change Overlapping Short Specific Cycles
Great Britain	0016	123.5	8.52	−8.53	1.846	1.91
	0017	133.9	5.74	−5.05	n.a.	n.a.
	0145	191.6	6.84	−7.26	1.680	.90
Germany	0018	169.4	11.07	−9.67	2.338	2.64
Canada	0049	424.8	23.85	−43.77	1.188	5.05
	0050	164.7	9.41	−10.61	n.a.	n.a.
Argentina	0057	280.0	16.97	−19.39	−.097	1.91
Australia	0062	208.8	12.66	−16.67	2.08	2.79
Italy	0140	239.3	10.71	−13.69	2.216	2.23
Ohio	0147	131.3	8.21	−9.06	2.547	3.08
U.S.	0155	207.3	11.50	−12.50	2.977	n.a.
U.S.	0271	220.1	12.23	−14.17	4.00[a]	2.35[a]

n.a.—not available.
[a] Average, 2 segments.

historic environment, within which building waves ran their course, was changing in character. Even two successive waves would touch different historic epochs; the terminal troughs in three successive waves would span over half a century. A changing environment and the shifting course of historic development would affect the form and character of long-swing movements. It is important thus at the outset to establish in some valid sense the *representative character* of the nationwide average cycle pattern and the consequent meaning of the zone of mean deviations. In our analysis of local long swings we encountered instances where the average pattern does not embody a recurring pattern of experience marred by irregularities. The average pattern in these instances offsets and helps to erase divergent types of experience embodied in successive patterns. In such instances the "average" represents the cumulative aggregate, not a typical pattern running through it. In our investigation of local cycles it would have been tedious formally to have examined the credentials of every average pattern before its use. But at the threshold of our study of nationwide average patterns presentation of such credentials is called for.

If the successive individual wave movements conform closely to a typical pattern they should be uniform at least in certain crucial respects: underlying secular change, sign of stage movements, predominance of phase (expansion or contraction), degree of duration, dispersion, and presence of clear-cut secular trend in amplitude or duration. There are other measurable characteristics but these should suffice to indicate the representative character of the average patterns and the meaning of the zone area of deviations bounding these patterns.

The first suggested measure, that of secular change, may be probed by a comparison between two measures of secular change measured by (a) per cent change per year and (b) average short-cycle standings (see Table 7-1). The magnitude of secular change corresponds to the upward tilt of our specific patterns themselves (Charts 7-3 and 7-4). In this very elementary respect, all successive long cycles conformed to the secular drift, i.e., the mean annual values of each successive long cycle were greater than its predecessor.

Stage movements are more variable, and some divergence in sign of stage movements in particular cases is to be expected. It is striking, however, that, out of 252 surveyed stage movements, in only 5.7 per cent of the cases was there a direction of change different from that of the series average. This means that individual cycle patterns with regard to this feature of general shape conformed to a structural type.

Another basic feature of general shape is balance of cycle pattern or relative predominance of expansion over contraction months. Expansions predominate in all of our average patterns. Out of thirty-five individual cycle patterns, 80 per cent conformed to type in this regard. In only 12 per cent of the cases were contractions longer; in another 8 per cent the two phases were of equal duration.

With regard to durations, the deviation bars attached to the charts and figures cited in the tables show that dispersion generally was as wide between, as within, series. For the nine countries involved, our mean duration was 19.09 years, with a mean deviation of 3.64 years. The mean deviation for the corresponding country series is 3.4 years, nearly the same magnitude. A relatively low mean variation was characteristic of country series generally and even prevailed for the one case, Great Britain, where three different series covering different segments of over 200 years of building experience yielded radically different duration levels. For the earlier eighteenth century and later nineteenth century, waves of extraordinarily long duration were involved, averaging 23.3 years in the earlier period and 28 years in the later period. But between the two periods there was a succession of four clear-cut long waves, with a duration range between 11 and 17 years and a mean duration of 14.5 years. Total amplitude experienced was comparable to the earlier eighteenth century movement as shortness of duration was offset by greater intensity of action. Yet, though the three series had a wide range of durations—from 14.5 to 28.0 years —the diversity of duration experience within a series and the historic experience involved was relatively narrow.

The final feature selected to test for the presence of structural conformity between average individual patterns of our surveyed series has regard to trend of duration or amplitude. If long waves were systematically growing longer or shorter or greater or lesser in amplitude, then the average pattern of a series would not incorporate all the systematic elements present in its component individual patterns. Both mean duration and amplitude could then more accurately be described and graphed in trend-adjusted terms and supplemented by trend factors for amplitude and duration. If there is no systematic trend indicated for amplitude and duration, then the variations both within and between series probably correspond to the circumstances in the historic environment which hinder or accelerate the swing process.

Tabulation of the direction of change of successive long cycle standings indicates some slight tendency for both amplitudes and durations to decline. For nineteen instances of successive cycles in seven countries, some eleven were downward both with regard to duration and amplitude. If we compare not successive but terminal cycles, the picture changes. From initial to terminal cycle, durations were shorter for both nineteenth and twentieth century United States and Great Britain but longer in eighteenth century Great Britain, Germany, and Italy. American, British, Australian, and Italian amplitudes terminated at a higher level than they originated. With this mixed picture no clear trend of amplitude or duration is indicated and the average represents a persistent central tendency. There are probably systematic elements in our residuals which could be isolated and separated from the mean values and their residuals. I believe, however, we can be satisfied that our mean values approximate a form of movement running through the individual cycle patterns.

The dispersion from these mean values in absolute terms will only be crudely measured by the mean deviations. The number of observations was too few to assume a normal distribution of these. We insert the deviations in the charts only as a rough index of the scale of dispersion. In terms of acceptable statistical measures, our bounded zone of mean values and deviations probably overlaps substantially with the interquartile range, which, for these purposes, would have been equally suitable as an index of the scale of dispersion. While this index probably serves satisfactorily between series and phases of a given series, it is biased in its distribution of dispersion between stages of a phase. Allowance will need to be made for the tendency of this measurement technique to minimize deviations at mid-stages (II, III, IV, VI, VII, VIII) and to maximize them at troughs and peaks (I, V, IX). The bias is not serious but it will systematically warp the distribution among the cycle stages of the scale of dispersion indicated in our charts.[3]

B. RATES OF PER YEAR CHANGE, LONG CYCLES

The average cycle patterns which we have just reviewed graphically spell out the form and character of the long-swing movement characteristic of urban building in the open markets of classical capitalism. In outward form these patterns are similar to the patterns of movement of industrial output etched out by business cycles. There is the same smoothed rise and fall, the same predominance of expansion over contraction phases, the same upward tilt signifying growth. Does the similarity extend to the annual *rates of change* implicit in these cycle patterns? To answer this question we took the "first differences" of successive cycle relatives and divided the differences by the average interval (called a "segment") between the middle of the earlier and the middle of the later stages. The results represent percentage rates of movement of cycle relatives per year between segments of a cycle.[4] These yearly rates can readily be converted into the more common monthly rates used elsewhere.

For virtually all expansion and for most contraction phases our methods smooth out irregularities in intervals between peak and trough years, since the successive cycle stages will embrace two or more adjoining years. But short contraction phases which last for four years or less receive very little or no smoothing, and contractions which endure for six years receive only bivariate smoothing between paired sets of adjoining values. Of our surveyed national experience, series 0147 for Ohio and series 0016 for England (1785–1849) have relatively short mean contraction phases of 5.4 and 6.6 years, respectively, and hence allowance in these instances will need to be made for an increase in variability of rates of change due to reduced smoothing. And of course, for all our series—except in the highly volatile ones where a moving average was substituted for the original series—peak and trough values are unsmoothed. The tendency to "peakedness" would be random in reference cycle patterns, except where turning points coincided, but would be biased to extreme values where specific cycle patterns are concerned. Our basic statistical procedures would tend to depress terminal values and to elevate peak values and thus tend to generate some rise in rates of change between stages I–II and IV–V and some fall between V–VI and VIII–IX.

The graphs of the average rates of change between cycle segments for nine of our nationwide series are presented in Chart 7-5. The vertical axis is scaled in terms of percentages, the horizontal scale is in terms of years to or from stage IV–V. The percentage changes to the right of stage IV–V occur during the contraction phase; the percentage changes to the left of the zero point correspond to the expansion phase. The intervals between stages are all scaled on the horizontal axis except interval IV–V, which is assigned a zero time value in order to align uniformly all IV–V stages of the different series.

As with the average cycle patterns, these average rate-of-change patterns are extended into a zone bounded by the mean deviations from the changes. The minor bias previously noted, which tends to reduce deviations at mid-stages and to enlarge them at turning points, will operate here to the extent rates of change will be involved.

Unlike our cycle pattern charts, the time scale no longer is standardized at one cycle relative for one month. A 1 per cent change in our vertical scale now corresponds to six months of cycle time; hence a 45° slope to the rate-of-change pattern means that the rate is changing by .166 per cent per month or 2 per cent per year.

The rate-of-change patterns graphed in Chart 7-5 exhibit a comparable movement in the mean values and zone of deviations. The movement of the deviations corresponded, with only nine exceptions, to the movement of the mean values. Divergences were concentrated in intervals IV–V, VI–VII, and VII–VIII.[5]

If rates of change were constant in expansion and contraction with merely a reversal of sign, our graph would be made up of two parallel discontinuous straight lines, one in the positive scale (for expansions) and the other in the negative scale, and at equal distance from the origin. If rates of change steadily changed, as in a sine function, then the change pattern would reproduce the function, but shifted to neutral timing, showing the rate peak and rate trough midway in the reference phases. If the rate of change steadily fell during expansions and became negative at the peak, then the change function would decline during the expansion and cross into the negative scale between IV–V and V–VI. This would represent an expansion steadily being sapped of its driving force. Since rates of change of building, as well as

CHART 7-5

Average Patterns of Yearly Rates of Change from Stage to Stage of Building Cycles, National Building Activity, 1711–1955

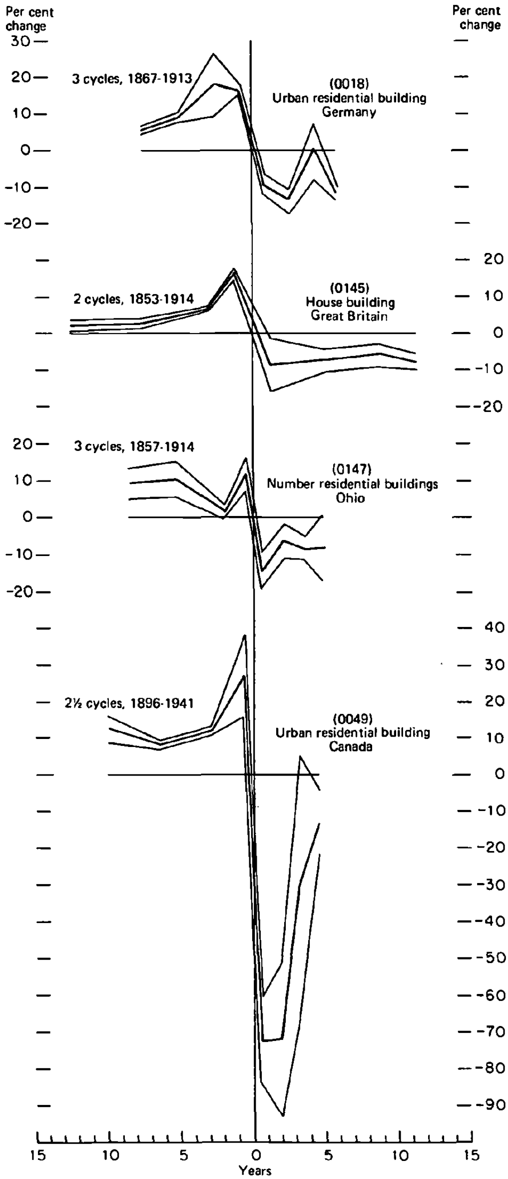
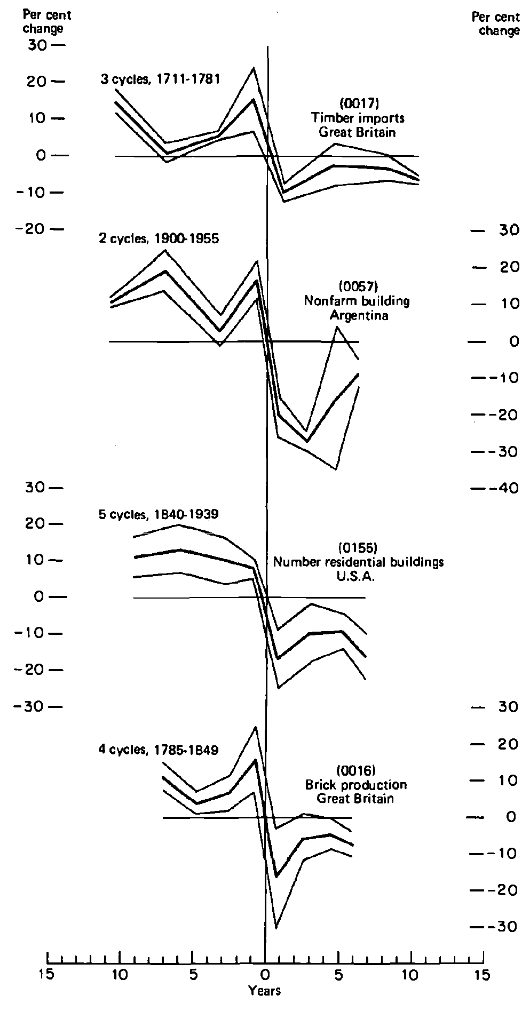


CHART 7-5
(Concluded)



building itself, elicit response and exert influence, careful consideration of rates of change seems indicated.

It will be interesting to compare our change patterns with the characteristics of similar change patterns for short cycles. Since for short cycles our time series would need to be on a monthly or quarterly basis to yield eight rate-of-change estimates, we have supplemented measures of aggregate output with proxy measures on imports and wholesale prices that conform well to movements of productive activity in four countries: United States, United Kingdom, Germany, and France.[6]

These average business cycles change patterns for four countries show certain interesting structural characteristics. Rate-of-change peaks in average patterns generally occur early in expansions. In our eleven national series, peaks were reached three times each in the II–III and IV–V segment but five times in the III–IV segment. Characteristically the high point of expansion is reached earlier in output expansions and somewhat later in import expansions. Countrywise, the United States tends to later peaks and Germany and France to earlier peaks, with the United Kingdom tending to a middle position. This ranking is based on average patterns and may conceal disparate movements in individual cycle experience.

Contractions exhibit a greater tendency to dispersion. Output troughs concentrate in the intermediate segments, as do prices. Import behavior is oddly dichotomized. Two of the countrywide series reach troughs at the beginning and two at the end of the contraction. The tendency to secondary relapses and pickups, characteristic of American comprehensive reference series, is reproduced in American specific cycles behavior but is found for three other countries only in the more volatile import series.[7] There is likewise little evidence, apart from U. S. experience, for the "striking and significant fact," noted by Abramovitz, that with respect to the rate of change in output "contractions and expansions are not symmetrical." Patterns of industrial output during expansion periods he found to be highly "variable." They sometimes reached their maximum points at the outset, more usually in the middle but rarely at the close of the expansion periods [2, pp. 359, 377f.]. During contractions, Abramovitz found that the most rapid rate of decline was reached "well before" the cyclical trough, in most cases at segments VI–VII but at adjoining segments also. The non-American experience was more inclined to exhibit symmetry of form between expansion and contraction behavior, with peaks and troughs in rates of change characteristically being reached within expansion and contraction phases and with some approach to a sinelike form. The dichotomy between expansions and contractions and the tendency for greater variability during expansions than in contractions is to be found, curiously enough, in the pre-1848 English behavior.

Rates-of-change patterns in our building cycles exhibit the same range of diversity and some of the characteristic tendencies of business cycles. Building expansions, like business cycle expansions, are often sinelike. Only one building expansion (0155) shows the declining tendency exhibited by only a few short industrial cycles. Building expansions seem, however, to be characterized by greater buoyancy of spirit, with a crescendo reached late in the expansion or at the peak. This variation from the sine form, in my judgment, is partly but not wholly, the product of statistical bias in our smoothing procedure.

The same field of variation in change patterns is found in the contraction experience with building cycles. Three of our series exhibit a sine formation. For five of our series, however, a secondary decline occurs in the rate of fall, which pulls down the rate at the terminal trough. This corresponds to the tendency, uncommon in short cycle output behavior, for low levels of the rate of change to persist in the contraction (series 0017, 0140, 0155, 0145, 0147).

C. RELATIONSHIP OF LOCAL AND NATIONAL LONG CYCLES

If we now compare nationwide long cycles in residential or related building with counterpart local long cycles, we observe a curious and striking family likeness. Let us commence with the simple property of duration, the data for which is set forth in Table 7-2. We take our national and local series as they come and tentatively allow each an equal weight.

The results are striking. As expected, the absolute range of local variation is wider, as is indicated by the standard devia-

TABLE 7-2
Summary Tabulation Nationwide and Local Cycles—Duration

	Local	*National*
Number of series	30	10
Number of cycles	81	30.5
Mean duration	19.67±5.00	18.96±4.36
Median duration	18.45	17.3
Ratio high to mean	1.68	1.48
Ratio low to mean	.54	.77

SOURCE: Chapter 2, Table 2-2; Chapter 5, Table 5-1.

tions and by corresponding ratios of the extremes to mean values at the upper and lower ends. But the mean and median values are nearly the same and the standard deviations are close together. Though the national sample of series is relatively small, the range of historic experience surveyed is wide, and the pattern of results reached would probably persist with much larger samples of nationwide or local cycles. The import of our table is, that with regard to duration, nationwide cycles center at the same value level as local cycles, have comparable cluster characteristics, and experience a relatively wide absolute range of dispersion. This indicates or implies a high degree of coalescence of local cycles, for otherwise mean local cycles would systematically be shorter and nationwide cycles appreciably longer.

A different kind of coalescence is exhibited by amplitude characteristics, which are detailed in Table 7-3. The range of nationwide amplitude is cut off by aggregation, as was the case with duration, but the center of the national distribution is around two-thirds that of the local. In aggregation some 30 per cent of local amplitude was eroded away. If we strike an average of the national experience for the mid-nineteenth century and later of the three countries most fully represented in the local returns—the United States, Great Britain, and Germany—we derive an implicit erosion rate of 34.6 per cent. These erosion rates of mean local amplitudes among nations correspond to erosion rates for five Ohio local groups when compared with statewide aggregation (32.7 per cent), five major U.S. areas, including the state of Ohio (36.6 per cent), and three major

TABLE 7-3
Summary Tabulation Nationwide and Local Cycles—Total Specific Amplitude

	Local	*National*
Number of series	30	10
Number of cycles	81	30.5
Mean total amplitude	306±92.37	214.3±83.16
Median total amplitude	288	200.2
High (ratio to mean)	1.58	1.98
Low (ratio to mean)	.59	.58

SOURCE: Chapter 2, Table 2-2; Chapter 5, Table 5-1.

German cities (45.1 per cent). These erosion rates represent the shrinkage in mean local specific total amplitudes emerging in the amplitude measure of the corresponding territorial aggregate.[8]

The erosion of amplitude in aggregation results from differential coverage and from variations in timing, which put some cities and areas in the lead and cause others to lag. Out of thirty-two matched turning points for the five local and regional American series, there was considerable variation from period to period, the mean deviation of the five local series being 1.39 years. A similar range of variation between timing of local and national cycles was found in Germany and in Great Britain. For the seventeen non-Ohio cities for which specific turns could be matched with national turns, fourteen had mean lead-lags of less than two years and none exceeded four years. The mean lead-lag, signs disregarded, was only 1.34 years. The over-all mean deviation at these measured lead-lags for twenty-eight local series was 2.61 years.

This expected conformity of regional to national movements shows up in the one instance when our survey included regional series. Australian brick production is fortunately available for a long time period for three major regions. The resulting set of specific and reference patterns graphically exhibit the expected high degree of conformity of regional to nationwide patterns of movement. The reference frame here is the national chronology of total, gross, nonagricultural capital formation, since brick production would be associated with all varieties of construction activity, not merely building. Since brick production itself experienced an erosion of specific amplitude of 13.6 per cent when measured on a national reference construction frame, it can be seen that the mean erosion of the three provincial areas, 22 per cent, indicates a high degree of convergence of provincial and national movements in brick production. It appears that the larger the level of aggregation the greater is the conformity to the national aggregate.

D. CONVERGENCE OF NATIONWIDE AND LOCAL CYCLES

Nationwide and local cycles, then, do not run independent courses but to a high degree conform to each other. However, local and national cycles can run a wide range in terms of amplitude and duration; and the response mechanisms and speculation potential of urban communities will be quite different both over space and in time. It would seem almost unavoidable that local cycles would offset each other or neutralize each other in conformity to the rule, suggested by Arthur Burns in his unpublished manuscript study, "that cyclical amplitudes become narrower as the geographic scope of a building series becomes wider" [39, pp. 59ff.]. This tendency to dispersal would be promoted from the supply side. It would be easy for any given impulse of long cyclical expansion in one area to work its way if the converse state prevailed elsewhere. Mortgage funds, building labor, and building materials could more easily be obtained; and an increase in demand for building would be satisfied with a lesser degree of price inflation. A local expansion impulse would thus be favored if other communities were in a more dormant condition.

If thus local cycles are to converge into a national movement, they will encounter supply resistance. There must be a powerful influence at work or a set of "integrating factors," as Arthur Burns called them, or an "extraneous force of considerable magnitude"—such as would be represented by "wars, inflation, or structural transformation,"—to "bond together local cycles." It was tempting to invoke the "extraneous factors," since these historically could be dated so readily and since they were known to be associated with backlogged need and surges of building. I, too, tended throughout the early phase of the present investigation to rely on these "extraneous forces."[9]

The "extraneous forces" unquestionably affect the long-wave process. But other bonding forces are available to integrate local cycles. These bonding forces spring from the local movements themselves, as soon as these movements are regarded not as oscillations around a stationary process but as a wavy form of growth. For as a form of growth, local cycles involve concurrent fluctuation in industrial building and the rate of labor-force inflow or immigration. The local boom in building then becomes a response to enlarged demand for shelter generated by expansion in local income, employment, and production. This has been satisfactorily demonstrated in many contexts and in many different historic environments by the statistical and descriptive materials assembled in the preceding chapters.

Where does this local expansion in income, employment, and production in a given community come from? It can only arise from an increase in local primary employment, which, in turn, will correspond to expanded demand in other localities for goods produced or services rendered by the given community. This expanded demand in other localities may arise from improved terms of service or from displacement of other products and production centers. Or expanded demand may involve all products and centers. Local industrial expansion, in turn, generates expansion elsewhere; and each local contraction tends to generate a counterpart contraction in other urban centers. Concurrent urban expansions thus occur under unfavorable supply conditions; but when supply conditions are most favorable the demand impulse is lacking. We now see why extraneous forces of considerable magnitude are not needed to integrate local cycles. These cycles are bonded together by the industrial interdependence which forces all urban communities with a diversified base to fluctuate in unison.

The tendency of local cycles to coalesce into a common typical pattern is, in its way, similar to the tendency of national business cycles to coalesce into a common international movement. Any domestic expansion, through the force of the import propensity, tends to generate counterpart expansions in trading partners at the same time that the impulse for domestic growth is scaled down. These counterpart expansions will of course generate some export "seepage," as it is called, or induced exportation, which, considering the likely scale of the parameters for an international economy, will be of much smaller magnitude than the originally induced importation. The tendency to produce a common movement out of the disparate impulses of the individual countries will be greater the higher the average level of import propensities and the more sensitive credit facilities are to shiftings in the current account of the balance of payments. Other countries had to "keep in step" which requires, as Keynes once wittily noted, that "everyone must conform to the average behavior of everyone else" [154, II, p. 286].

Local urban communities are much more closely bonded together than the national economies of the Atlantic community. The import propensity, so to speak, is much higher, and a larger fraction of productive output is channeled for sale to outside markets. Under these circumstances it would be very difficult for an urban community with a diversified industrial base to take off on special tangents of growth that vary significantly from the predominantly national movement. Urban areas that face comparative disadvantage in attracting new or in keeping old industry will, of course, lead at downturns and lag at the upturns. Urban areas that are favored by comparative advantage and in which, accordingly, nationwide industrial growth is concentrated will tend to lead in upturns, to rise at higher annual velocities, and possibly to lag at peaks. Otherwise lags and leads will grow out of "overshooting" induced by the process of rise or fall and exemplified excellently by the behavior of the vacancy series. But the extent of overshooting will itself be constrained by shifts in demand impulses growing out of the rise or fall in demand for industrial products locally produced. Communities with a nondiversified industrial base, in which an important role is played by industrial products serving special markets at home or abroad, could more readily exhibit a particular nonconforming reference pattern. It is striking that a collection of small neighboring urban communities—such as was drawn together in some of our Ohio groups—conformed to the national and regional movement. Indeed, our Ohio groups, down to the lowest degree of urbanization, conformed closely to the statewide movement, while the still more comprehensive and closely interlocked Australian regions disclosed an almost perfect synchronization of regional and national patterns. A similar synchronization of regional patterns was established by the early work of Riggleman [222].

So too, we are not surprised at the relatively low level of the mean deviations found by Long to coexist between the median yearly turning point and his individual city turning points.[10] But we now see that dispersion was held in bounds by the powerful forces which balance income accounts and impose a common rhythm of movement on industries, regions, and cities.

E. NATIONWIDE WAVE MOVEMENTS: REVIEW

We have found that there are good reasons why local and nationwide cycles in building should coalesce and conform as they do to a common typical pattern. On the same grounds we should expect a similar reproduction on the national scale of features which we found to play an important role in local cycles. Our investigation showed that nonresidential building swings in cycles comparable to residential building, though with a tendency to lag; that industrial building should exhibit a marked short or major decennial rhythm which also responds to residential long-swing rhythms with a tendency to lead; and that total building should, accordingly, fluctuate in long swings. We would also expect that the urban labor force would be mobilized nationally as they are locally in long swings, and that marriage rates should reflect long-swing rhythms though perhaps only in very mild form.

To these manifest rhythms exhibited on the local scene there would correspond other rhythms more likely to become recorded and statistically identified on a nationwide basis. Thus, if input resources of labor and real capital are drawn into the industrial economy in long swings, there should be corresponding fluctuations in total gross capital formation and the flow of final output or at least in the rates of growth of capital formation and final output. So too, we would expect long rhythmic swings in the composition of gross capital formation and in the modes of its financing by domestic or foreign sources or through profit or credit inflation. A rhythmic fluctuation would be expected in at least the rates of growth of total money stock, for otherwise price levels of output would fluctuate inversely to output. We know that this pattern of inverse fluctuation did not characterize the behavior of an important segment of the price level of output, namely, the cost of new building.

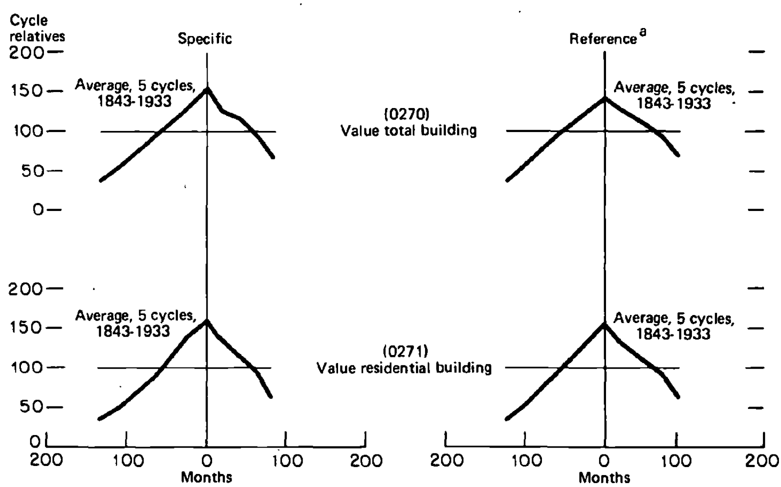
The field of investigation before us has widened considerably. It now encompasses all systematic influences that affect economic progress and industrial growth. This field of investigation is evidently too wide and too difficult to be pursued rigorously with the intensity of effort that has characterized our local investigation or our efforts to analyze nationwide patterns of urban building. Nor is this effort necessary. For at least two countries—the United States since 1870 and Great Britain—informed investigators have ransacked available historical and statistical information and their pioneer work has already attracted considerable research support. For the United States I refer to the work of Simon Kuznets, Moses Abramovitz, Richard Easterlin, Jeffrey Williamson, Burnham Campbell, who together have thoroughly treated long swings in American aggregative development since the Civil War in many of the collateral fields of behavior we have noted. See [161, 1, 78, 126.]

Our particular research effort has added to this recent work three important additional nationwide nonfarm measures of new residential construction and the annual value of residential and total building both available since 1850.[11] (See Chart 7-6.) These series exhibit the same long swings with slight variations in turning points as the number of residential units built. More interesting is the implied relationship between residential and nonresidential building inherent in the estimated series. Both types of building fluctuate in the same rhythm, but the timing relationship is subject to drift. In the first long swing nonresidential building leads in the downturn and upturn; in the second timing is uniform. In the three succeeding swings nonresidential building lags appreciably at the peak. This drift in timing is clearly indicated in the succession of reference patterns shown in Chart 7-7, and is exhibited by Long's estimates for the latest prewar swing (closing in 1918) [1, Table 4].

The somewhat divergent tilt of the average patterns for residential numbers and residential values corresponds to the secular growth of per unit values in residential building. Thus the

CHART 7-6

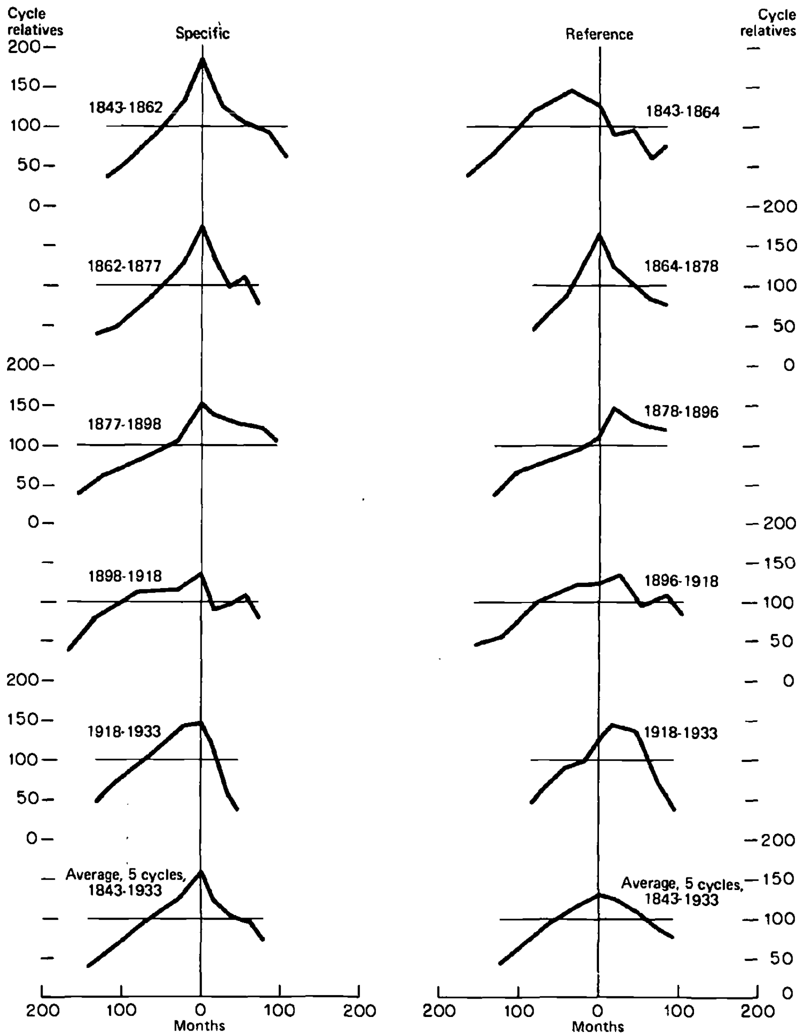
Patterns of Average Long Cycles, Specific and Reference, Value of Residential Building and Total Building, Nonfarm, U.S., 1843–1933



[a]Reference chronology is from series 0155, number of dwelling units built.

CHART 7-7

Patterns of Successive Specific and Reference Long Cycles, Value Nonresidential Building Nonfarm, U.S.



annual growth rate of residential numbers, 2.977 per cent per year, contrasts with 3.783 per cent per year for the value of residential building. A detailed examination of the trend rise in residential per unit values was attempted in earlier publications, and it is believed that the trend rise of the order of magnitude specified is amply supported by independent data, by the upward drift of real per capita incomes, and by known propensities for housing expenditure out of income [108, pp. 268–276].

The other major country that has been the subject of extended inquiry into long swing movements is Great Britain. Here the pioneer work was by A. K. Cairncross and Brinley Thomas whose impressive investigations published nearly at the same time in the early fifties [46; 245] have set off a flurry of research and debate regarding long wave experience in Britain, especially the relation between waves of domestic activity and migration of labor force or export of capital during the six decades preceding World War I [284; 66; 117; 167; 47]. Study of the long-swing process in British economic development has now been pushed back to the first decade of the eighteenth century by new revelations about economic development and population growth during that century and especially by the publication in 1959 by the distinguished historian of the industrial revolution, T. A. Ashton, of a new work on "economic fluctuations" during that century inclusive of fluctuations in building and real estate [11]. Ashton assembled time series of building materials used, including imported fir timber (graphed in Chart 7-2), window glass and wallpaper output; and he showed from contemporary evidence suggestive snatches of patterns of behavior characteristic of the more familiar contemporary long-swing movements. Though Ashton himself interpreted his materials in terms of short-term business fluctuations and financial crises, the longer rhythm of building and urban development stood out both from his account and from his time series. That rhythm was independently brought to light by two major students of London economic life and building during that century, one noting that the "records of population and the number of houses . . . show London expanding irregularly from its centre . . . in a succession of waves" [100, pp. 98, 99–111], the other asserting flatly that London's growth "has not been a matter of gradual and even incrementation but of distinct waves of activity at intervals roughly of about fifty years" [243, pp. 24, 25, 98, 292]. A corresponding growth pattern in industrial output exhibited four major growth surges between 1700 and 1810 [129, Diagram P]. With this supportive background J. Parry Lewis in his recent monograph on British building cycles had little difficulty in recognizing the same long swings marked out in our chronology of the eighteenth century except for his classification of a "halting, gentle, barely perceptible rise" in timber imports between 1727 and 1733 as an expansion phase of a new long swing while our statistical analysis treats this "rise" as only a phase of a twenty-year-long decline [167, pp. 17 ff.]. A corresponding decline in rates of domestic economic growth over the two decades in question seems well established [71, pp. 5 ff., 61; 243, p. 111; 100, pp. 21-62].

While these long swings in urban growth and building in the eighteenth century appear well established and with many of the characteristics of those occurring in the next century, in one crucial respect they differ with regard to causation. The contraction phases of three out of four eighteenth century swings are associated with wartime periods of what we would now call "tight credit" marked by high levels of consol yields (1700–1711, 1740-49, 1756-63, 1776-85). These were periods when public debt was being rapidly increased to finance wartime expenditure and the rising yields which made public stock attractive to investors drew loan capital away from mortgage markets, hampered by an interest ceiling fixed by the usury act at 5 per cent. Ashton rightly insists that the "existence of this upper limit is of the utmost importance to an understanding of the fluctuations of the period, since beyond the usury limit further mortgage borrowing "might become impossible" [11, p. 86; 57, I, p. 348; 154, I, pp. 186 ff.].

As the pace of economic development accelerated with the industrial revolution and as usury restrictions were eased, the character of the long-swing movement appeared to change. The wave process became more intense, the per year amplitudes of both rise and fall increased while the durations shortened (see Chart 7-2) and especially during the decade of the 1830's there was a full coalescence of a "long swing" in building with the business cycle proper. After 1860 durations were more extended and amplitudes became more sluggish. The relationship between American and British building cycles shifted at about the same time and the migration of both capital and labor took on greater importance.

Besides the United States and England, the Canadian experience has been subjected to intensive analysis, with regard to both adequacy of statistical measures and substantive wavelike movements. The Canadian series on transportation and population that can be carried back to 1820 and annual estimates for GNP that go back to 1870 "display seven and a half long swings of an average length of seventeen and a half years over the period ending in 1950.[12] The fluctuations closely parallel the related American series.

With regard to other countries that have been less intensively studied, no effort was made to compile a complete set of long nationwide time series. The respective statistics are in process of development and the work involved in the evaluation and processing of such data exceeded the bounds of our investigation. We did, however, collect and analyze long nationwide time series that seemed particularly suitable—as was the case for Australia and Italy—or, as in the case of Germany, involved a country which through its major cities had loomed large in our investigation. The Italian patterns show the same degree of conformity between residential and nonresidential building as was found in America over a similar time period. The Australian patterns indicate that the different industrial and product sectors of the economy will develop a wide variety of timing relationships. The activities which show the lowest degree of participation in nationwide wave movements are mining investment (possibly reflecting the fortuitous character of mineral discoveries), investment in shipping, and investment by local authorities. Railway and commercial investment exhibit marked swings, as in the United States, and the reference patterns for industrial investment show clear-cut participation with a tendency to lead at upturns, as did our Ohio patterns of industrial building. It is noteworthy that agricultural reference patterns of investment, dominated by investment in livestock, are not inverted.

F. SUMMARY

Our study of nationwide patterns of urban residential building utilized twelve series for seven countries. The long-swing experience of two countries, Sweden and France, was not included in our formal tabulations because our available time series did not go back far enough to cover two or more long swings. Six of our series related to building in the United States and in the United Kingdom, two of the series related to Canada, and one each related to building in Australia, Argentina, Germany, and Italy. We surveyed 28.5 long specific cycles in residential or total building in seven countries.

This formidable body of long-cyclical experience was studied with regard to patterns of movement in absolute values and in rates of change. Absolute values were reduced to cycle relatives, smoothed, and averaged, as in the usual National Bureau procedure. Rates of change were computed from first differences of these cycle relatives expressed on an annual basis and then averaged. Cyclical experience in both the absolute values and rates of change was found sufficiently homogeneous to warrant consideration of the "average" as the representative form. The tests for homogeneity related to sign of secular movements, predominance of phase, sign of stage movements, and secular trend in amplitude or duration.

The average rates of change from stage to stage of building cycles reproduced in their pattern of movement many of the characteristic features found running through rates of change during short business cycles. There was experienced the same diversity of forms of movement with early and late peaks and early and late troughs. In building cycles the peak and trough in the rate of change tends to be reached later—and often at the close of the phase—both in expansions and in contractions. Building cycles thus appear to be characterized by greater intensity of spirit. Both the rise and fall take more time to reach their climactic rate of change. This appearance of greater intensity was produced by some combination of real movements and by a smoothing procedure bias which tended to magnify up and down rates of change at peaks and troughs.

Comparison of mean durations of local and national building cycles disclosed nearly the same duration in both. Our local series including 81 cycles averaged 19.7 ± 5.0 years per cycle; our national series with 30.5 cycles averaged 19.0 ± 4.4 years per cycle. But on virtually the same durations, total amplitudes of the nationwide movements were scaled down by some 30 per cent in the process of aggregation. Mean, median, and extreme range values for nationwide amplitudes were appreciably less than for local amplitudes.

This erosion of amplitude in aggregation was found whenever our investigation uncovered both aggregates and their components. Degree of erosion generally ranged between 30 and 40 per cent. Erosion of amplitude grew chiefly out of variations in local timing around national or regional reference turning points. The mean lead-lag, signs disregarded, varied around 1.35 years, but the mean deviation at turning points was nearly twice this, 2.61

years. Rarely did a local series persist in an offbeat course after four years. Of the nineteen local communities surveyed that could be related to a nationwide or reference frame, only one showed characteristic inversion. The larger and more important the local communities, the greater the synchronization with the national movements.

This synchronization was partly induced by major wars, which are known to generate concurrent waves of building in the various communities of a nation. But synchronization will also be generated in the peacetime economy by the normal tendency of matured local communities with a diversified industrial base to grow in integrated fashion. Any prevailing national rate of growth will be translated into a counterpart local rate of growth of demand for industrial products produced in any particular locality. Communities that are innovating or that are favored by comparative advantage will grow at a faster than average rate; and conversely for the retrogressive communities. Any local domestic expansion generates expansion elsewhere by reason of the import propensity and export multiplier. Convergence is thus forced upon local communities; as Keynes says of nations under a gold standard, they "must conform to the average behavior of everyone else."

Since local and national cycles converge, we should expect features found in local cycles to show up on the national scale. Many of these features for the United States, the United Kingdom, Canada, and Australia have been detected and analyzed by other investigators. New evidence was presented showing that the value of American nationwide nonfarm building, both residential and nonresidential, fluctuated with near corresponding amplitude. Nonresidential building tended to lead before the 1870's and thereafter to lag, particularly at peaks. Our new estimates showed that residential building values grew at a yearly mean rate of secular growth nearly 0.8 per cent greater than the corresponding rate for residential numbers.

NOTES

1. The French series exhibits a clear-cut long swing from 1886 through to 1901; the character of the movement thereafter is ambiguous. Kindelberger found no reliable measure of nationwide building activity for any stretch of years before 1914 and thus exaggerated the extent to which patterns of building

activity in France "remains shrouded in mystery" [155, p. 304]. On Sweden, see Chapter 2.

2. Canadian building permit data are evaluated in Appendix I.

3. For analysis of the bias in question, see [193, pp. 199 ff.].

4. For a more detailed exposition see [41, pp. 30–31; 193, pp. 296 ff.; 2, pp. 350–358].

5. The exceptions are:

Series	*Stage*	*Series*	*Stage*
0140	VII–VIII	0145	VI–VII
0155	IV–V, VII–VIII	0147	VII–IX
0016	VII–VIII	0049	VI–VII, VIII–IX
0018	IV–V		

6. The wholesale price level was for imported and domestic commodities 1792–1850. Nineteen specific cycles were analyzed, having timing I–V with eleven leads, ten lags, and three concurrences; the mean lead at peaks was 0.4 months, at troughs 0.2 months. The cyclical variation in the pig iron price level should have conformed closely to pig iron output. The series runs from 1795–1803 to 1817–43 and involves 8 specific cycles with II–V timing [97, pp. 814–815].

7. Most of the comprehensive series analyzed by Mitchell showed a retardation between I–III and "a goodly proportion of the series show a partial recovery from the retardation" [193, p. 299].

8. To illustrate, the total mean specific amplitude of our five Ohio sample groups involving twenty counties was 227.28. In the process of aggregation of sample group returns, 42.2 per cent of local mean amplitude was lost.

9. The "extraneous forces" hypothesis has been given its fullest published defense in [62]. Drawing upon the "variety of demand" (p. 36 ff.) and the "influence of localism" (p. 51 f.) Colean and Newcomb noted certain "general movements, in which the normal diversities of construction demand according to type and locality were forced into a general coincidence" (p. 54). Such "forced coincidences" were found in the twenty years following the Civil War and World War I and were thus located in "special circumstances among which war obviously plays a crucial part" (p. 57). In a more guarded way, Long [173, p. 162 f.] merely observed "that wars have had far-reaching effects on cycles in the building industry"; they intensify the severity of cycles "and determine when at least some cycles occur." A leading study of the role of war and associated disturbances in "long waves" has marked out the periods, 1816–41, 1872–97, as most peacelike or free from warlike activity. See [56, p. 370]. Yet each of these periods spanned one or more building waves.

10. See Long's interesting account of dispersion in timing in [173, Chap. VIII]. He reported that all the local series for detailed residential construction "agreed rather well" with the computed nationwide index (p. 133), that "troughs show high correspondence" rarely exceeding more than two years (p. 139), and that despite the "immobility" of the building industry and the potential "great individuality" of building activity, "long cycles do appear in

all cities and the agreement of the turning points of these cycles is surprisingly high . . ." (p. 145).

11. For full analysis and derivation of these three series see my [109], [110], [108]. In view of critical commentary on these series by M. Melnyk [187, pp. 485–486], note the following caution about the new series which "should not be regarded as embodying an independent set of measurements." The new series should, rather, "be regarded only as a relatively consistent set of estimates intended to reconcile and link together a conglomeration of independent annual or decennial measurements and primary estimates of building activity or stocks of wealth produced by many collecting agencies both in the State of Ohio and nationwide. Reconciliation at best is approximate and rests upon inferences from information which is often of uncertain quality or relates to relationships which are merely indicated but which cannot be conclusively proven. We can only link data of different character and scope by judgments which sometimes have a margin of error" [110, p. 418]. With these qualifications may I add that the new estimates are *much more reliable* and rest upon a broader base of tested information than any of the alternative series of nonfarm building. The total urban building series is derived from a set of decade nonfarm building aggregates for 1850–90 resulting from the application of Ohio building rates per unit of changes in wealth and nonfarm labor force to nationwide changes in the two measures which themselves were drawn from Census returns. Decade aggregates were then distributed annually for 1860–89 on the basis of decade indexes showing decadal movements as derived from our Ohio annual returns and from building permit indexes developed by Riggleman, Isard and Long, with Ohio returns weighted one-third, not one-quarter as Melnyk mistakenly asserts. See [187, pp. 485–486] and [109, p. 67].

12. [36]. See also [35; 90]. See, for brief review, our Appendix I. For the latest analysis using GNP estimates (of dubious acceptability before 1900) see [69, pp. 279–301].