Volume Title: Long Swings in Urban Development

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Volume Publisher: NBER

Volume ISBN: 0-870-14226-7

Volume URL: http://www.nber.org/books/gott76-1

Publication Date: 1976

Chapter Title: Introduction and Summary of Findings

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Chapter URL: http://www.nber.org/chapters/c3784

Chapter pages in book: (p. 1 - 32)

CHAPTER 1

Introduction and Summary of Findings

A. HISTORICAL BACKGROUND

This work sets out the main results of an extended inquiry into the empirical characteristics of the urban growth process as manifested in long fluctuations in urban building and real estate market activity. Forms of urban growth were first examined by German scholars around the turn of the twentieth century in a series of case studies on urban growth affecting residential building, real estate activity, and land values.[1]

The tendency of residential building and associated real estate activity to grow in wavelike form was observed in many of the local studies. This wavelike tendency was traced back to the eighteenth century by Conrad [65], who studied the city of Freiburg for twenty selected years from 1755 to 1875. He found that waves in the rate of growth of population and of buildings tended to be about thirty years in length, whereas the rate of change in prices was about half that length, but of greater intensity (see Chart 1-1).

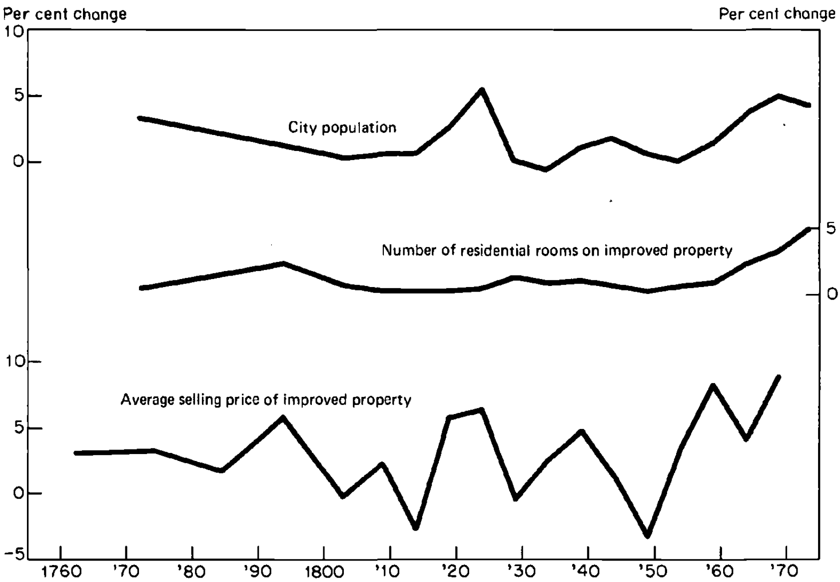
While Conrad's study of Freiburg stretched back farthest in time, the studies of Berlin between 1843 and 1910 by Emmy Reich, and of Rhine cities by Spiethoff, most clearly indicated the wavelike character of modern urban growth. It is perhaps characteristic that in Reich's and Spiethoff's work, long waves were not categorically marked off from the general business cycle to which they were accommodated and with which they were identified during major contractions.[2]

The tendency of urban growth to run in long waves was clearly formulated in the general work of Mangoldt. Land values and all associated real estate activity tended to rise by a process of wavelike terracing in which upward surges were followed by stepladdered plateaus, sometimes marked by absolute declines.

NOTE: Throughout the book, numbers in brackets refer to the bibliography at the end of the volume.

CHART 1-1

Per Cent Annual Change, Averaged over Periods 1775–1875, Population, Residential Building, and House Prices, Freiburg, Germany



SOURCE: M. Conrad [65] as extracted in R. V. Mangoldt [179], p. 4.

He found that pattern so characteristic that he termed the tendency a law. Though his interest focused more on the rise than on its terracing, the phenomenon of local building cycles was distinctly observed.[3] The early German work was followed by intensive studies of urban building real estate patterns in major metropolitan communities of other countries.[4]

Aside from the summarization of these studies by Warren and Pearson,[5] the principal effort to collect the major findings on an international scale and in a comprehensive framework was undertaken in the 1930's by Arthur F. Burns at the National Bureau as a part of an over-all inquiry into cyclical characteristics of the building and construction industry. The first published expression of this research may be found in a paper by Burns calling attention to the "longer cycles" lasting from fifteen to twenty years in residential and urban building and in parallel long cycles in immigration, in subdivisions, and in real estate trading. In this study the mechanism of building cycles was explored theoretically [40]. The same mechanism was explored empirically in an extended manuscript written late in the thirties, utilizing some twenty-seven selected American long building series and seventeen foreign series. Summary results for American experience as distilled in this investigation were set forth later [41, pp. 418–428].[6] The central finding was that building construction is characterized by long cycles of "remarkably regular duration" running usually from fifteen to twenty years in length. These cycles were "clear-cut in outline, attain enormous amplitudes and are paralleled by long cycles in other real estate processes."

Although Burns took up other tasks, the study of long waves in construction was carried forward by other investigators at the National Bureau, under the general guidance of Simon Kuznets and Moses Abramovitz. Many of these studies, dealing with aggregate construction, demographic change, railroad and utility construction, and residential building, have already been completed, and still others are in process.[7] Other investigators in England and America have taken up the study of building cycles or long swings especially as they are propagated across national frontiers by migration of capital or labor.[8]

B. STATISTICAL COVERAGE OF THIS STUDY

This monograph is concerned predominantly with long waves in urban building and related real estate and demographic activities—in particular urban communities or regions. The statistical starting point was the fund of long time series collected and analyzed by the National Bureau of Economic Research. I dropped certain cities and areas included in the National Bureau tabulations, following an early decision to include only those communities for which two or more pre-1918 long cycles were available for study, and to exclude segments of time series depicting the behavior of building and real estate markets predominantly affected by wartime experience or by governmental activity and controls. This decision, which assigns greater weight to nineteenth-century experience, has theoretical implications which are developed at length in Chapter 2.

If the sample of the time series analyzed was narrowed by this decision, it was broadened by others. From nearly all of the surveyed regions I drew more abundantly from the statistical sources to bring under review additional measures of building, demographic, or real estate activities. From English investigators we added ten urban areas for which time series were available reaching far back into the nineteenth century.[9] More readily available were sets of building, demographic, or real estate time series for Amsterdam (three series), Stockholm (four series), Paris (five series), Sydney (three series), and Montreal (one series).

These additions were supplemented by records of building, real estate conveyance activities, and marriages in the eighty-eight counties of Ohio between 1857 and 1920 (see Appendix E). As adjusted and used in this investigation, these records were reduced to 125 time series covering the state as a whole, three large metropolitan counties, and five groups of counties selected to represent different degrees of urbanization, central-city size, and other economic characteristics.[10] These time series were analyzed in the same statistical format as my other series, thus putting all measures on a fully comparable basis. Because so much of my information regarding local building and real estate cycles stems from Ohio records, many of my summary tables and averages distinguish between Ohio and non-Ohio sources. This does not imply that Ohio experience is to be weighted equally with experience elsewhere; it rather warns against interpretation of averages resting upon Ohio and non-Ohio sources as having any semblance of the proper weighting. Unfortunately, outside of Ohio, available information was too fragmentary and scattered to make proper weighting feasible.

The analysis of *local* long cycles is supplemented in this work by a survey in Chapters 7 and 8 of long cycles as manifested on the nationwide level. For this purpose new and separately published estimates were prepared for (a) the number of nonfarm housekeeping residential units erected annually in the United States since 1840 and (b) the value (in 1870–1910 Ohio appraisal dollars) from 1850 to 1939 of total nonfarm building, residential and nonresidential. These estimates were in effect an average of the best available yearly index measures, aligned for trend and growth by use of benchmark estimates from the periodic Census returns, which were themselves adjusted for comparability to reflect building experience on the basis of the newly discovered Ohio sources.[11]

For England the process of estimation was considerably refined and extended by the work of Cairncross, Weber, and Parry Lewis for the nineteenth century and Mrs. Schumpeter and T. S. Ashton for the eighteenth century. For Germany it was found possible to construct a serviceable nationwide measure of urban residential building since 1867.[12] For France I was able to add nearly twelve years to an aggregative index based upon official French sources.[13] For other countries, such as Canada, Australia, Italy, and Japan, estimates prepared by recent investigators were used.

The analysis of national long cycles was not intended to be conducted on as exacting or on as comprehensive a scale as local long cycles. At the national level there are measurable influences affecting economic growth, the emergence of new technologies, and the role of finance which may not be directly felt at the local level. Quantitative evaluation of this complex of forces for any single country bristles with difficulties. The difficulties are compounded when processes within countries are affected by related processes abroad. My objectives at the national level were more limited. First, I wanted to collect and to appraise available measures of aggregated urban or nonfarm building and to compare tendencies to long cycles found at the national and at the local level. Second, it seemed desirable to shed light on the tendency to synchronization or inversion of different national movements. Third, I hoped to analyze demographic activities and shifts in price and value levels which played a role in long-swing movements. In these respects some contribution may have been made to the contemporary discussion of long swings, even though no formal effort at over-all synthesis has been attempted.

Both at the local and national level our inquiry was confined in principle to *urban building* as ordinarily measured by building permits and excludes many kinds of construction activity—including road building, canal and bridge construction, railway construction—which have played an important role in long-swing movements at the nationwide level.

C. FORM AND SCOPE OF ANALYSIS

An essential stage of the investigation of long-swing movements utilizing over two hundred long time series was the selection of appropriate statistical procedures to isolate the long-swing movement and to fix upon its measurable characteristics. This work of isolation involved three basic questions:

(a) Should underlying secular trends be presupposed separate from long swings and eliminated? (b) How could the irregular play of short cyclical fluctuations be taken out of our data without affecting the basic contour lines of the long-swing movement? (c) Could long swings be taken out of their historic context of antecedence and succession and shaped into some average pattern? The full statement and resolution of these issues makes up Chapter 2.

The advantage of trend elimination is that it facilitates the recognition and measurement of those essential characteristics of long-swing movements which take the form of acceleration and retardation of rates of growth. The disadvantage is that the force or tendency of secular growth is converted from a property of the long swing to a level plane around which long-swing fluctuations occur. I share the view of Schumpeter and Burns and Mitchell that the long swing tends to be a process of growth, and that we should envisage long swings as a *form of development* and not as separable from development. Hence I refrained from utilizing statistical procedures for trend adjustment.

I likewise disagree with methods of smoothing to eliminate from the time series the influence of short cyclical fluctuations. The two methods most commonly used, that of moving averages with a fixed period and that of overlapping reference-cycle periods fixed in a national chronology, are subject to two major biases. A fixed moving average is suitable for removing the effects of a periodic fluctuation with a relatively fixed period and amplitude. But with wide variability in both period and amplitude, use of a fixed short-term moving average will tend to give the appearance of long swings which do not exist. If a long-term moving average is employed, the effect is to smooth out unduly the form of the long swing itself, to convert short-period abnormalities into long-swing contours, and to shift turning points and bias measurements for amplitude. Use of a fixed reference-cycle period designed to approximate the succession of national states of cyclical "expansion" or "contraction" is a suitable smoothing device most of the time—but not all of the time, and especially not for periods of severe and sustained depression, such as 1873–79 and 1929–33, when a short cyclical reference "contraction" overlaps with a building decline or depression. The effect of the statistical procedure for these periods is to dampen unduly these downswings and thus to alter the appearance of essential characteristics of the long-swing movement.

For this reason I decided to use the mildest of smoothing procedures. As used by the National Bureau of Economic Research, this procedure allocates the entire expansion and contraction phases of long swings into "intervals" of approximately equal duration. These are "smoothed" over by "averaging" experience during the interval. In this procedure the annual values or "standings" at turning points are not themselves affected; averaging is confined only to values or standings within the three segments or "stages" of the long swing.

In removing these smoothed values from their time series array, I again diverged from prevalent practice, since other investigators are loath to cut the line of succession and antecedence which is inherent in the time series presentation. Without denying the influence of the preceding movement, it still seemed reasonable to me to believe that each long swing is substantially the outcome of its own processes; and that no violence is done to the essential nature of the long swing by separating each swing from its time series context to make it amenable to statistical manipulation. To this end, the "standings" were reduced to index relatives by division into the mean annual value for the entire cycle (or "cycle base"), thereby creating a "cycle pattern" for long cycles. Since the index relatives are expressed in homogeneous terms and all refer to the standardized stages or standings of a unit cycle, they can be consolidated by simple averaging into an "average cycle" pattern. This average pattern transforms the succession of long cycles and its stepladder growth into the intracyclical tilt of the average pattern itself. The amplitude of these patterns is then measured, as with short cycles, by the differences between cycle relatives at successive turning points. These cycle patterns are "specific" if resulting from use of the chronology of the analyzed series, or "reference," if resulting from the use of a reference chronology. For all activities within a given area, the reference chronology was derived from that used for residential building. A reference analysis for a local or regional residential-building series was provided by a national residential-building chronology. The composite of these measures of long swings was then easily manipulated to yield still other measures—of lead and lag, of secular trends, of rates of change—for which standard statistical procedures had been devised by the National Bureau of Economic Research.

This study was confined at the outset to three crucial questions:

1. How widespread in time and space are long urban-building fluctuations?
2. How similar are such fluctuations in various countries, over time, within different-sized communities, and with regard to different types of building?
3. How do urban-building fluctuations compare with business cycles with regard to duration, amplitude, timing, and form of movement?

An attempt to answer these questions led inevitably to real estate markets and to the underlying markets for building sites, building labor, building materials, and finance. These, in turn, revealed the influence of still more fundamental processes—migration from farms and villages, and marriages—by which labor supply is augmented and formed into households. Hence, the survey includes two additional questions:

4. How pervasive have been corresponding fluctuations in markets for undeveloped land, improved realty, rentals, mortgage credit, building labor and materials, as well as in migration and marriage?
5. What consistent relations exist between these different phases of urban growth and real estate market activity?

These questions can only be answered by an examination of the facts, particularly those derived from statistical time series. Needless to say, my interest is not in statistical measures as such but in the activities they represent. Since the statistical measures used here were incomplete and for many purposes fragmentary, our interpretations are often speculative. Many of the processes involved in *local* fluctuations are sustained and influenced by conditions in other urban communities, in the nation as a whole and, to a certain extent, in the entire world or at least its more advanced and integrated areas.[14] Our interpretations can be described, in Simon Kuznets' words, as "at best a sketch of possible but untested association between the findings and a set of known or reasonably acceptable general patterns of economic behavior, an indication of the directions in which specific tests of the suggested associations are to be sought, not a demonstration of the existence of such links. In short, explanations are conjectural rather than tested, partial rather than complete, suggestive rather than definitive" [161, p. 6].

We have not sought to go beyond these conjectural, partial, and suggestive explanations, nor do we ask, as Easterlin [78, p. 47] did, "Are the observations on long swings consistent with a model of relationships based on economic theory?" The answers to this question depend upon presuppositions built into the theory or into the whole range of theories that may be relevant. These presuppositions in turn should be consistent with essential characteristics of the real world and it is one of the conclusions of this work that among these essential characteristics is a tendency toward long swings in urban growth in the unregulated markets of classical capitalism. Until we know more about these long swings, especially at the nationwide level, it is wiser to postpone or move cautiously in the work of modifying economic theory to be consistent with their reality.

D. SUMMARY OF FINDINGS

Natural and Local Swings

The findings of this work are presented separately for local long cycles in Chapters 2 through 6, and for national cycles in Chapters 7 and 8. This division corresponds to the distinction drawn early in the investigation between the local cycles in major urban communities, whose existence was more or less presupposed, and national cycles, whose existence was subject to question. Clarification of the relationship between local and national cycles was indeed one of the paramount objectives of the investigation.

As this objective was probed, it became increasingly evident that local and national cycles were not different species of behavior but the same field of behavior spelled out in different ways. Local cycles were simply a local phase of a national movement, while the national movement was in turn mainly a coalescence of local cycles. Our local building series included eighty-one long cycles averaging 19.7 years in duration per cycle, subject to a mean deviation of 5.0 years; our national series with 30.5 long cycles averaged 19.0 years per cycle with a mean deviation of 4.4 years, or virtually the same duration (Chapter 7, pp. 206 f.). We found that all of our regional areas exhibited regional and local cycles which matched the national movement, and that individual cities would only rarely "miss" a national set of turning points or possess an "extra" cycle (Chapter 7, pp. 208 ff.). Due to variation in timing and these occasional "misses" or "extras," the amplitude of the swings of cities and regions will run from a fourth to a third greater than the amplitude of the swings for the more inclusive aggregates (Chapter 7, pp. 207 f.). Substantial nonconformity in pattern and in dating was found characteristic only of the sample of rural Ohio counties with the lowest degree of urban influence and with a high responsiveness to shifts in agricultural conditions. Synchronization of local and national cycles was partly induced by major wars which caused all local building first to turn downward in major depressions in settled urban communities and then upward some time after the close of the war. Synchronization was to an even larger extent induced by the bond which ties together the little local economies whose outputs become each other's inputs. Because of this bond of integration, any prevailing national rate of growth will be translated into a schedule of counterpart local growth rates distributed around the mean as communities are favored or handicapped by innovation or by comparative advantage in resource layout (see Chapter 7, pp. 209 ff.).

Our surveyed long swings in building encompass the years between the early 1840's and the late 1930's. On the assumption that swings for a given area are to be dated by turns in their most common and fundamental component, residential building activity, twenty-four reference chronologies were constructed (see Chapter 2). These are detailed in Table 1-1, which groups reference chronologies under a set of master headings setting out the five long-swing movements which were found to be widely diffused through urban communities of North America, Western Europe, and related westernized communities. In only three cases were there extra or "skipped" cycles. Conformity to this Western World pattern was not, however, always positive. A tendency to counterwave with inverted timing was noticeable at times in Great Britain and, through the early years (1841–70), in Berlin, Amsterdam, and Paris. Dispersion in timing fell off discernibly for the two turns in the late seventies and late eighties but noticeably widened thereafter. A similar trend of dispersion of turning points, from American data only, has been found by other researchers [173, pp. 146, 152].

Other evidence not drawn from the patterns of building behavior attests to the presence of forces making for a tendency to counterwave or inversion in national and regional long-swing patterns. The evidence of marriage rates (Chapter 8, pp. 224 ff.) suggests that countries with primarily agricultural populations experienced a long-wave pattern between 1870 and 1913, with a duration of around twenty-five years and peaks in 1883–84 and 1907–8. Industrial countries exhibited nearly inverted but somewhat weaker marriage-wave patterns, with peaks in 1873 and 1897 and troughs in 1882–83 and 1910. During the seventy-five years before 1913, the three leading countries—England, Germany, and the United States—experienced long waves which at no time were completely in or out of phase with each other, partly because swing durations in the three countries differed. Between 1821 and 1861 England tended to be in phase with the U.S. 56 per cent of the time, but Germany was in phase only 32 per cent of the time. Between 1862 and 1913 the pattern shifted, with England inverting 37 per cent, and Germany 47 per cent of the years (Chapter 8, Table 8-3).

Duration

The findings with regard to local building activity are derived from the eighty-one long specific cycles of record for thirty urban areas located in eight countries. For national building activity, the records covered 28.5 long specific cycles in residential or total building in seven countries. Local cycles varied widely in duration, with a substantial clustering between fifteen and twenty-five years and with fewer than 5 per cent of the long cycles running over twenty-five years (Chapter 3, pp. 59 ff.). Longer rhythms may have run through our series but the time runs were too short to bring them to the surface. The lower limit of the local duration range is essentially indeterminate since the shorter *long* fluctuations (ten years and under) tend to fold into the longer *short* fluctuations of the business cycle proper. Nearly 14 per cent of the recorded building cycles had a total duration of under ten years, though only 3 per cent of the series had an average duration as brief as this (chiefly the industrial building

TABLE 1-1

Summary of Reference Chronologies (Based on Long Swings in Residential Building)

Area	Source (Series No.)	Trough, 1840's	Peak, 1850's	Trough, 1860's
United States				
1. Nationwide				
Total construction	[a]	1843	1854	1861
Residential building	0155[b]	1843	1857	1864
2. Ohio statewide	0147			1862
3. Cincinnati	0110			1863
4. Toledo	0115			1859
5. Cleveland	0123			1859
6. Ohio I	0171			1863
7. Ohio II	0172			1859
8. Ohio III	0173			1864
9. Ohio IV	0174			1864
10. Ohio V	0175			1859
11. Manhattan	0092			
12. Chicago	0085		1857	1862
13. St. Louis	0081			
14. Detroit	0098			
Other Areas				
15. England	0015[e]			1859
16. Glasgow	0004			1864
17. London	0009		1856	1868
18. Germany	0018			1866[f]
19. Hamburg	0030			
20. Berlin	0022	1841	1851	1864[g]
21. Stockholm	0039			
22. Victoria	0059			1866
23. Amsterdam	0052			
24. Paris	0035	1848		1868
25. New South Wales	0107			

NOTE: Underscore dates are for areas showing "inverted" timing; a date under a "peak" column marks a "trough" and vice versa.

[a] For a suggested "construction" chronology after 1861, see [1, pp. 105–107]. Abramovitz justifies extension of this reference chronology back to a trough at 1821 and peak

Peak, Early 1870's	*Trough, Late 1870's*	*Peak, Late 1880's*	*Trough, Late 1890's*	*Peak, 1900's*	*Trough, 1910–21*	*Peak, Mid-1920's*	*Trough, 1930's*
1871	1878	1892	1898	1912	1918	1927	1932
1871	1878	1889	1896	1909	1918	1925	1933
1873	1878	1892	1898	1905	1910		
1868	1880	1888	1900				
1873	1878	1892	1902				
1873	1878	1891	1900	1907			
1874	1878	1887	1900	1906			
1868	1878	1892	1898	1907			
1868	1878	1892	1896	1912			
1872	1878	1889	1894	1903	1910		
1875	1880	1887	1898	1902	1910		
1871	1877	1887	1893	1905	1918	1926	1933
1872	1879	1892	1900	1911	1918	1926	1933
	1878[c]	1892	1900	1908	1918	1925	1933
	1878	1892	1896	[d]	[d]	1926	1933
	1878	1886	1899	1914			
	1876	1883	1898	1912			
1873	1881	1892	1899	1914			
1874	1883	1890	1894	1904	1913		
1878	1883	1890	1897	1910			
1875	1880	1890	1900	1906			
		1885	1893	1903	1921	1930	1940
1874	1880	1889	1894				
1871	1881	1891		1905	1916	1924	1932
1870	1882	1886	1899	1908	1913		
1871		1885	1894				

at 1836. See particularly [198, p. 48; 200, pp. 24 ff.; 147, Tables 2, 3, 7-A, 10, 11]. The plausibility of the hypothesis that urban growth and building as far back as the 1820's developed a growth rhythm with a period between fifteen and twenty years has been reinforced by the work of Douglass North [207]. The outlines of a clear-series of Ohio). None of the national building series exhibited specific cycles under ten years. The inference seems plain that the tendency of building fluctuations to drift into the mold of business-cycle fluctuations is confirmed both for large territorial aggregates and, in the long term, for local communities.

There was little consistency manifested in the distribution of durations, either local or national. Very long durations were found in the earliest phase of English capitalism up to the middle of the eighteenth century. Thereafter, and increasingly as the tempo of industrial revolution accelerated, the duration of English long swings shortened. At the apogee of this revolution—1830–40—the long swing in process coalesced with a well-researched major industrial cycle which ran its course between 1832 and 1843. After an interregnum of uncertain chronology, two distinct waves took shape with relatively slow tempos and long durations averaging twenty-eight years between 1857 and 1913. This return in the late nineteenth century to the pattern of long durations characteristic of the early eighteenth century seemed to spring from different conditions. The earlier pattern was markedly affected by the rhythm of the major wars, with their periodic diversion of labor force and loan capital from civilian use. In the later nineteenth century, the long duration seemed more closely related to the high degree of integration of the United Kingdom into the Atlantic and Empire economy, to

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Notes to Table 1-1 (concluded)

cut expansion wave were cut between 1793 and 1808 (pp. 25 ff.). North indicates that the 1810's were a decade of relative stagnation in our foreign trade, urban population, and inland waterway traffic. Deflation followed the peace settlement, with prices falling from 1815 to 1823. North is, however, inclined to date the post-1815 long-term trough at 1823 rather than 1821 (p. 181, n. 11, and Chap. XIV). Regardless of this suggestion for timing, for a few of our series the reference chronology was extended back to 1821 and 1836.

[b] See [109, Table 15 and Chart 21].

[c] Derived from trough of our series number 0084.

[d] Skipped.

[e] Also series 0145.

[f] Though our series began in 1867, a variety of evidence indicated a trough in 1866. To derive specific cycle patterns, series 0018 was assumed to have a trough in 1867. To extend back our reference-cycle patterns for series 0019 and 0022 (building material prices and Berlin residential building), an additional pair of reference dates, 1850 (trough) and 1861 (peak), were utilized. These datings are tentative and provisional. The period of the 1850's was one of accelerated growth for Germany. See [240, p. 130; 232, pp. 80 ff.; 229, pp. 251 ff.; 49, p. 283]. The peak of 1861 is dubious but it was indicated by our Berlin and Bremen materials.

[g] Followed by an "extra" trough in 1870.

the marked tendency to invert long-swing rhythms of North America and Australia, and to an altered cyclical sensitivity of building to finance.

The pattern of other national durations exhibited no simple or clear-cut association with either secular growth rates or amplitudes. There were too few observations to throw into a regression, considering the wide range of variation of amplitude, growth, and duration, and the play of many influences on these variables. Consideration of the summary exhibit of our national series (see Chapter 7, Table 7-1) will indicate the crosscurrents which seemed to prevail. For seven of our series the duration range was intermediate—between fourteen and eighteen years—and yet for these series growth rate ranged between 124 and 295 cycle relatives. Slow growers have both long and short durations and high and low amplitudes. Thus, Germany has a duration and amplitude 85 and 83 per cent, respectively, of the American but a growth rate as high or higher.

There were many more observations of local building cycles to consider and a more definite pattern emerged (Chapter 3, pp. 59 ff.). Longer durations of local cycles are not associated with larger amplitude up to a critical amplitude boundary of 350 cycle relatives. Thereafter, per year amplitude rates are constant: whatever stretches out duration builds up total amplitude. There was no clear-cut pattern by which local or national duration was associated with growth rate or with time. In nineteen instances of successive long nationwide cycles, the distribution was not significantly different from random (Chapter 7, p. 200).

Amplitude and Conformity

The amplitude attained by building cycles over their full duration was measured for purposes of this investigation by taking what amounts to the sum of the differences, in terms of cycle relatives, between a cycle peak and the preceding and succeeding troughs. A beginning trough of 50, a peak of 200, and a terminal trough of 100 in terms of cycle relatives would thus result in a total amplitude of 250 cycle relatives, or a range of movement up and down that is two and a half times the average level over the entire cycle period. Specific amplitude for a given series means the rise and fall measured from the peaks and troughs of the given series; reference amplitude for the same series is measured by changes between peaks and troughs, which for any given area is usually represented for purposes of this investigation by the specific chronology of residential building activity. Differences between specific and reference amplitude are due to divergences in timing at turns between the given series and residential building, and thus constitute a crude measure of lack of perfect conformity of a given series with the cycle chronology of residential building activity.[15]

So measured, the amplitude cumulated by building cycles over their full duration was truly enormous. Specific total mean amplitude for 62 local building series was 303.4 ± 100.3 cycle relatives. The 30 local residential building series experienced a comparable distribution of amplitude and nearly the same mean value, 306.0 ± 92.4. The nationwide level of amplitude is understandably less, due to the imperfect coalescence of particular local cycles, the variety of local turns, and occasional "misses" or "extras." Thus the mean total specific amplitude for all our national series is 214.0, or 70 per cent of the corresponding local mean value (Chapter 7, Table 7-3). Mean specific amplitude for the state of Ohio was 131.3, or 64 per cent of the mean level for areas within the state. The corresponding ratio for eleven English urban series and for the nation was 67 per cent; for five major U.S. urban or regional areas and nationwide, 57 per cent; and for three major German cities, 54 per cent. This is the net measure of the degree of synchronization, or the lapses therefrom, emerging from the record of national and local long cycles (Chapter 7, pp. 206 ff.).

There was no clear-cut trend of amplitudes over time. For the nineteen recorded instances of *successive* long national cycles, the declines were only slightly more numerous than increases. The decade before and around World War I, America, Germany, and France experienced weak contractions and a less clear-cut form of long movement. But the English long cycle that reached a trough in 1911 was relatively clear-cut and of large amplitude. The high amplitude everywhere in the 1920's and 1930's gave little indication of a trend of declining severity. The two centuries of English building give little or no indication of a trend of amplitude. The total mean amplitude of the two long waves of the late nineteenth century was greater than that of the waves of the eighteenth or early nineteenth century but the difference is chiefly due to varied duration. Grouped in order of time, our measures for the English long cycle follow.

	No. of Cycles	Mean Duration, Years	Mean Specific Cycle, Amplitude: Total	Year	Per Year Fall
1711–81	3	23.3	133.9	5.74	−5.05
1785–1843	4	14.5	123.5	8.46	−8.15
1857–1914	2	28.0	191.6	6.84	−7.26

For the first two periods our statistical measures refer to over-all building activity. For the latest period only residential building is measured. The more inclusive aggregate of building will generally exhibit less amplitude; hence the figures for the latest period should be reduced by between 10 and 20 per cent to adjust to an all-building basis.

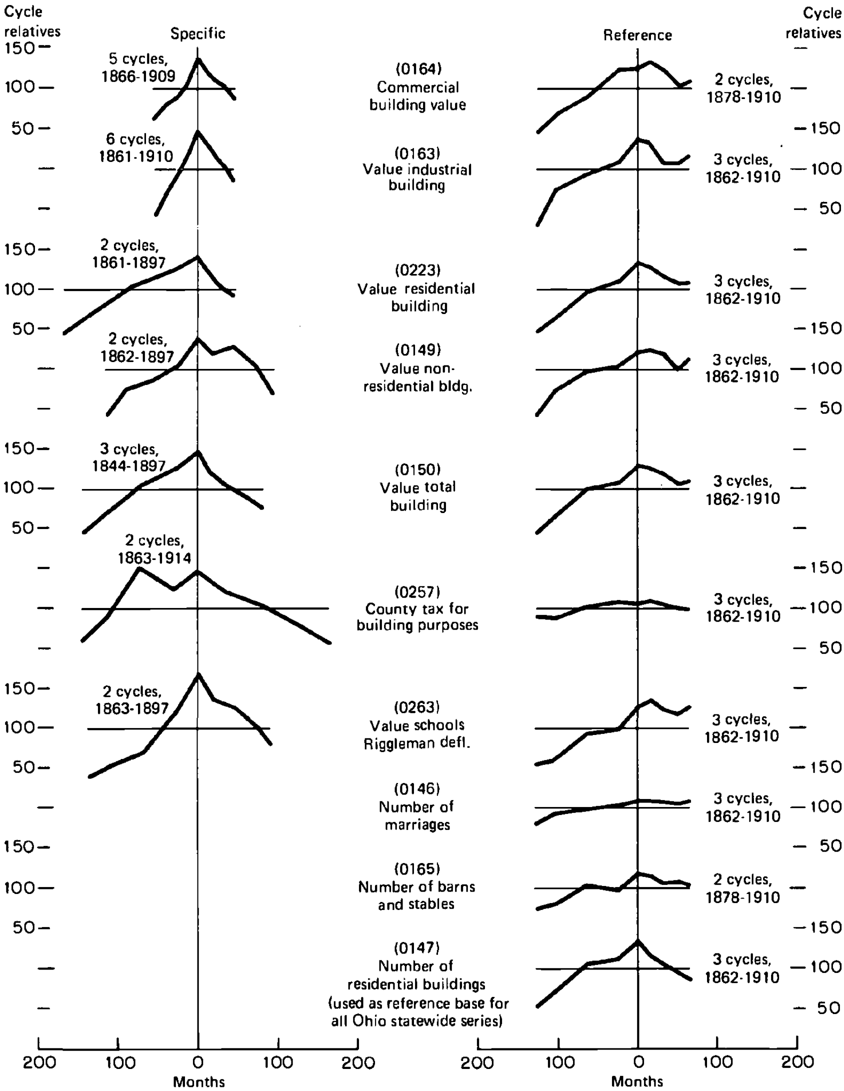
Long-cycle behavior of nonresidential building, either in the aggregate or in its various forms, was available for only a few of our larger aggregates—for the United States, Australia, Ohio—and on a local basis for our Ohio urban areas and for a few other cities. Everywhere nonresidential building as an aggregate conformed in its long-swing movements to residential building, with no indication of "missed" or "extra" or "special" cycles. This record of positive conformity is confirmed by the findings of other investigators.[16]

Conformity in pattern was, at least in the American case, associated with systematic variation in timing. Before the 1880's, nonresidential building series tended to lead by two to three years. Afterward a lag is prominent, especially at peaks (see Chapter 7). Nonresidential construction in Italy also lagged behind residential by between 1.5 and 1.9 years (see Appendix A, Table A-1, on microfiche).

This broad over-all conformity of movement of nonresidential to residential building, with variable timing, breaks down into special patterns for the different types of nonresidential building. Detail here was disclosed by Ohio average patterns for different types of building, as set forth in Chart 1-2. Measured long specific cycles in industrial building in Ohio (with a mean statewide duration of barely nine years) corresponded closely to

CHART 1-2

Patterns of Specific and Reference Long Cycle Averages, Ohio Statewide, Value of Building Activity



"major" business-cycle rhythms. The total specific amplitude exceeded that of residential building both in total movement and rate of change per year. This overt specific rhythm was overlapped by a longer oscillation period that showed up in our reference-cycle patterns and correlograms, with a tendency to lead residential building (Chapter 3).

Chart 1-2 shows that commercial building expansions tended to continue beyond residential peaks and led on residential upturns but with a much shorter lead than industrial building (see Chapter 3). As the chart indicates, public and quasi-public building exhibited the slowest and most uneven response to building rhythms. School-building rhythms conformed moderately to building cycles but with a long lag of more than two years. The lag may reflect slow decision making at governmental levels, the elaborate structure often involved, or lags in cycles of school populations (see Chapter 3). Another activity related to local public building—taxes levied for building purposes by county governments—exhibited a long specific rhythm which hardly reflected standard building rhythms in any way (Chapter 3). Street paving in at least two of three non-Ohio communities for which information was available exhibited clear-cut patterns with tendencies both to lag and to lead up to two or more years (Chapter 3, pp. 77 ff.).

Movement of farm building as such was not an object of investigation. However, our sources occasionally turned up information bearing on long swings in farm building. Two items of information indicated that at least between 1870 and 1914 long swings in agricultural growth were inverse to those of the nonfarm economy. For the United States this was directly indicated for capital formation and growth in cultivation for agriculture as a whole (Chapter 8, pp. 233 f.). The same tendency to inversion was exhibited by marriage rates in predominantly agricultural countries. On the other hand, Ohio agriculture exhibited two indications of building swings in a positive rather than an inverted form. One indication relates to farm mortgage credit recordings, which show clear-cut reference-cycle fluctuations in value (Chapter 4, pp. 104 ff.). A second indication is the clear-cut long reference-cycle behavior of barn and stable building shown in Chart 1-2. Perhaps extension of farm settlement in America and in other agricultural countries proceeded in contracyclical rhythms, and intensive building within settled farm communities developed in cyclical rhythms.

In the aggregate of nonresidential building, the tendencies of public building to lag behind turns in residential building is in part offset by a tendency of industrial building to lead. Hence, amplitude of fluctuation is scaled down, but the duration of expansions and contractions is sufficiently extended to bring all kinds of building eventually into a common movement. In Ohio, in America as a whole, in Italy, and wherever detail by types of building was found, the long-swing behavior of total building was so similar to that of residential building over comparable cycle periods that one pattern could frequently be substituted for the other with only slight variations in form or position. Long swings in urban building are thus a total, not a segmented, phenomenon and involve building as a whole.

Demographic Base

Since buildings are used by people, it is possible that long swings in urban building could mirror long swings in the growth of urban population and household formation. It was our initial hypothesis—and we believe our empirically confirmed conclusion—that long swings in demand for new building were grounded and sustained in good part on long swings in migration and household formation. An expansion of urban building characteristically occurs when people migrate from farm and village communities, where rates of natural increase are relatively high but marginal productivity of labor is low. Migrants go to cities where marginal productivity of labor is relatively high but where rates of natural increase are low. Rural migrants drift most easily to neighboring urban areas but, where opportunities are abundant, migrants will travel long distances and across national frontiers.

This rural-urban migration was often accompanied by a farm-to-farm migration, called for by settlement in the New World of fertile farmlands available at cheap prices. Currents of farm-to-farm migration, which played a role through most of the nineteenth century, do not necessarily flow at rhythms governed by building and real estate cycles. Hence, our reference-cycle patterns of international migration, which includes both farm-to-city and farm-to-farm components, have a specific source of irregularity built into them (Chapter 8, 237 ff.). Our local urban population or migration series for particular communities is free from this particular kind of irregularity, though the enumeration is more difficult to carry out and the statistics are correspondingly scarcer.

We surveyed three urban migration time series from which were extracted eleven specific long cycles. These series uniformly exhibited, as expected, prominent and unambiguous specific long cycles with a total specific amplitude of 321, i.e., the same order of magnitude as for residential building. Turning points for migration series were varied in timing and magnitude of movement relative to that of building. Cyclical correspondence with residential building was loose. Only 28 per cent of the variability around the trend of building activity was "explained" by a linear regression against deviations from the trend of migration. The average deviation on twenty-five matched turning points was 2.3 years. Hence, total reference-cycle amplitude was reduced by 47 per cent from its specific level. Variation in timing did not obscure a clear tendency for migration to lead up to two years, particularly on upturns (Chapter 5, pp. 123 f.).

Our survey of nationwide migration experience was limited to the United States, England (and Wales), and Germany—the three countries most prominently represented in our local series. Fourteen long specific cycles were surveyed. The American experience was that of a net "receiving" country; the other two countries had a net emigration. As expected, American immigration up to the Civil War seemed appreciably affected by farm settlement. Likewise, during the earlier decades of the nineteenth century, emigrants attracted to farm settlement in the New World played an important role in English and German migration. By the end of the century this influence had nearly disappeared from the migration records of the three countries. However, migration patterns for all three countries were disturbed by a conflict of "push" and "pull," except when building and growth waves within England and Germany inverted the American experience. When this occurred, persons would become attracted abroad when least wanted at home and vice versa. We found that the tendency to inversion varied over time, with corresponding irregularity built into our national reference migration patterns. Nevertheless, it was highly significant that English and German emigration reference patterns in the nineteenth century were primarily inverted—with reference to their own patterns of residential building—while the American patterns were primarily positive. Mean specific amplitude was built up to 274 cycle relatives of which only 155 survived to the reference level. As in our local series, a primary tendency to lead shows up on the nationwide level for the three countries.

American amplitude was greatest and England and Wales after 1850 lowest.

The same force which attracts migrants—favorable opportunities for settlement or for gainful industrial employment—will encourage or discourage the formation by marriage of new mating households and hence increase the demand for additional shelter. Records for eight urban communities or groups of communities indicated that people married at a much steadier rate than they migrated. Amplitude for our marriage series ran to a sixth and seventh of that of migration. For many of our marriage series there were long stretches of time in which specific fluctuations were so muted or mild that they were not recognized apart from the short fluctuations in which they were embedded. Timing was more perfectly concurrent, with less variation at matched turning points. Some 39 per cent of the variation in building around its trend was explained by a simple regression of variations in marriages from their trend.

Rates of marriage on a nationwide basis do not as clearly exhibit long swings as corresponding rates for urban communities. Specific total mean amplitude for 10.5 specific long cycles of industrial countries averaged only 36.5 cycle relatives; and, due to timing variabilities, this was eroded to 16.7 on a reference basis (Chapter 8, Table 8-1).

This low amplitude in part reflects adjustment of our national marriage statistics to a per capita basis, thus eliminating upward trend. For the same reason turning points became advanced from two to four years. More important was the inclusion in national marriage statistics of marriages of farm populations. Marriage rates of agricultural populations will, of course, respond to changes in agricultural or crop conditions. For a number of countries, regression analysis traced out the decline of farm influence and the rise of industrial influence on nationwide marriage rates (Chapter 8, pp. 232 f.).

Vacancy Rates

Long swings in urban building are by no means entirely attributable to corresponding variations in labor force and urban investment. They were exaggerated by systematic tendencies to alternating states of over- and underbuilding, or—alternatively put—to changing rates of utilization of standing building stocks.

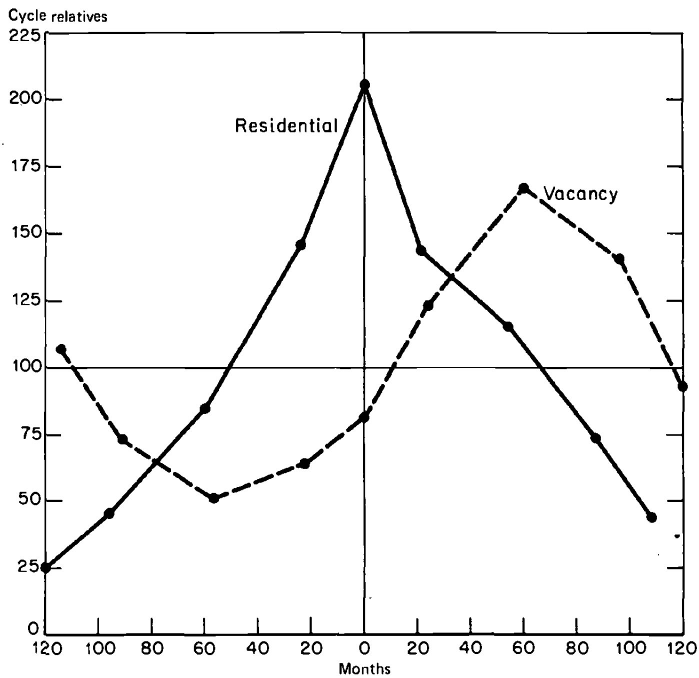
Direct evidence of long swings in rates of utilization of standing stocks—an unemployment of property rather than of people—is found in the vacancy rates, which fluctuated systematically over a specific total amplitude nearly matching that of residential building, 306 cycle relatives (Chapter 5).

The cycle patterns of vacancy rates in different communities at different time periods were found to be sufficiently similar to warrant representation in terms of a single cycle pattern (see Chart 1-3). The chart graphically discloses the tendency of new residential building to lag behind but eventually outrun a fluctuating demand for additional shelter. Throughout the first half of the reference expansion, the demand for additional shelter outpaces new building, and vacancy rates decline. Throughout

CHART 1-3

Average Long Cycle Patterns, Specific Residential and Reference Vacancy, Six Cities, 1851–1940

Specific Residential composed of:			Reference Vacancy composed of:		
London	1856-1914	(3 cycles)	London	1873-1914	(2 cycles)
Glasgow	1864-1912	(2 cycles)	Glasgow	1864-1912	(2 cycles)
Berlin	1851-1900	(3 cycles)	Berlin	1851-1900	(3 cycles)
Hamburg	1878-1910	(2 cycles--I)	Hamburg	1878-1910	(2 cycles--I)
Stockholm	1870-1940	(3 cycles)	Stockholm	1893-1940	(2 cycles)
St. Louis	1892-1933	(2½ cycles--P.L.)	St. Louis	1892-1933	(2½ cycles--P.L.)



the second half of the expansion, new building outpaces additional demand, and continues to do so through the first half of the reference decline. Hence, vacancy rates reach their peak around the middle of the reference contraction.

A changed vacancy rate will generate changes in rent levels and in realty price levels, and all three affect the willingness of builders to build new dwellings. The relationship is inverted, i.e., a diminished rate of vacancies causes an increased rate of building and vice versa. But these changes in new building are induced directly and indirectly only over time. The lag of new building behind vacancies ranges from three to five years; it is consistent, with relatively small deviations (mean 2.25 years) on thirty-six matched individual turns, a mean correlation coefficient of −.77, and a ratio of reference to specific total amplitude of .78.

Vacancy fluctuations can be fruitfully expressed not only in terms of cycle relatives but as a percentage of the total stock of residential buildings. The mean reference vacancy rate for the communities involved was 2.6 per cent at the initial vacancy trough, 8.5 per cent at the vacancy peak, and 1.9 per cent at the terminal vacancy trough (see Table 5-2). Since the annual mean growth in nonfarm stocks of housing over the same stretch of years for the United States may be estimated at 2.6 per cent per year, the swing in urban vacancies on the rise amounted to 2.3 years of our mean annual increase in housing stock and 2.5 years on the fall.[17] The corresponding swing in Berlin building was on a somewhat reduced scale. But by either the American or Berlin magnitudes, the equivalent of a substantial amount of new building was added to or offset by the swings in vacancy rates.

Real Estate Market Activity and Values

The surging demand which generates long swings in building is not confined to new building alone; it also extends to demand for building sites. These sites are obtained by land development and subdivision into prepared lots. Both of these activities evince specific total amplitudes nearly double that of residential building, indicating a tendency to over- and underdevelopment of new sites as demand for shelter fluctuates. The primary phase of land development—procurement of land in urban environs—reaches its peak long after residential building has peaked and continues to decline until nearly midway through a building expansion. The work of lot preparation and subdivision is more promptly adjusted to building needs and conforms in its timing, with a lag of under six months, to movements of building activity proper.

Demand for new building not only affects land markets but also affects demand for old realty and for the mortgage credit used in financing both new and old realty purchases. The number of newly recorded deeds and mortgages—reflecting primarily transactions in used residential properties, in vacant lots, and in small business or consumer credit—exhibits clear-cut reference expansions and contractions. Turns in deeds lead turns in mortgage activity by up to two years. Amplitude of movements on a specific basis are considerable, ranging from one-half to two-thirds of amplitudes for residential building. The divergent rhythms of deed and mortgage activity may reflect a tendency towards accelerated nonfarm use of mortgage credit during reference contractions for activities not connected with real estate purchase, i.e., for personal credit or business financing. Such use of mortgage credit gives way to realty needs during reference expansions.

Comparable long swings in mortgage credit extended, when measured not by number of recordings but by the dollar consideration involved, were found for the American and German urban communities surveyed. But for larger areas American and German experience diverged. For Germany as a whole, long-swing fluctuations in the total flow of mortgage credit were almost as distinctive as for the city of Berlin. In Ohio all semblance of reference fluctuation in statewide value of mortgage recordings was rubbed out in the process of aggregating all uses of mortgage credit. Since the statistics of new building showed significant statewide long swings and since we may infer the existence of corresponding swings in statewide mortgage credit used to finance new construction, there must have been inverse long swings in the flow of credit for business or personal uses or to finance transfers in improved or unimproved property.

One set of market signals that would influence extension of mortgage credit to purchases of new or old realty is foreclosures. These play the role in realty credit markets that commercial failures play in commercial credit markets. Foreclosures develop a specific amplitude of the same order as residential building, with consistent timing, an inverse relationship, and a clear-cut tendency to lead. The pattern is similar to that of vacancy rates.

Building and real estate market activity result from choices made in a complex of markets, including those for rentals, sales of old buildings, urban sites, building materials, labor, and mortgage credit. Prices in these markets are linked in an equilibrium system. As demand for shelter, buildings, and realty investment rises and falls, sympathetic currents of fluctuation are propagated through the real estate and building markets. Price margins shift with the uneven response of the price system. Some of the principal measures of price response at different levels of building and realty markets are presented in Table 1-2. These summary measures vary in terms of accuracy, comprehensiveness, and comparability of the underlying statistics. We comment first on the price of undeveloped urban sites, go on to the various components of realty and building value, and finally discuss the value of improved realty.

Urban sites may be bought and sold as raw acreage or in the form of graded and cleared subdivided lots equipped with streets, sidewalks, and other improvements. Urban sites have tended to appreciate over time; they can be easily purchased on instalment terms at low interest rates; they are traded in organized realty markets; and they are subject to little or no upkeep and relatively modest property taxes. Hence investment in them has been cultivated in the quest for capital gains. These prospective capital gains depend upon expectations of the steady growth in value of the sites concerned. Expectations are grounded on hazy knowledge of the past qualified by vague allowances for the future. Hence land values, in terms of both price and volume of transactions, exhibit extreme instability and play an important role in mechanisms of amplification at the local level of realty and development swings.

Information on raw acreage sold in undeveloped form was available for study only in Ohio. The five and one-half long cycles in per acre values had a specific and reference mean amplitude of 336 and 188 cycle relatives, respectively, with a tendency to comparatively irregular timing, approaching full inversion.

Prices of urban site values for developed land were available for survey in only two cities, with a mean level of amplitude considerably below amplitude in the volume of subdivision

TABLE 1-2

Average Long Cycles in Price and Value Measures, Amplitude and Duration

					Amplitude, in Cycle Relatives		
					Specific		
		Number of Series	*Number of Long Cycles*	*Predominant Lead or Lag Relative to Residential Building*	*Total*	*Per Year*	*Reference Total*
1.	Price per acre, underdeveloped land, Ohio	4	5.5	Inverted	336.0	16.2	188.0
2.	Building material prices	3	12	Nearly concurrent	60.0	3.3	26.8
3.	Hourly earnings, building trade differential over manufacturing, U.S.A.	1	4	Moderate lag	47.9	2.6	19.8
4.	Cost of building	6	12	Moderate lag	50.6	2.9	34.1
5.	Mortgage yield differential over bond yield, U.S. and Germany	3	8	Moderate lag	134.2	8.6	62.9
6.	Dwelling rental						
	Vacant	3	5	Strong lead	60.7	4.0	51.8
	Occupied	2	5	Slight lag	37.2	2.3	22.6
7.	Real estate prices, improved property	9	22.5	Nearly concurrent	103.2	6.4	62.4

SOURCE: Table 6-8.

activity itself. The mean specific amplitude for the price of subdivided vacant lots in Paris was 132 cycle relatives, while Chicago's record of improved urban site values over a comparable stretch of years was 193. In both cases, amplitudes receded as urban growth rates slowed down.

Some follow-through for urban site values is found in virtually all segments of the real estate market. Newly constructed properties will include, of course, an allowance for the cost of land on which the building is erected. Old properties will be appraised not only with reference to the usability of the improvements but with regard to the site's best potential use. But though important for new and old realty, urban site values in most urban communities play a lesser role in determining realty values than do the improvements worked into the site or placed on it in the form of a building.

The cost of improvements was resolved, for purposes of this investigation, into prices for building materials, building labor, and mortgage finance or the interest cost of loan capital. Since the three sets of prices are established in nationwide markets, with relatively small local differentials, nationwide price indexes were analyzed rather than those of particular urban communities.

Of the three cost components, only prices of building material exhibit clear-cut specific long cycles related to building cycles. These long cycles stood out prominently over the entire nineteenth century in the United States and Germany. Their amplitude is quite moderate, corresponding to the ease of expanding supply and the competitive nature of the product markets concerned. Mean specific amplitude, excluding the principal periods of wartime inflation, was only 60 (see line 2, Table 2). Because of wide variations in timing in England and in America, very little reference fluctuation showed up in measures for those two countries. In Germany, the process of reference fluctuation was more distinctive.

The long cyclical response of the other major direct component of building cost—hourly wages—was not as well marked. Our information on building-trade wages exhibits little direct indication of any long-wave movement with a rhythm resembling building cycles. There is ample indication, however, of tension in labor markets, generated by building cycles. Differentials between hourly earnings in the building trade and in manufacturing exhibit a clear-cut long-wave movement in America, with a tendency to lead residential building at earlier turning points, before building-trade unions were powerful, and to lag at the later ones. The mean specific amplitude of this percentage differential was only 48 cycle relatives, of which only 20 survived timing variabilities for inclusion in reference amplitude (see line 3, Table 2). Since both sets of hourly earnings were in a rising secular trend, shifts in the differential between them were probably accompanied by moderate accelerations and retardations in both set of rates.

As the wage differential rose and building-trade crews were enlarged, productivity probably slackened. The influence of this shift in labor cost is indicated in the cyclical behavior of our measures of total building costs, which chiefly cover expenditure for labor and materials (see line 4, Table 1-2). Specific amplitudes for twelve long cycles in unit building costs were 51 cycle relatives, and the reference amplitude was eroded to 34 cycle relatives. The sluggish timing of labor costs probably accounts for the tendency of building costs to lag one or two years behind building turning points. Long waves of building met a supply resistance which evoked a partial response in the cost of building. The latter fluctuates with an amplitude one-sixth that of building activity itself. It thus appears that building labor and materials are drawn from the economy and released in long swings with relative ease.

Mortgage interest rates share a common long-term movement with investment yields on high-grade securities of long maturities. This long-term movement typically spans two or three building cycles and overshadows any specific long rhythm of mortgage yields. A concealed or covert rhythm shows up, however, in mortgage-yield differentials relative to bond yield. Relative differentials in the United States, Germany, and Scotland exhibited clear-cut long cycles conforming in their general character to building cycles proper. Of eighteen potential reference turning points, all were matched, and the mean deviation from the mean lead-lag was only 1.44 years. Standard total specific and reference amplitude ran nearly three times the corresponding amplitude of wage differentials (see Table 1-2).

This amplitude of movement may be regarded as a measure of the capital market's resistance to shifting the pattern of its fund allocation to accommodate mortgage credit requirements entailed by long building swings. Thus regarded, resistance in the capital market is more tenacious than the resistance of the labor or industrial materials market to shifting the pattern of use of labor and industrial resources. Does the greater resistance in the capital market to financing long-swing building swings merely reflect the more competitive character of the loan fund market and the more precise adjustment of price to short-run market-clearing forces? Or again, does the greater resistance reflect the more crucial role of finance limitations in the mechanisms of generation and propagation of building cycles and long waves generally? These questions are raised but not answered in this volume.

The rise and fall of unit site value and building costs acts as a brake on long swings in building. But the effectiveness of this braking action may be offset by corresponding movements of rental levels and selling prices for improved properties. The variation in rental prices for vacant dwellings is considerable: a mean specific amplitude of 61 and a reference amplitude of 52 cycle relatives (see Table 1-2). Turns in vacant rental prices lead house building by a little over two years. These swings in turn induce swings in the rental prices for occupied dwellings, with turns delayed by two years and amplitude cut in half (Table 1-2). While the measured swings in building cost exceed occupied rental amplitudes, rental prices for newly erected structures may be supposed to fluctuate over a wider range. Hence, fluctuations in rental returns and building costs for newly erected properties partly offset each other so far as incentives to build, indicated by realty profit margins, are concerned (Chapter 6). However, since rental returns tend to lead and costs to lag, a cyclically shifting profit margin may generate swings in realty selling prices. Price swings for improved realty do have an amplitude of movement nearly double that of the cost of new building. This additional amplitude reflects a possible cyclical movement in rental profit margins and underlying shifts in urban site values. This movement may be generated in good measure by land speculation and land development activity, which, as we have seen, are very sensitive to long-swing movements. Here one of the sources can be seen for the fluctuation in financial inducements which helps to produce local amplification of long-run growth waves.

The following chapter presents a full statement and justification for the statistical methodology utilized in this investigation. In Chapter 3, we will consider long local swings in building activity as a whole and by type of building: residential, industrial, commercial, and public. In Chapter 4, the same local swings will be traced in real estate market, lending, and development activity. In Chapters 5 and 6, our center of interest shifts to more fundamental levels where causal influences will be encountered. These influences in Chapter 5 center on migration of labor force and formation of new households through marriage, and changes in vacancy and occupancy patterns. The influences dealt with in Chapter 6 involve a systematic survey of shifts in relationships between values and prices at various phases of building and real estate market activity: site values, lot values, real estate selling prices, rents, building costs, mortgage yields. In Chapters 7 and 8, certain crucial aspects of long national swings are reviewed.

NOTES

1. See [65, 149, 209, 242, 189, 159, 86, 188, 274, 81, 191, 220, 180, 219, 239, 179, 281, 283, 96, 79, 87, 80], a compilation of dissertations on Saarbrücken, Koblenz, Bonn, Aachen, München-Gladbach, Elberfelds, Barmens, Duisburg, Bremen, Kiel, Köln, Neuwied). For critical reviews of the Eberstadt position as developed in earlier works, see [273 and 282].

2. Thus Reich generally refers to ups and downs of building as a phase of general business cycles [219, pp. 1, 6 ff., 48 ff.]. Her chronology of peaks and troughs did not distinguish between long and short turning points, and her average cycle period for annual percentage change in residential building (Table III, pp. 126 ff.) is ten years. But her portrayal of the general course of a building cycle emphasizes its system of lagged reactions—in use of incomes, demand for shelter, reduced vacancies, higher rent, higher land values, etc. Spiethoff simply applies to residential building his standard chronology of phases and periods (averaging around eight or more years). See [239, pp. 17 ff.].

3. [179, Part I, particularly pp. 39 ff., 85 f.].

4. J. C. Spensley wrote about London [238] and Alexander Cairncross wrote about Glasgow [45]. North American investigators published studies about Chicago, St. Louis, Manhattan, Oakland, Pittsburgh, and Toronto [134, 224, 174, 186, 152, 37]. Paris was studied by L. Flaus [93]. Three investigators in the 1930's attempted to summarize American urban experience with building and real estate fluctuations: John R. Rigglemen [222], W. H. Newman [206], and C. D. Long, Jr. [173].

5. [280, pp. 97–153]. On these pages the results of an extensive collection of data were assembled and the results were graphically exhibited.

6. Allusion was there made to a "monograph on construction work which

will discuss in detail long cycles in building construction and related activities in the United States and foreign countries." This monograph has not appeared in published form.

7. See particularly Moses Abramovitz [1] and items cited in his bibliography (pp. 237 ff.) by himself; Blank; Easterlin; Gottlieb; Grebler, Blank, and Winnick; Guttentag; Kuznets; Ulmer; and Wickens. See also the work of Richard Easterlin [78], and Burnham O. Campbell [50].

8. The study and interpretation of long swings and business cycles in the United Kingdom have been converted, through the work of A. Cairncross and B. Thomas, into a study of long swings in the Atlantic economy. See Alexander Cairncross [46] and J. Parry Lewis [167] (London 1965), papers and studies by B. Weber [284], E. W. Cooney [66], John Habakkuk [116], and others. Recent American theoretical enquiry included three papers, by Bert Hickman, B. O. Campbell, and J. G. Williamson [126]. For recent discussions, see [168, 5, 246].

9. Alexander Cairncross very kindly sent us a copy of the original work-sheets of Bernard Weber, whose investigation of building activity in individual cities culminated in a new nationwide time series of English residential building from 1838 to 1950. See Appendix B, series 0001–0009. For the series borrowed from investigations of Parry Lewis, see Appendix B, series 0143–0145.

10. The character and composition of the sample are indicated in Chapter 2.

11. See publications by the author, Appendix B, series 0155, 0270-2.

12. See Appendix H, "Urban Residential Building Index, Germany, Series 0018."

13. See Appendix B, series 0037.

14. J. Parry Lewis' "descriptive work" on building cycles was incomplete because it lacked the "model" of an interacting network of fluctuating economies out of whose processes in a disturbed environment long swings are generated. See [167, pp. 2 f., 8, 211–232].

15. Two other simple measures of conformity often used in this study are the mean deviation expressed in units of a year between matching reference and specific turning points and the correlation coefficient.

16. Thus Abramovitz finds that Long's value of private nonresidential building permits (series 22) and his index of the value of public building permits (series 35) conformed perfectly during long swings between 1871 and 1935, though, in terms of annual change per year, two extra cycles characterized as "minor interruptions" (p. 105) were recognized and these reduced average durations to 12.56 years (series 22) and 10.36 years (series 35). See Abramovitz [1, Tables 13 and 15 and Chart 6].

17. See [109, p. 47]. The rise in vacancy rates from reference trough to peak of 5.9 per cent (8.5 minus 2.6) is equal to 2.3 years of new residential building at mean rates.