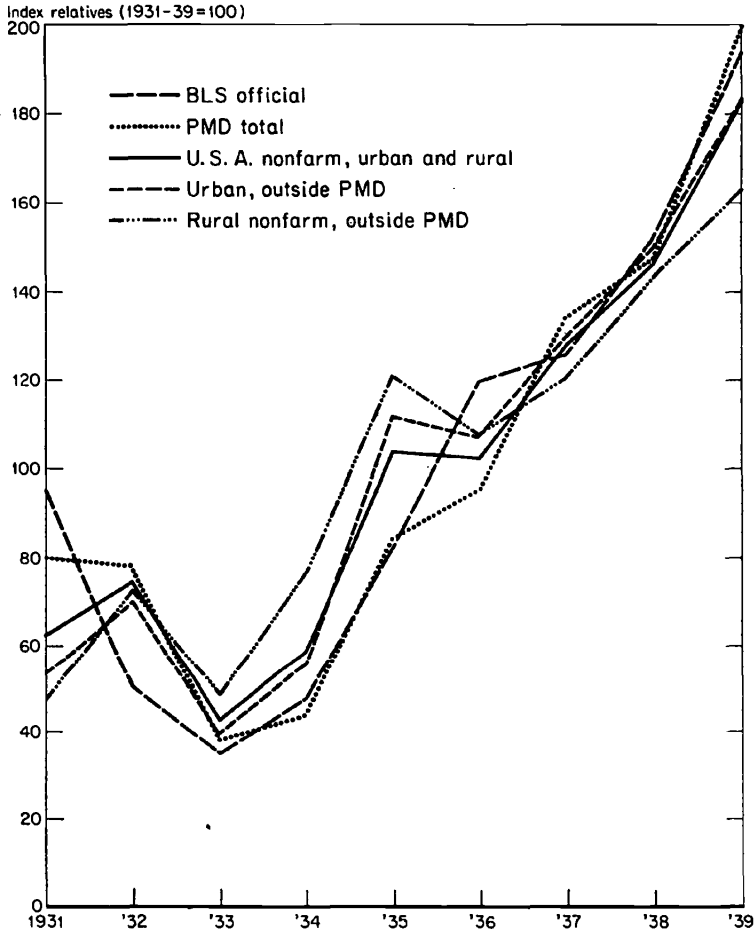# 5

Estimation of Decade Annual Indexes

We now turn to the third stage of the procedure used in this study, the fixing of suitable decade indexes, i.e., sets of ten index relatives of housing production in a decade with the decade average as base. Application of these relatives to our accepted decade aggregates would yield estimates of annual housing production coordinated with both decade level and annual patterns of movement. It would be unwise to apply the indexes implicit in any one set of annual estimates on record to trace out the course of residential building over the century. None of them could be totally disregarded; none could be wholly trusted. Each of the estimates attempted represents a tendency in building which should be reflected in the totals and indexes. Hence it seemed desirable to work decade by decade and to assemble sets of decade indexes corresponding to different tendencies in residential building—either by area or city size class—or with biases that would be offsetting. In assembling the component indexes and determining their respective weights, it was necessary to keep in mind decade fitting at decade endings. The decade indexes and the final estimates are shown in Table 15.

For the decade of the 1930's, the index pattern of the BLS-NBER series, the outcome of skilled manipulation of a broad permit reporting system, was applied to our estimated decade total to yield annual estimates. The only alternative pattern by which to gauge its adequacy was that afforded by the 1940 Census vintage report which, for the thirties, spelled out for each year the reported production of dwelling units allegedly built in that year and surviving to the 1940 Census date. Since in census-reported age distribution the reported ages bias toward round figures, the reported 1930 production is excluded from our decade index comparison. We show in Chart 13 the index patterns for 1931-39 vintage residential production by city-size class, along with the official series. The fit is close. Hence we accepted the pattern of the official indexes and

CHART 13

Decade Indexes of Dwelling Units,
1931-39

Index relatives (1931-39=100)

Legend:
- – – – BLS official
- ············ PMD total
- ———— U. S. A. nonfarm, urban and rural
- – – – – Urban, outside PMD
- –·····—··· Rural nonfarm, outside PMD

Source: BLS figures from *Construction During Five Decades,* 1953, p. 3; the other four series obtained from 16th Census, *Housing, Characteristics by Type of Structure,* 1945, pp. 3-7.

TABLE 15

ESTIMATED PRODUCTION OF RESIDENTIAL HOUSEKEEPING UNITS,
1840-1939

Year	Decade Indexes	Housing Production (000)	Year	Decade Indexes	Original Housing Series (000)	Housing Production (000)
1840	69.01	36	1890		328	278
1841	79.02	41	1891		298	252
1842	65.45	34	1892		381	323
1843	65.72	34	1893		267	226
1844	73.32	38	1894		265	225
1845	87.98	46	1895		309	262
1846	111.16	58	1896		257	218
1847	137.68	72	1897		292	247
1848	134.06	70	1898		262	222
1849	157.71	82	1899		282	239
1850	78.28	94	1900	54.75		230
1851	90.28	109	1901	78.58		330
1852	100.70	121	1902	76.09		320
1853	110.53	133	1903	82.65		347
1854	114.72	138	1904	96.00		403
1855	115.20	138	1905	127.42		535
1856	112.13	135	1906	124.65		524
1857	118.08	142	1907	112.26		471
1858	86.09	103	1908	110.04		462
1859	81.24	98	1909	137.22		576
1860	87.80	93	1910	113.13		477
1861	71.32	76	1911	111.87		472
1862	74.04	79	1912	120.93		510
1863	69.35	74	1913	113.10		477
1864	56.19	60	1914	110.73		467
1865	76.62	81	1915	112.40		474
1866	107.65	114	1916	110.58		467
1867	131.86	140	1917	68.97		291
1868	156.70	166	1918	40.14		169
1869	159.06	169	1919	98.38		415
1870	118.63	158	1920		217	250
1871	140.54	188	1921		491	491
1872	125.76	168	1922		767	767
1873	130.39	174	1923		950	950
1874	92.69	124	1924		963	963
1875	95.53	127	1925		1,048	1,048
1876	76.48	102	1926		1,010	1,010
1877	77.11	103	1927		837	837
1878	60.63	81	1928		741	741
1879	67.16	90	1929		473	573

(continued)

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TABLE 15 (concluded)

Year	Decade Indexes	Housing Production (000)	Year	Decade Indexes	Original Housing Series Production (000) (000)	
1880	48.76	127	1930		330	485
1881	73.61	191	1931		254	373
1882	80.19	208	1932		134	197
1883	91.43	237	1933		93	137
1884	94.89	246	1934		126	185
1885	102.73	267	1935		221	325
1886	107.00	278	1936		319	469
1887	125.61	326	1937		336	494
1888	123.31	320	1938		406	597
1889	141.61	368	1939		515	757

NOTES

1840–59: Decade totals of 520,000 and 1,202,000 units distributed on the basis of decade indexes made up of the geometric average of Riggleman (Isard-adjusted) and Ohio building value. Ohio figures from unpublished tax increments (see discussion pp. 75 ff.); Colean and Newcomb, *Stabilizing Construction,* p. 227.

1860–89: Decade totals of 1,061,000, 1,333,000, and 2,597,000 units for the sixties, seventies, and eighties, respectively, were distributed by the geometric average of the following indexes equally weighted: (1) Ohio statewide, (2) Riggleman-Isard adjusted, deflated by a Riggleman cost of building index, and (3) Long index-number residential building permits (Long, *Building Cycles,* pp. 227-228; Colean and Newcomb, *Stabilizing Construction,* p. 226; Riggleman, *Variations in Building Activity,* pp. 257-258; Table 16 following).

1890–99: Blank's yearly estimates reduced by 15.3 per cent. Yearly totals in Grebler, Blank, and Winnick, *Capital Formation,* p. 332, Table 15.

1900–19: Chawner's decade estimates of 4,200,000 and 4,220,000 distributed by index relatives (1900-19=100) made up of simple average of Blank's and Chawner's series (Blank, *Volume of Residential Construction,* p. 27, Table 13.

1920–29: Blank's new series at 7,497,000 for the decade (compared with official series at 7,034,000). Figures for 1920 adjusted by 33,000; figures for 1929 raised by 100,000. The adjustment for 1929 was for "linkage" only and was for that reason arbitrary. The need for adjustment indicates a hiatus in the sets of decade totals and yearly indexes. *Ibid.,* p. 59.

1930–39: Official BLS-NBER yearly estimates (*Construction During Five Decades,* 1953, p. 3), raised by 47 per cent to make a 4,019,000 decade total.

Sum of indexes by decades differs from 1,000 because of use of geometric averages and because of rounding. For the same reasons, production totals by decade also differ slightly from the decade aggregates that were distributed.

raised them by a decadewide adjustment to offset the underestimation previously noted.

With Blank's decade total for the twenties, the decade index that went along with it was accepted.[55] As Blank noted, this index corresponds closely with that of the official series. I departed from his index for 1929 to smooth the transition, and for 1920 because his estimate for that year in the light of available information seemed unduly low.[56]

For the decades of the 1900's and 1910's, Chawner's decade totals were used, as previously noted, but not the unmodified index patterns that went along with the totals. Blank's decade indexes involved decade totals which, like Chawner's, were about the same in magnitude for the two decades though resting at a lower level. Blank's decade indexes reflect a more intensive working of a wider mass of empirical materials. But some of the pattern implicit in Blank's indexes must have been generated by the underestimation of level running through them. Under the circumstances it seemed reasonable to average the two sets of decade indexes. The average of the resulting pair of indexes is shown in Table 15.[57]

For the 1890's, Blank's index was used, since it was drawn from a city coverage much larger than other available indexes were. By 1890, his index is based upon 25 cities accounting for 14.5 per cent of total nonfarm population. In contrast, Long's residential permit index for 1890 covered only 12 cities. The Riggleman index for 1890 has the requisite coverage (32 cities) but it measures nonresidential as well as residential building and it is cast in value terms. Only the Ohio residential building index was suited for averaging with the Blank index. But since the Blank index was adjusted for nonurban building and since the two idexes corresponded closely (see Chart 14), the Blank index was accepted for the nineties.[58]

[55] For details see Blank, *The Volume of Residential Construction*, p. 59.

[56] Estimates for the year 1920 compare as follows: Wickens (1941), 247; Chawner (1939), 300; Blank (1954), 217; BLS (1959), 247. (Blank, *Volume of Residential Construction*, Table 13, p. 59; Wickens, *Residential Real Estate*, p. 49; Chawner, *Residential Building*, p. 13; *Construction During Five Decades*, p. 3.)

[57] See the detailed discussion of the Chawner and Blank indexes in Blank, *Volume of Residential Construction*, pp. 25-28.

[58] With the index relative, 1890-99 = 100, the combined decade indexes are as follows for the years beginning 1890:

	1890	1891	1892	1893	1894
Blank, alone	115.6	101.4	129.6	90.8	90.1
Blank-Ohio average	102.7	109.6	127.6	100.7	89.3
	1895	1896	1897	1898	1899
Blank, alone	105.1	87.4	99.3	89.1	95.9
Blank-Ohio average	102.7	89.0	93.5	87.6	99.4

CHART 14

Decade Indexes for the 1890's

Index relatives (1890-99=100)
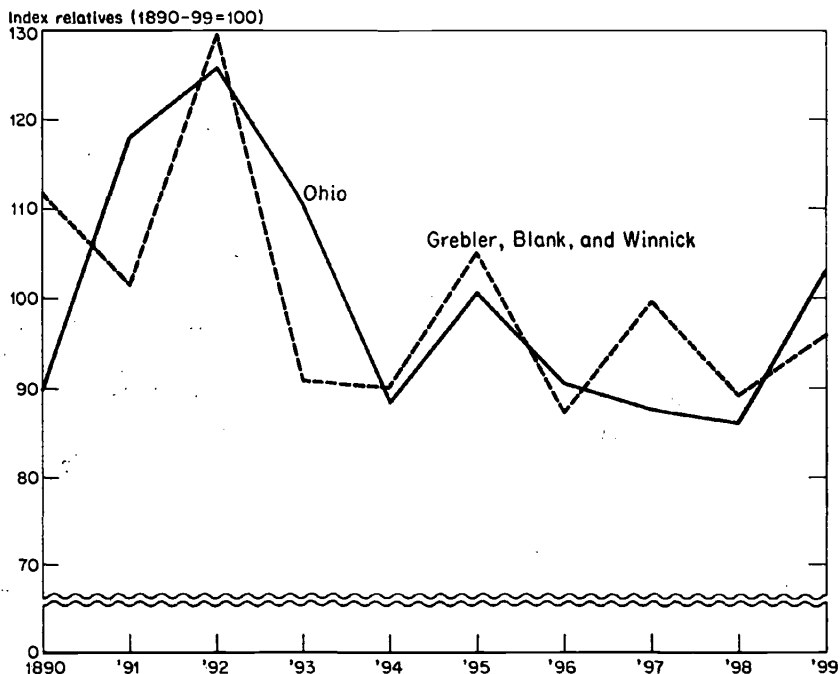
Source: Grebler, Blank, and Winnick, *Capital Formation*, p. 332; unpublished Ohio yearly totals.

For the three decades between 1860 and 1890, difficulty was experienced in devising appropriate annual indexes. None of the standard available measures had a claim to special validity in those three decades. Blank's index was too limited in coverage to be used alone for the 1880's. The Ohio experience is likewise unsuitable as a sole measure of nationwide patterns of movement, since Ohio overresponded to the rise of the sixties and underresponded to the boom of the eighties. The annual statewide Ohio returns for residential production also include farm dwellings, which played a variable role over those three decades. Newly erected farm dwellings are estimated to account for 27, 50, and 13 per cent of aggregate decade production of houses during the 1860's, 1870's, and 1880's, respectively (see Table 11, columns 1 and 6). There is no reliable way to remove the influence of farm construction from annual aggregate statewide returns. Aggregation of returns separately for highly urbanized

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and other counties showed that the level of production in the highly urban counties receded more during the seventies—relative to the late sixties and eighties—than it did in other counties (see Table 16). The highly urban counties reached a peak in 1868 which nearly matched the 1873 peak; for other counties the boom in the early seventies carried

TABLE 16

NUMBER OF URBAN AND OTHER DWELLING UNITS
PRODUCED IN OHIO, ANNUALLY, 1860-89
(thousands)

Year	Urban	Others	Total
1860	1,864	5,821	7,685
1861	1,390	4,948	6,338
1862	1,306	3,652	4,958
1863	1,405	3,933	5,388
1864	1,631	3,537	5,168
1865	2,832	5,853	8,685
1866	4,006	8,253	12,259
1867	4,004	9,415	13,419
1868	4,233	9,997	14,230
1869	3,257	8,103	11,360
1870	2,775	7,164	9,939
1871	3,467	9,134	12,601
1872	3,658	11,514	15,172
1873	4,413	12,580	16,993
1874	4,318	10,657	14,975
1875	3,839	11,538	15,377
1876	2,574	8,574	11,148
1877	2,674	8,331	11,005
1878	1,874	6,534	8,408
1879	2,586	8,161	10,747
1880	2,523	7,302	9,825
1881	4,567	14,848	19,415
1882	4,962	14,392	19,354
1883	5,901	14,834	20,735
1884	6,194	12,373	18,567
1885	5,840	10,156	15,996
1886	5,033	9,916	14,949
1887	8,342	12,423	20,765
1888	8,897	11,862	20,759
1889	8,259	12,766	21,025

NOTE: Urban totals for five counties containing large cities: Hamilton (Cincinnati), Franklin (Columbus), Montgomery (Dayton), Cuyahoga (Cleveland), Lucas (Toledo); the "others" make up the rest of the state with its 83 counties. The total is taken from NBER series 0147.

residential building to levels nearly a third above the peak of 1868. On the other hand, the long-swing contraction was equally marked in both categories; and total specific amplitude of residential building tends to vary, if at all, inversely with degree of urbanization.[59] Thus while our total statewide building index is serviceable, possible merit may be found in separate use of its highly urbanized and other components.

The Long index before 1890 reflects the building experience of a few metropolitan centers. It is excessively weighted with New York (Manhattan) experience and fails to allow adequately for secular growth. The Riggleman index as adjusted by Isard is also metropolitan in character but during those decades it is much more broadly based and less dependent upon eastern seaboard building patterns. The index measures the value of total urban building, not of residential units; and small towns and cities are not adequately weighted in the index. Besides these major indexes, we have available separate city returns for Manhattan from 1868 and for Chicago from 1860 on.

Two possible approaches were explored in detail. First, an effort was made to assess index availabilities for each decade and to select an appropriate set of indexes with changing weights. The judgment involved in selecting components and assigning weights was inherently opportunistic and marked by some arbitrariness, but variation of weights and components by decades improved judgment for each decade. The three sets of decade indexes developed in this fashion are shown in the next tabulation.[60]

[59] Below are urbanization indexes, chronologies, and specific amplitudes for statewide Ohio and its sample groups.

Sample Group	Peak	Trough	Amplitude Specific Cycle Fall	Urban Population as Per Cent of Total, 1920	Farm Mortgages as Per Cent of Total Value, 1885
I	1874	1878	85.2	93	12
II	1868	1878	86.7	83	39
III	1868	1878	83.4	77	37
IV	1872	1878	102.5	43	57
V	1875	1878	118.7	20	84
State	1873	1878	74.5	64	49

[60] For the decade of the eighties Blank's index was combined with the Ohio statewide index, with Long's index of residential permits, and with Riggleman's per capita building permits (see Chart 15 and Table 17). An alternative average of a set of indexes including Chicago and Manhattan corresponded in pattern with the simple average of the four indexes. The high amplitudes of the Long index should offset the limited downward bias in the population adjustment of the Riggleman index. For the decade of the seventies, a broadly based Blank index was no longer available, and greater reliance had to be placed on the Riggleman index with its broad coverage. It was assigned a double weighting. The Riggleman deflated index was used, since in the decade a profound price

Component Activities	Weight Allowed in Decade Index		
	1860's	1870's	1880's
Ohio, statewide			1
Riggleman, per capita			1
Riggleman, per capita deflated	1	2	
Blank, residential units			1
Long, number residential permits	1	1	1
Ohio, urban	1	1	
Ohio, other	1	1	

Tables 17-19 and Charts 15-17 show the behavior of the several indexes and their averages. Application of the averages to our decade totals yielded a set of annual building totals, reproduced in Chart 18, "shifting weight variant." The second procedure used to derive decade indexes for 1860-89 involved a constant set of series with unchanging weights for the three decades. This eliminated the arbitrariness involved in shifting indexes and weights by decades though it entails a less efficient use of available information. The most serviceable index measures running for the three decades were found to be Ohio, statewide; Long, number of residential permits; and Riggleman-Isard, deflated value of building permits. It was necessary to deflate the Riggleman-Isard series since in the period covered a profound price revolution distorted value calculations cast in current prices. The three series reflect, in different ways and with different degrees of emphasis, divergent tendencies of United States building experience. Fortunately, the main outlines of movement being shared, the pattern of weighting was not too difficult. In the absence of measured criteria, each index was weighted equally and averaged geometrically. As Chart 18 shows, the constant weight and variable weight series conform closely, facilitating selection of the constant weight series because of the simplicity of its design.

revolution distorted value calculations cast in current prices. It was felt that the upward bias in a metropolitan building series and inclusion of Long's high-amplitude and limited-coverage index offset the downward bias inherent in the per capita adjustment. Since the Riggleman index in the seventies did not cover Ohio cities, separate averaging of the Ohio urban index, with its five large urban counties, was deemed justifiable. The Ohio nonurban index was included to represent smaller urban patterns of movement. A test computation of another plausible pair—Riggleman and Ohio nonurban—displayed a parallel pattern. The broader based average was selected (for indexes, see Table 18 and Chart 16). For the decade of the sixties, the combination of Riggleman, Long, and Ohio urban and nonurban was used. Because of its reduced coverage of only six cities (four eastern seaboard, plus Milwaukee and Indianapolis) and its predominant reflection of eastern seaboard urban experience, the Riggleman index was weighted only once. While inclusion of two Ohio indexes may not be fully defensible, both reflect patterns of economic activity running through the whole central northwest territory. In the absence of better information, their inclusion seemed justifiable (see Table 19 and Chart 17).

TABLE 17

DECADE INDEXES OF RESIDENTIAL BUILDING FOR THE 1880's

(1880-89=100)

	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889
1. Ohio, statewide	54.2	107.0	106.7	114.3	102.4	88.2	82.4	114.5	114.4	115.9
2. Riggleman, per capita	62.3	76.7	90.9	98.9	93.3	104.4	115.1	118.4	109.4	130.6
3. Blank	50.8	57.7	60.5	83.8	100.6	113.8	130.1	144.3	118.4	140.1
4. Long, residential	40.7	57.8	64.2	79.2	89.9	113.5	128.5	137.0	130.6	158.5
5. Geometric average of lines 1 to 4	51.4	72.3	78.3	93.1	96.4	104.4	112.2	128.0	117.9	135.4

SOURCE, by line

1. Table 16.
2. Riggleman, *Building Cycles*, pp. 258-60.
3. Blank, *Volume of Residential Construction*, p. 42, Table 11.
4. Long, *Stabilizing Construction*, p. 228, App. B, sect. 3.

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TABLE 18

DECADE INDEXES OF RESIDENTIAL BUILDING FOR THE 1870's

	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879
1. Riggleman permits per capita, (1913 dollars)	138.9	147.9	115.3	111.8	95.6	96.4	79.9	73.9	64.8	75.5
2. Long, residential, number of permits (1870-79=100)	139.1	169.6	126.1	126.1	89.1	89.1	73.9	80.4	56.5	50.0
3. Ohio, number of urban residential (1870-79=100)	86.2	107.7	113.7	137.1	134.2	119.3	80.0	83.1	58.2	80.4
4. Ohio, number of nonurban residential (1870-79=100)	76.1	97.0	122.2	133.6	113.1	122.5	91.0	88.5	69.4	86.6
5. Geometric average, lines 1 to 4	111.9	131.1	118.4	123.6	104.3	103.9	80.8	79.8	62.6	72.4

SOURCE: Same as for Table 17.

TABLE 19

DECADE INDEXES OF RESIDENTIAL BUILDING FOR THE 1860's

	1860	1861	1862	1863	1884	1865	1866	1867	1868	1869
1. Riggleman, permits per capita (1913 dollars)	126.0	83.2	72.4	87.1	52.1	74.9	101.7	118.0	136.6	147.8
2. Long, residential, number of permits (1860-69=100)	85.7	62.9	91.4	88.6	45.7	62.9	88.6	125.7	160.0	188.6
3. Ohio, number of urban residential (1860-69=100)	71.9	53.6	50.4	54.2	62.9	109.2	154.5	154.4	163.3	125.6
4. Ohio, rest of state, number of residential (1860-69=100)	91.7	77.9	57.5	61.9	55.7	92.2	129.9	148.2	157.4	127.6
5. Geometric average lines 1 to 4	91.9	68.4	66.2	71.3	53.7	83.0	116.0	135.7	154.0	145.4

SOURCE: Same as for Table 17.

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CHART 15

Decade Indexes of Urban Residential Building for the 1880's

Index relatives (1880-89 = 100)
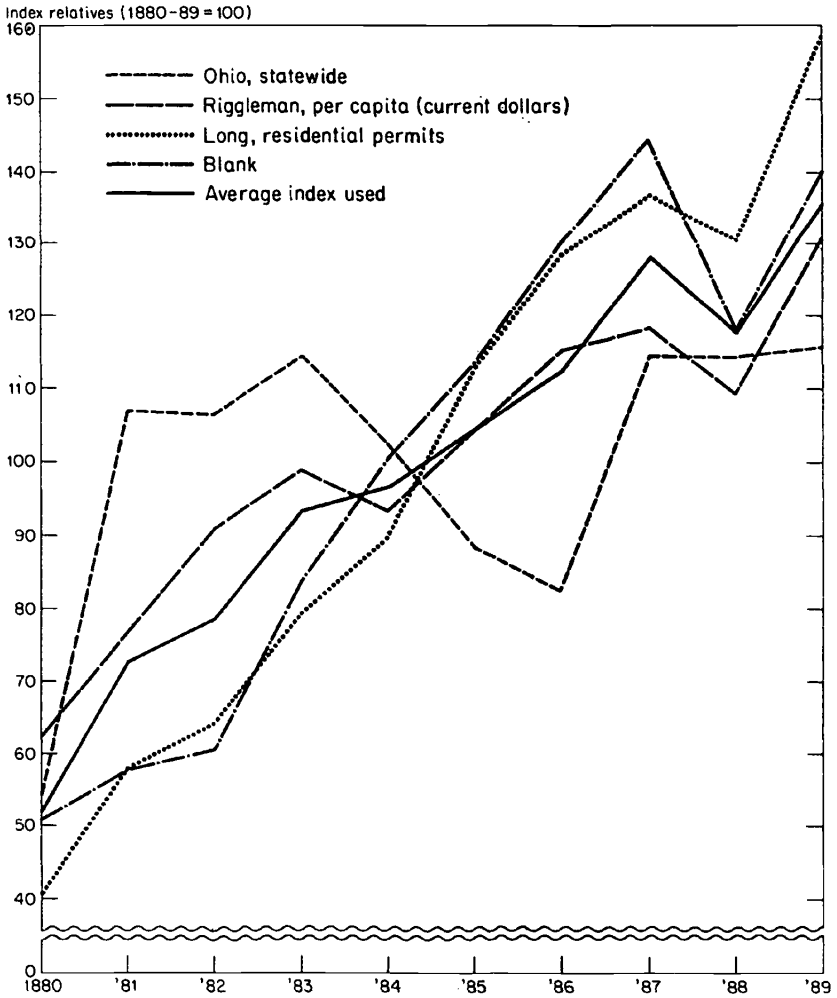
Source: Table 17.

CHART 16

Decade Indexes of Urban Residential Building for the 1870's

Index relatives (1870-79=100)

Legend:
- ————·········· Ohio residential, urban
- ———————— Ohio residential, nonurban
- ——— — ——— Riggleman
- ——·——·——· Average of Riggleman and Ohio, nonurban
- ·················· Long
- ——•——•—— Manhattan
- ——————— Average index used
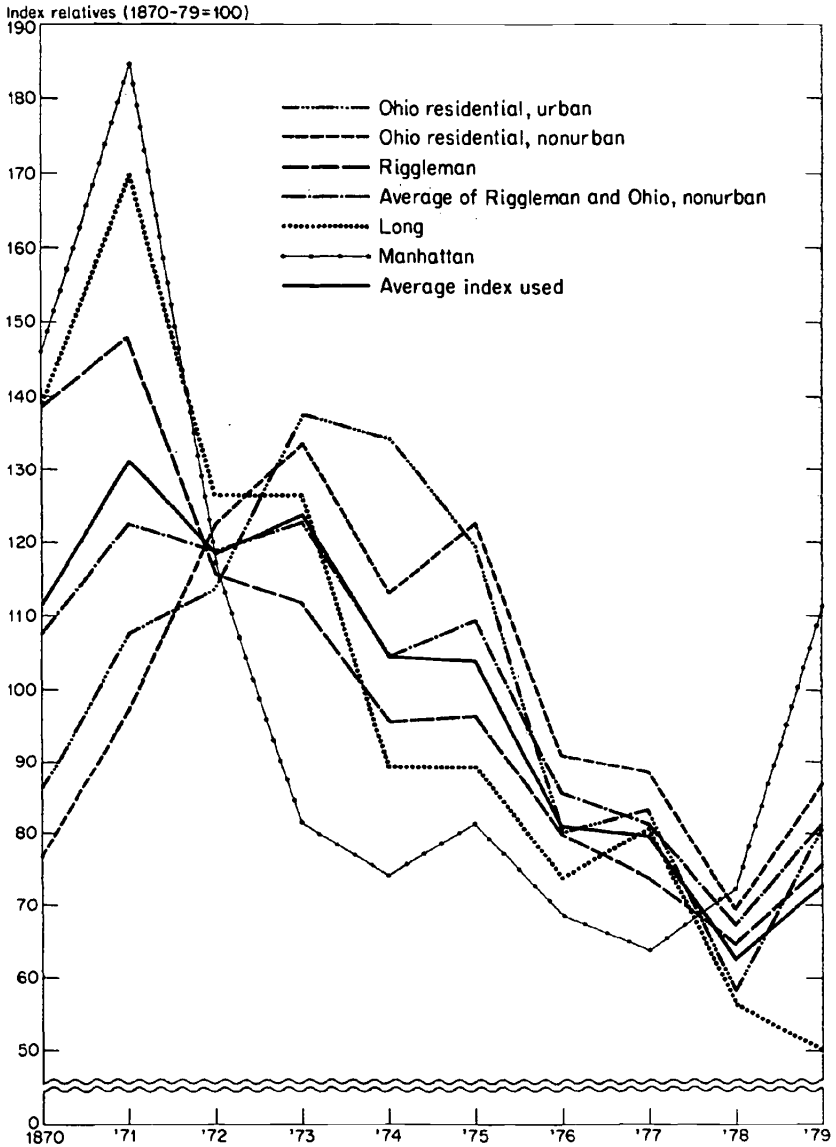
Source: Table 18 and NBER files.

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CHART 17

Decade Indexes of Urban Residential Building for the 1860's

Index relatives (1860 – 69 = 100)

Legend:
- —··—··— Ohio residential, urban
- ——————— Ohio residential, nonurban
- ——————— Riggleman
- —·—·—·— Chicago
- ················ Long
- ——————— Average index used

Y-axis values: 220, 200, 180, 160, 140, 120, 100, 80, 60, 40, 20, 0

X-axis values: '860, '61, '62, '63, '64, '65, '66, '67, '68, '69
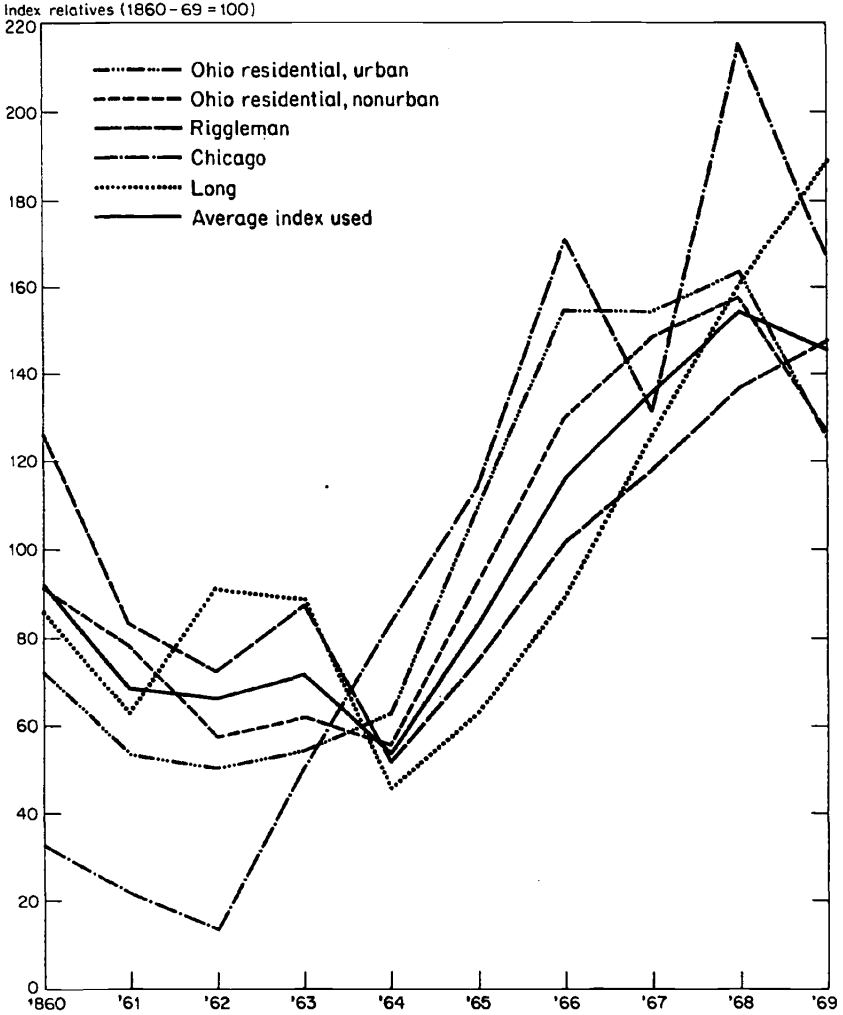
Source: Table 19 and NBER files.

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CHART 18

Estimated Annual Residential Production,
Constant and Shifting Weight Variants,
1860-89
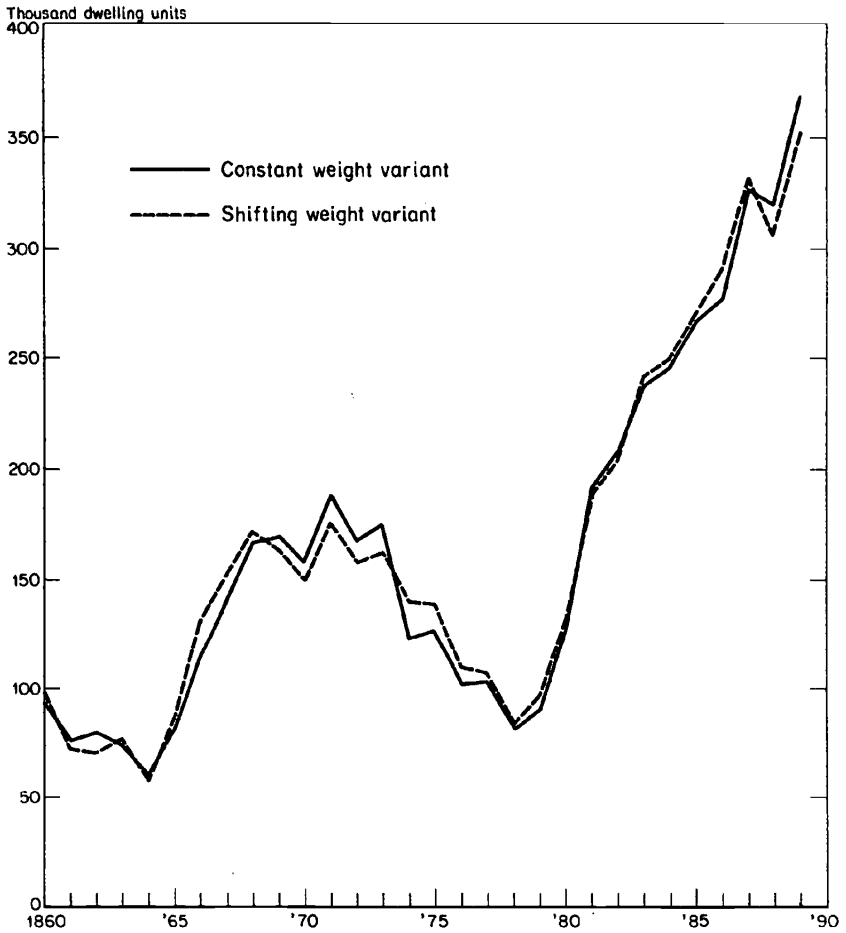
Source: Constant weight: Table 15, years 1860-1889. Shifting weight: Tables 17, 18 19, geometric average, multiplied against decade totals listed in notes to Table 15.

In applying annual indexes to the decade total for the 1860's allowance was made for replacement of Civil War losses in housing. Of the estimated 1860 stock of nonfarm dwellings, an estimated 22 per cent or 628,000 were in the South. Civil War damage was intense in certain areas: the upper valley of the Shenandoah; the country between Washington, D.C. and Richmond; cities such as Atlanta, Columbia, Nashville, Charleston; the belt of territory ravaged by Sherman's army; and other areas of concentrated fighting.[61] By a rough guess on the basis of estimation of the populations involved, housing production for 1866-69 was raised by 32,000 units (see Table 15 and notes).

We turn now to the estimation of the annual series for 1840-59. The only comprehensive annual indexes of building available are those derived from Ohio and the Riggleman study. The Riggleman index for those decades reflects building rates in the eastern seaboard urban communities of Manhattan, Boston, and Washington. (Three other cities were added to the index, but either late in the surveyed years or with little effect on the totals.) The Ohio index for the two decades was derived from the 1840-60 record of increments of real property assessments in Ohio municipalities converted into building value with the aid of regression analysis of total value of new building and annual increments of the assessed value of municipal (town, village, and city) real property between 1858 and 1889. The regression involved problems of two separate classes. There was, first, the need to adjust the correlated variables for comparability and, second, to design an adequate regression relationship which "fitted" the observed relationship.

The total value of building as initially reported in Ohio building statistics, including farm and nontaxable public building, was utilized as

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[61] Sherman's march through Georgia and the Carolinas allegedly was accompanied by much burning and destruction, "not a building [was left] on the railway from Macon to Savannah" (O. Eisenschiml and R. Newman, *The Civil War,* New York, Grosset & Dunlap, Vol. I, 1956, p. 658; E. M. Coulter, *The South During Reconstruction 1865-1877,* Baton Rouge, Louisiana State University Press, 1947, p. 1). The upper valley of the Shenandoah, according to J. B. McMasters, "was a scene of desolation. . . . Beyond Harrisonburg, toward Staunton, was the region laid waste by Sheridan, and there, within a circle five miles in diameter, scarcely a house, barn, mill or building of any sort was standing." The country between Richmond and Washington was "like a desert." Homes of Union volunteers in Tennessee and northern Georgia "had been ruined by rebel armies or guerillas." Charleston was allegedly a city of "ruins" (*A History of the People of the United States During Lincoln's Administration,* New York, D. Appleton, 1927, pp. 637-640). Columbia, S. C., was burned under official orders. A tentative number of 32,000 dwelling units was allowed for war loss. According to general historical accounts rebuilding was speedy (see Coulter, *op. cit.,* p. 255 ff.). Hence the war replacement was spread over 1866-69 and moderately peaked in 1866.
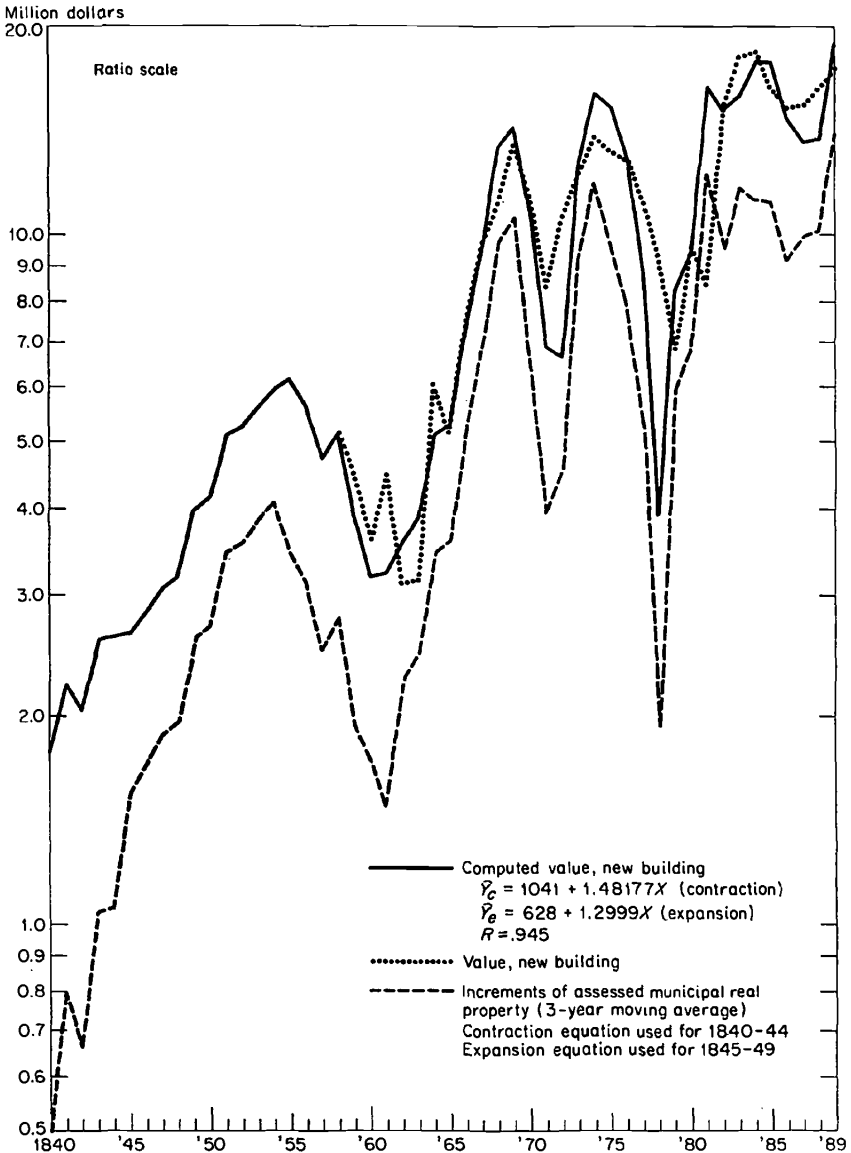
one of the correlated variables. Property-tax assessment reports refer to nonfarm real property, excluding public or quasi-public property. Despite these elements of noncomparability, the levels of building and tax-assessment increments, as shown in Chart 19, were closely aligned throughout the entire period. The nonfarm taxable building predominated in total building values, even in the early period of the comparison; and possibly the relative movement of farm and public building was mutually offsetting. At a later stage of the research, another regression was prepared between assessment increments and building values, fully adjusted for comparability. The assessment increments were for all real property (farm and nonfarm) and the taxable building excluded all public and quasi-public building (which would not be represented in the assessments). The fit during the "regression" period is somewhat closer in the second case.[62] These more closely matched variables apply to all building and property increments and, in the early years 1837-55, the changes in farm real estate assessment dominate the assessment totals. The relative share of nonfarm assessments was rising rapidly during those years. Since the present quest is for a nonfarm building index, it seemed desirable to utilize the regression which applied only to assessment increments in municipal property.

The assessment increments measure the net resultant of the assessed value of (1) old buildings dropped from the tax rolls because of demolition or destruction, (2) assessed values of newly erected structures or improvements added to the tax rolls, and (3) revaluations of properties already on the rolls. Revaluations disturb the relationship between net new building and net change in assessments. Before 1846, the disturbances were marked owing to laxity in assessment and weak central supervision. After 1846, disturbances due to revaluations were scaled down, since revaluations were concentrated in scheduled reappraisal years set at first for 1853 and 1859, thereafter, decennially. The upward shift of values resulting from revaluations was sizable in 1853 and in 1870. Assessed values for identical or nearly identical properties were raised 61 per cent and 60.9 per cent, respectively, reflecting the inflations of 1846-53 and 1861-66. The revaluation of 1859 showed a 5.5 per cent fall in the level of real estate values fixed in 1853. After 1870, the standard of assessment seemed fixed and resulted in a widening gap between assessed and market values. Outside the reappraisal years, revaluations were permitted only

[62] See charts of these matched variables and description of regression in my paper, "Value of Nonfarm Building, Residential and Nonresidential, U.S.A., Annually, 1850-1939," submitted to the Conference on Research in Income and Wealth, Chapel Hill, North Carolina, September 4-5, 1963.

CHART 19
Ohio Building, 1840-89

Million dollars

Computed value, new building
$\hat{Y}_c = 1041 + 1.48177X$ (contraction)
$\hat{Y}_e = 628 + 1.2999X$ (expansion)
$R = .945$

•••••••••••••• Value, new building

– – – – – – Increments of assessed municipal real
property (3-year moving average)
Contraction equation used for 1840-44
Expansion equation used for 1845-49

Source: Assessments from state auditor's annual reports, as reported by letter from auditors' offices, and as compiled for this study by the Secretary of the State of Ohio. Value of new building was extracted from annual reports of the Secretary of State. These data are unadjusted for assessment undervaluation.

in exceptional circumstances and appear to have affected only small fractions of assessed property on the rolls.[63] Disturbances thus introduced into the relationship between building and assessment increments could be offset or neutralized by smoothing with a 3-year moving average.

The level of assessment or relationship of assessment values to market values was, for years after 1846, accepted as originally prepared for tax use. The first three major reappraisals—1846, 1853, and 1859—resulted in a level of assessments which closely approximated market value.[64]

The level of assessment gradually receded after the Civil War and by 1890 hardly covered more than two-thirds of the value of the property.[65] Since, however, recorded values for new building reflected values established for tax assessment, correction of both tax-assessment and building value statistics was not required. On the contrary, for the few years before 1846, when properties were evaluated for tax purposes at one-fourth to one-third of market value,[66] use of those values as a base for regression projection would have understated building in the early forties. Hence, for years before 1846, assessment values were doubled.[67]

[63] Revaluations were carried out periodically at intervals of 6 to 10 years. Pending reappraisal, old properties were assessed at fixed values. Hence, increments in assessed value, as noted in an official report, were "principally occasioned by new structures" (*Annual Report,* State Auditor, Ohio, 1865, p. 22). In the 1866 report it was noted that "real estate stands taxed on the official value fixed upon it in 1859" (*ibid.,* 1866, p. 20).

[64] The census estimates of true value of all taxable property (real and personal) for 1850 and 1860 were understated by 19.6 and 14.0 per cent, respectively. In the contemporary view of the Ohio statistics commissioner, understatement was concentrated in personal property (see Ohio Statistics Commissioner, *Sixth Annual Report,* 1862, p. 24). His finding was confirmed by deed surveys for the periods Apr.–Oct. 1853 and the year ending 1859, showing that assessment of sold properties ran to 87.4 and 101.0 per cent of market value (*Proceedings 1853,* Board of Equalization, Columbus, Ohio, 1854; *Ohio Executive Documents,* 1859, part I, pp. 857-860).

[65] See data and reports collected in my paper, "Value of Nonfarm Building."

[66] One responsible judgment was that, before 1846, assessed values ran to a quarter of market values (E. L. Bogart, *Financial History of Ohio,* University of Illinois Studies, 1912, p. 210). The 1846 reassessment boosted the values of assessed urban property by 256 per cent. The Ohio statistics commissioner noted that "prior to 1846 the assessments fall so much below the real values that they afforded but little criterion of the actual wealth" (*loc. cit.*). On the 1846 revamping, see the history and appraisal in Bogart, *Financial History of Ohio;* and *The Passing of the Frontier, 1825-1850,* C. Wittke, ed., Columbus, Ohio State Archeological and Historical Society, 1941, pp. 425-430.

[67] Actual annual assessment increments for real property located within municipal corporations, the increments adjusted for undervaluation before 1846,

The form of the regression presented difficulties. A trial estimation was made by fitting a linear regression line between new-building and tax-assessment increments. The results showed a systematic bias in the estimated value; on the expansion phase, there was a tendency toward overestimation and, on the contraction phase, underestimation reflecting a tendency for assessment revaluation of old properties to exaggerate swings. An attempt to allow for this behavior by using a multiple-linear regression function, including annual percentage change as a variable, did not produce workable results. The coefficient of correlation was .69. After tests of several other multiple-regression linear functions, also with unsatisfactory results, the correlation formula finally employed was an average of two simple linear functions, with and without constant terms, fitted separately to expansion and contraction phases. The coefficient of correlation of the resultant composite function is .94. The estimated value for new building from 1840 to 1857, along with actual values from 1858 on and smoothed assessment increments from 1840 on, are presented in Chart 19. Since the bases for regression are assessment increments in municipal real property, our projected values for new building reflect primarily nonfarm activity. The previously mentioned regression, based on increments of all real property including farms, involves a later trough for nonfarm activity in 1844 as against 1840, and a much dampened rise during the forties.

As indicated, neither the Riggleman nor the Ohio indexes are on as strong a footing for the decades before 1860 as for the decades following. In addition, they pertain to the total value of metropolitan and urban
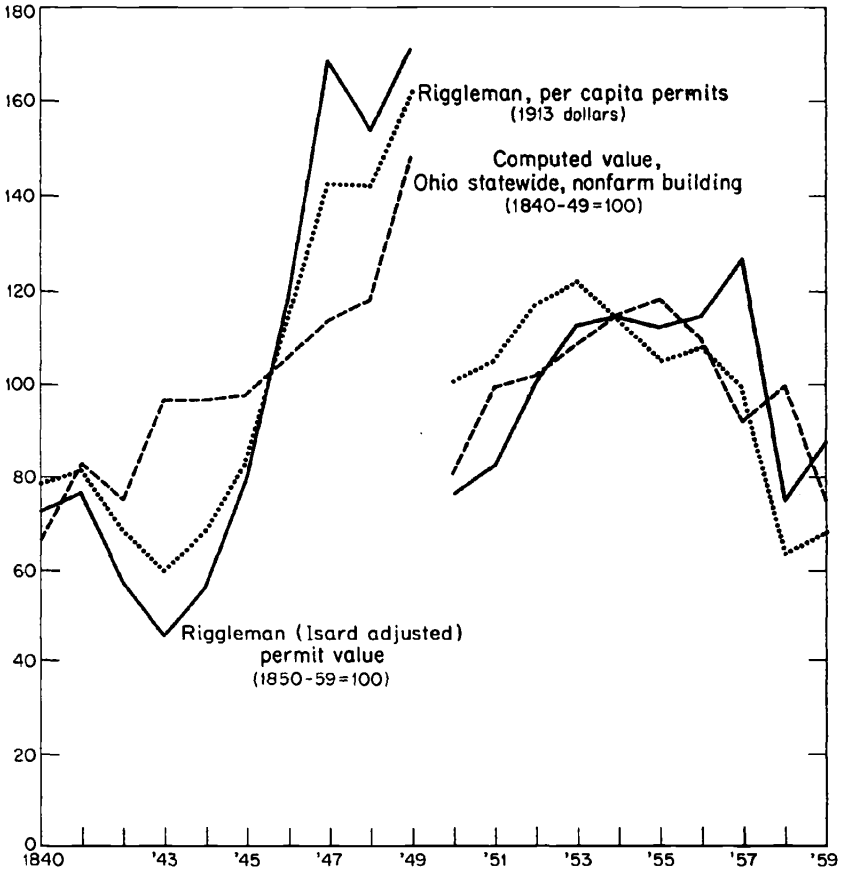
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and our three-year moving averages appear below. Since 1841 was a reappraisal year, the high negative value recorded for that year and the sizable gain for the subsequent year reflect the vagaries of shifting appraisal policy. For the calculations, the year 1841 was treated as zero.

	Actual Annual	*Adjusted Annual*	*3-Year Moving Average*
		(*dollars in thousands*)	
1839	441.3	882.6	—
1840	308.0	616.0	499
1841	−510.3	0	791
1842	878.3	1,756.6	667
1843	122.4	244.8	1,041
1844	561.5	1,123.0	1,051
1845	1,788.2	1,788.2	1,537
1846	n.a.	1,700.0	1,703
1847	1,620.1	1,620.1	1,873
1848	2,298.3	2,298.3	1,958

CHART 20

Decade Indexes for 1840-59

Riggleman, per capita permits
(1913 dollars)

Computed value,
Ohio statewide, nonfarm building
(1840-49=100)

Riggleman (Isard adjusted)
permit value
(1850-59=100)

Source: Riggleman, *Variations in Building Activity,* pp. 287-288; Colean and Newcomb,
Stabilizing Construction, p. 226, App. N, Table 2; estimates graphed in Chart 19.

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building, which shares the swings of residential building, but often with variations in timing and amplitude. The amplitude and upward drift of the Riggleman index, as adjusted by Isard and used here, fit more closely to our accepted decade estimates of nonfarm residential building. Neither the Ohio nor the Riggleman series is deflated, partly because value shiftings in the period were difficult to measure accurately and partly because of doubt that Ohio assessments were adjusted to shifts in current costs. The resulting average of the two sets of decade indexes— Ohio nonfarm and Riggleman (Isard adjusted)—can lay out only the general course of residential building within those decades.

The two sets of decade indexes, along with Riggleman per capita permits in 1913 dollars, are shown in Chart 20. Since the movement is a common one, a geometric average (detailed in Table 15) of the two selected indexes was computed for use in projecting nationwide nonfarm residential building. An interesting check on the order of magnitude of our estimates for 1840-60 is afforded by the ratio of the 1857-59 recorded Ohio count of dwelling production to estimated nationwide dwellings. The Ohio share for 1857-59 is 6.3 per cent compared with 8.0 per cent for the decade of the sixties. The acceleration in Ohio building relative to nationwide levels was also found to characterize urban growth rates in Ohio and the nation (Chart 8). Another test for order of magnitude shows that residential building in 1844 in four large cities, accounting for 16.8 per cent of total estimated 1840 nonfarm population, amounted to 18.3 per cent of our nationwide nonfarm estimate for that year.[68] Our order of magnitude holds at least for this segment of the period.

[68] The editor of the *Cincinnati Miscellany* (Vol. II, 1864, p. 58) compiled the number of houses built in 1844 in Philadelphia, Boston, New York City, and Cincinnati (6,422). This is 18.3 per cent of our nationwide estimate for that year. The four cities had a census population in 1840 of 939,597. We estimate nonfarm population by scaling down our 1860 estimate (see footnote 39) in the ratio of the movement of nonagricultural labor force between 1840-60. Thus derived, the estimated nonfarm population in 1840 was 5.61 million of which our four-city share was 16.75 per cent.