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Building in Ohio Between 1837 and 1914

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In a preceding work an effort was made to develop a new nationwide series of the number of dwelling units erected annually in the United States since 1840.[1] This series was made possible only by utilization of the newly discovered statistical record of residential building in the state of Ohio during the second half of the nineteenth century. Of that record only the data on the number of dwelling units erected were used in the earlier study. This study is a preliminary report on the value of building by class of structure derived from the Ohio building statistics and on the adjustments required to make raw data usable for analytic purposes.

The original agencies that collected building statistics in Ohio were local personal property tax assessors who were following a program of statistical reporting inaugurated by state law in 1857 and maintained through 1915. The local assessors were required as a matter of official duty to make an annual return for personal property and for alterations in the roster of real property caused by demolitions, destruction, or improvements. Local assessor reports for towns or townships were submitted to county auditors who consolidated them and forwarded them

NOTE: The present paper grows out of intensive research during the past four years into all phases of urban building carried on with the aid of the National Bureau (see progress reports in the Annual Reports of the National Bureau for 1962, pp. 48–51, and 1963, pp. 46–47) and particularly with the aid of Moses Abramovitz. In its technical form, the study owes much to my research helpers, first of all to Mary D'Amico of the University of Wisconsin-Milwaukee. Paul Sampson, formerly of the Numerical Analysis Laboratory of the University of Wisconsin, and Asa Maeshiro were responsible for carrying through many of the regression calculations. The processing and tabulation of Ohio data were made possible by a special grant in 1961 from the Rockefeller Foundation. A grant from the Wisconsin Urban Program (Ford Foundation) provided timely help in the summer of 1961. The graduate school of the University of Wisconsin provided the research assistance which made possible the regression tabulations and analysis.

[1] Manuel Gottlieb, *Estimates of Residential Building, United States, 1840–1939*, NBER Technical Paper 17, New York, 1964 (hereinafter referred to as Gottlieb, *Estimates*).

to the Commissioner of Statistics. After 1868 this office was filled *ex officio* by the Secretary of State. Between 1858 and 1868, the county returns were published with statewide totals and extended commentaries in the report of the Statistics Commissioner. After 1868, building returns were published in the statistical supplement to the annual report of the Secretary of State along with vital, election, production, court, and other statistics. For most of these years, the statistical reports and schedules were included in the annual compilation *Ohio Executive Documents.*

The reports on new building were presented with shifting detail and coverage. From the first report in 1858 until 1915, the number and value by counties of newly erected taxable structures were published annually (except for the omission of value figures in 1866). Detail on type of building was first attempted in 1862 for industrial buildings ("mills, factories, machine shops, foundries, furnaces"). In 1865 the number of "dwellings" and "barns and stables" was enumerated, and commercial-type buildings ("stores, warehouses, shops, and other places of business") were added in 1867. Although these categories were given in finer detail for some later years, by 1887 reporting under these categories had been stabilized. For 1873–79 returns for barns and stables and for 1887–90 returns for industrial buildings were included under a residual miscellaneous category.

No exact definitions of the building categories were ever spelled out in the published reports, nor were any archives or records for the statistical department ever located. Since the reported headings varied (e.g., industrial building finally turned into "manufacturing establishments" while commercial establishments became "stores and warehouses"), there is no certainty that classification of types of building was consistent from year to year or that there were not gradual drifts in reporting the aggregates or the types of building. In a few cases, misclassification of building was discovered chiefly by reference to inverse variation for a particular type of building and for the "miscellaneous" residual.

Reporting of tax-exempt construction was less comprehensive and was slower to get started. Enumeration of the number of newly erected churches and schools was attempted in 1859 and in 1860, but returns were manifestly incomplete. Only in the 1869 report were returns presented by counties for construction of schools and churches by number and value. In 1873 construction of "public halls" and "county building" was added. Returns for public halls were soon included in the miscellaneous heading and county building was unreported as a separate category for seven years between 1887 and 1894.

The data on residential building by number of "dwellings" were found

internally consistent for degree of urbanization, real estate activity, and other variables.[2] Comparison of building permit data available for four central cities for 1900–12 and for one central city back to 1888 with corresponding assessor data for the counties involved showed the expected order of magnitude and parallel patterns. All comparisons showed divergences due partly to variations in coverage and definition. But these divergences did not impair broad comparability of level and pattern, even on the county level, and were reduced to minor proportions for county returns consolidated into group or statewide totals. A detailed presentation of this evidence is reserved for later treatment.[3] Confidence in the validity of the Ohio statistics was further buttressed by the professional skill and judgment indicated by the founder and designer of the Ohio statistical system and by the continued willingness of the state legislature to sponsor collections of data and to impose statistical reporting obligations on local government officers.

Adjustments in the building reports filed by these officers, as originally reported in our source documents, are made under five headings: (1) for clearly deficient returns or for occasional printing errors whereby digits were dropped or added; (2) for inadequate reporting of tax-exempt building; (3) for extrapolation to 1837; (4) to allow for alterations in standards of appraisal or for changing purchasing power; and (5) to convert a record of "completions" to a record of building activity. A positive program of data evaluation and analysis is then presented in the last three sections: (6) farm unit residential values, 1850–1912; (7) nonfarm unit residential values; and (8) adjusted time series of building in Ohio.

1. Deficient Returns

Deficient returns for the three categories of building—total, residential, and barns and stables—are summarized in Table 1. Coverage in the reporting system was best maintained between 1866 and 1905. There were many omissions in the reports before the Civil War and omissions rose ominously after 1910. In 1914 less than half the counties reported, a still smaller number in 1915, and thereafter reports ceased. Deficiencies for a particular year in either value or number were generally corrected by adjustment with the average per unit value of adjoining years. Where number and values were both lacking, we resorted to linear interpolation.

[2] See Gottlieb, *Estimates*, pp. 18–35.

[3] It is hoped that the complete results of the investigation into Ohio building, marriage, and conveyance statistics will be set forth in a special monograph, with appropriate detail including, of course, evidence related to evaluation.

Deficiencies for several consecutive years were generally corrected by reference to the index behavior of comparable counties. Our estimates for the last two reporting years were derived from the percentage change for the thirty-nine and thirty-three identical counties reporting both for 1913/14 and for 1914/15 and accounting for over half of all building. Somewhat more care was exercised in adjustment for deficiencies of the sample groups compared to the state aggregate. Generally, the missing counties accounted for a small fraction of statewide building so that crudities of adjustment could hardly exert an appreciable influence on the levels of the returns.

TABLE 1

COUNTIES NOT REPORTING IN ORIGINAL OHIO BUILDING SCHEDULES, 1858-1915

	1858-70		1871-1909		1910-14	
	Number	Dollars	Number	Dollars	Number	Dollars
Total building	31	38	70	19	112	98
Residential building			58	11	122	99
Barns and stables[a]	15	3	103	69	163	133

[a]Between 1873 and 1879, detail on barns and stables was grouped in with "miscellaneous" building.

On our statewide listings, it was more difficult to allow for deficiencies in the categories of building where construction was intermittent and ran a wider range of year-to-year change. Hence our statewide totals for industrial and commercial building were adjusted by different standards depending upon whether the deficient counties were highly urbanized or not. Between 1867 and 1910 the thirty-eight deficient industrial returns for the ten counties making up the first three sample groups were adjusted by the most appropriate method, the details of which must be left to the future monograph. Other deficiencies were only caught for counties that were deficient on total production. In these cases, the deficient counties were credited with their prorated share for the seventy-three nonurban counties and the totals were adjusted accordingly. The same method in principle was used to adjust commercial building for deficient returns. Our statewide totals for industrial and commercial building probably tend to understatement because of inadequate allowance for deficiencies. The behavior of the sample groups of counties under the indicated headings was subject to little or no bias on that account since adjustments for

deficiencies were consistently made for all members of sample groups. Indeed, the rationale for utilizing sample groups partly grew out of the need to concentrate adjustments for deficiencies (and other errors in reporting) in a smaller group of returns.

2. *Tax-Exempt Building*

The inadequacies in reporting tax-exempt building were made apparent by the independent reports of school statistics collected by county auditors and later by county school superintendents; these statistics were obtained from local school boards and screened and republished with statewide totals by the state superintendent of schools. From 1837 to 1852, these reports were published in *Ohio Legislative Documents* with commentary and analysis. Between 1853 and 1902, school reports were included in the *Ohio Executive Documents*. After 1903, school data were published as Annual Reports of the Superintendent of Public Instruction. State superintendents frequently lamented inadequate and irregular reporting, particularly in the early years by local school officials. After eight years of annual reporting, the Secretary of State avowed "it is impossible even to conjecture what is the number or condition of the school houses in Ohio."[4]

In 1854 the reporting system was revamped, coverage was extended, and the school statistics for most items became reliable. After 1856 only one or two counties failed to report and coverage within reporting counties was more complete.[5] Blank register forms were prepared and furnished local school officials and statewide efforts were made to instruct local officials in how to keep records and make out reports.[6] Even under the new regime, items on average pupil enrollment or attendance were reported year after year with a floating margin of error.[7] Both internal and external checks indicate that items of school statistics with which we are concerned —number and cost of new school buildings erected—were reliably and consistently reported.[8]

For the aggregate period 1870–1910, school reports showed a building

[4] *Ohio Legislative Documents*, no. 33, 1845, p. 502.

[5] The number of deficient counties included in statewide school statistics are as follows: 1837, 13; 1845, 29; 1850, 8; 1853, 18; 1858, 7; 1856, 3; 1857, 1; 1858, 0; 1863–67, 0 (*Ohio Statistics*, 1880, p. 303).

[6] *Ohio Executive Documents*, 1868, Pt. I, p. 625.

[7] *Ibid.*, pp. 623 ff. Enumeration of "school houses" was made difficult by the diverse practices of school clerks in reporting school rooms or school structures (*ibid.*, 1865, p. 354).

[8] Report on these checks must be deferred to the monograph noted earlier. It is noteworthy that the time series of the cost of school building moved in close and plausible correspondence with an item drawn from local government budgets, namely, "total expenditures on sites and building."

value 2.6 times higher than assessor reports.[9] The school reports were believed to be more reliable since they were collected together with a broad variety of other school data, since the reported cost of school construction tallied well with school budgeted capital expenditures, and since both reporting and state compiling officers were professionals. A commentary found in an early assessor report indicated the grounds for incomplete assessor coverage. "School houses and churches not being taxable," it was noted, "are not often returned." This note was appended to the 1860 report at which time classification of new construction by type was not attempted.[10] The original reports on new building were collected by township or municipal assessors whose primary responsibility was to collect assessments on taxable personal property and to make an assessment allowance for the destruction of old taxable buildings and for the erection of new taxable buildings. Assessors could easily submit a statistical report on new building that would or could tally exactly with positive adjustments for realty assessment. Separate inquiry would need to be made for a report of tax-exempt building. It was hoped that, when separate breakdowns of exempt construction were added to assessor reports at various times between 1869 and 1872, the returns had become reasonably complete. But the school statistics demonstrated the reverse.

It was easy, of course, to substitute values for school building, as reported in school statistics, for assessor reports both before and after 1872. These values were deflated with a Riggleman index to adjust for changes in cost of building. The results are shown in column 1 of Table 2 from 1860 on.

Besides school and assessor-derived reports of building, there was available from 1856 on a well-audited series extracted from the annual financial reports of the state auditor on the property taxes raised by county governments for "building purposes." This was one of the breakdowns of property taxes classified by purpose or broad expenditure use. The deflated decade totals are shown in column 2 of Table 2. Unfortunately building expenditures could also be financed by borrowing; and taxes could be levied to accumulate in a building "fund." Thus neither the year-to-year movements nor trend of the series accurately represents local government building. The series does, however, accurately measure the willingness of public officials in Ohio to impose a levy on property owners to raise funds for building purposes.

[9] Our deflated (in 1913 dollars) aggregate of the cost of school building was $67.28 million against $26.06 million for assessor reports of school building for the 1870–1910 period. Even undeflated school building costs were approximately double the assessor reports ($53.6 million).

[10] *Annual Report*, Ohio Statistics Commissioner, 1860, p. 80.

TABLE 2

DECADE AGGREGATES OF TAX-EXEMPT OHIO BUILDING, 1850–1910
(THOUSAND 1913 DOLLARS)

Decade	School Building (1)	County Building Tax (2)	Estimated Total Exempt Building (3)
1860's	6,975	3,733	23,000
1870's	11,233	7,719	47,000
1880's	12,708	7,822	35,000
1890's	18,158	6,834	61,000
1900's	25,181	5,359	65,000
1870–1910	67,280	27,734	208,000

Source: NBER files, series nos. 0257,0263

With the aid of the school and county building data and periodic measures of the net change in stocks of exempt building, a set of decade estimates (listed in column 3 of Table 2) was prepared from the 1860's on of total estimated exempt construction. These estimates, when expressed as a percentage of total decade building, follow the counter-cyclical pattern shown by the increments to standing stock.[11]

3. *Extrapolation to 1837*

The collection of formal statistics on new building began in 1857. As noted in a previous publication, a close correspondence was found, as might be expected, between annual increments to total real estate assessments and new taxable building.[12] This correspondence derived from the state policy of freezing realty assessments between formal reappraisals except for property destruction or new building.[13] Any interim assessment

[11] Thus the ratio of exempt to taxable building as shown by growth increments of standing stock is as follows (in per cent):

1853–59	41.2
1859–70	16.9
1870–80	42.9
1880–90	9.7
1890–1900	27.3
1904–12	6.1

For 1890–1900 and 1904–12, on all real property including land values. The sources for these figures are *Wealth, Debt and Taxation*, Bureau of Census, 1907 and 1915; reports of Ohio State Board of Equalization for 1853, 1859, 1870, 1880, 1890, 1900.

[12] See Gottlieb, *Estimates*, pp. 76–79.

[13] I.e., for destruction or building exceeding $100 in value.

reductions for particular old properties were to be offset by assessment increases in other old properties. This policy was substantially, if not exactly, carried out. To allow for these irregularities, assessment increments were smoothed by computation from overlapping pairs of years. Chart 1 indicates that the correlation between new building and assessment increments was close for the period 1857–99. The coefficient of correlation was .938, using a set of linear estimation equations fitted separately to long expansion and contraction phases. These estimating equations were then applied to the smoothed assessment increments for 1837–56. These increments were doubled from 1837 to 1845 because of the low ratios of tax appraisals to market values prevailing at that time.[14] Unlike the tax assessment regression made to project nonfarm construction, this estimation had a more refined base and involved a projection of total building including farm building.[15]

Since exempt property was virtually not reported before the July 1869 report, it was necessary for our total building series, which by extrapolation with realty assessment increments is carried back to 1837, to be increased by an allowance for exempt construction. This allowance was devised by comparing movements of exempt and taxable building as disclosed in the periodic realty appraisals carried out in 1853, 1859, and thereafter decennially.[16] For this purpose, exempt building was represented

[14] Perhaps the tax increments before 1846 should have been raised two and a half times to put them on a level with post-1846 assessments, but, as in our earlier study, doubling seemed advisable in view of early assessment irregularities.

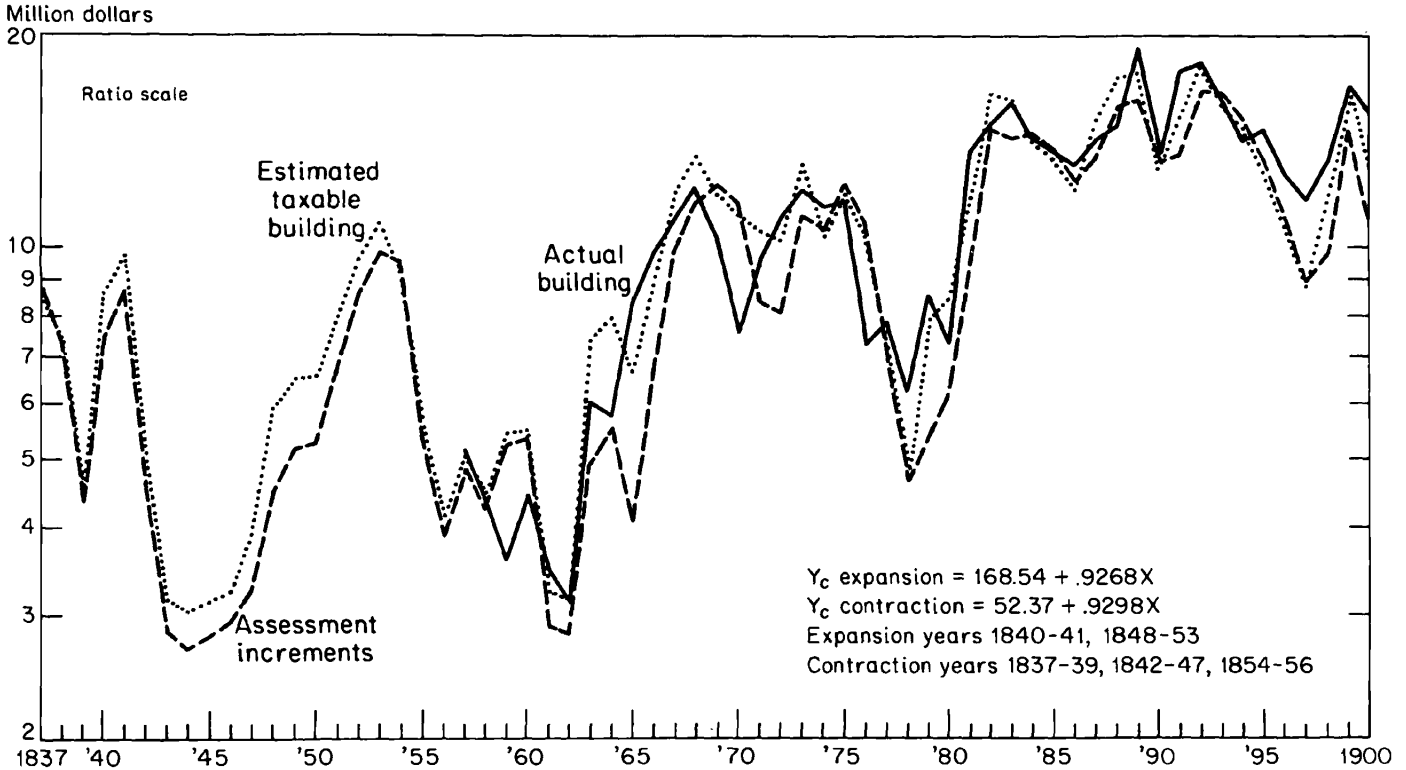
[15] Differences between the two regressions are summarily listed here (for earlier projections, see Gottlieb, *Estimates* pp. 75–80):

Area of Difference	*Value Projection*	*Earlier Projection*
1. Scope of building variable	Taxable building	All building incl.
2. Tax increment	All assessed realty	Assessed realty of towns and cities
3. Method of averaging tax increment	Average of overlapping pairs of years	Three-year moving average
4. Number of regressed observations	1857–1900	1857–1889

[16] School reports indicate that exempt property was appraised with the same standards as taxable property. Reported total value of school property shows the same degree in slippage from market value characteristic of appraisals of taxable property. The ratio of assessed to school statistics book values were 99.5, 74.7, 66.0, and 56.9 per cent for 1859, 1870, 1880, and 1890 respectively. See footnotes 19 and 20 for similar ratios for taxable property. On the other hand, the total value of church property as reported in the U.S. Census was 177, 141, and 179 per cent of the appraised total for 1860, 1870, and 1890. Since appraised values were taken for tax purposes and were screened where possible against sale values, I am inclined to accept their findings for present purposes.

Chart 1

Taxable New Building, Actual and Estimated, and Realty Assessment Increments, Ohio, 1837–1900



Source: Annual reports of the Auditor and Secretary of State of Ohio for 1835–1900.

at 10 per cent of taxable building between 1837 and 1853, at 41 per cent during 1853–59, and at three times reported school construction (deflated) from 1860 to 1870.[17]

4. *Standard of Purchasing Power*

It was found necessary to correct the reported values for shifts in the level of assessor valuation and to approximate in the best manner possible a set of values of constant or at least consistent purchasing power.

The problems involved in the establishment of a workable approximation to a deflated building value series from 1857 to 1914 were many and complicated. An important phase of the problem was the variant drift in the ratio of appraised to market values for old properties, the corresponding or divergent appraisal standards for new properties. The raw materials for the analysis were comprised of originally reported values per unit of building of different types for twenty counties studied in small homogeneous sample groups, for the sixty-eight nonsampled counties, and for all counties consolidated on a statewide basis.

We were fortunate in being able to establish that, at the starting position of our value series (1857–60), appraisal values for old properties as recorded in realty tax assessments and by inference for newly built properties were at least 90 per cent of prevailing market values. In the take-off period, the Ohio system of property assessment was still under the influence of the revolutionary tax legislation of 1846, which both broadened the scope of the property tax base and provided an effective means of achieving levels of assessment which closely followed market values.[18] This finding was supported by documented analysis of the sales-assessment ratio for a broad stratum of sold properties in both 1854 and 1859. It was reaffirmed by the independent Census of wealth canvass in 1850 and 1860 and by informed current opinion, including

[17] In 1853 real property in all buildings (taxable and exempt) was appraised at 110.6 per cent of taxable building alone. Accordingly, taxable building for 1837–56 as determined by regression analysis was increased by 1.1 to allow for exempt construction. For 1853–59 this allowance was raised to 1.41 since increments in the value of exempt building, disclosed by the 1859 statewide appraisal, were $6.8 compared with $16.5 million for taxable building. Apparently public building was shifted or adapted to a countercyclical basis. In the decade of the 1860's the ratio shifted to 1.169. Consistently higher for the 1860's was a set of estimates for exempt building determined as a multiple of school building. The ratio of school to total exempt building showed little variation from 4.85 in 1859 to 4.47 in 1870 and 4.68 in 1890. We scaled down the multiple to three times, since at this rate we obtained a consistent series of estimates for the 1860's midway between the two variants.

[18] Gottlieb, *Estimates*, pp. 76 ff.

that of the State Auditor, the independent Commissioner of Statistics, and a competent contemporary observer, Ezra Seaman.[19]

After the Civil War another consensus of evidence indicated that appraisal levels of valuation receded with reference to market values. Assessors regarded early post-Civil War market values as speculative and hence in the basic 1870 appraisals aimed at a level about 65 per cent of prevailing market values. At the succeeding decennial appraisals, conducted concurrently but independently by the agents of the Census Bureau and local and state appraisers, the evidence indicates a sliding tendency in the assessment-to-market ratio, which by 1900 was around 47 per cent.[20] The sustained price lift and boom in real estate values that marked the early 1900's lowered assessment-to-market ratios still farther.[21]

[19] The statistical surveys of bona fide deeds disclosed the following relationships between the aggregate of sale value and assessed value:

Time	*Sales Proceeds (dollars)*	*Appraised and Equalized Value as Percentage of Sales Proceeds*
April–October 1853	8,309,421	87.4
Year ending July 1, 1859	12,109,306	101.0
1869, agricultural	33,666,285	60.8
1870, agricultural	24,920,440	60.2
1869, urban	22,471,254	68.9
1870, urban	16,932,600	66.3
Jan. 1, 1879-Oct. 1, 1880, city and town transfers only	12,131,806	58.9

Statistical Report Secretary of State, Ohio, 1881, pp. 643–644; *Ohio Executive Documents*, 1859, Pt. I, pp. 857–60; *Abstract of Transfers on Sales of Lands and Lots 1869-70*, Auditor, State of Ohio, 1871; Board of Equalization *Proceedings 1853*, 1854. The ratios of total taxable (including personal) to true value was estimated by the assistant marshalls who took the Censuses of 1850 and 1860 at 85.96 and 80.39 per cent, respectively. The Ohio Statistics Commissioner concluded after a detailed review of the evidence that the 1859 appraisements "come very near the commercial value" (*Ohio Executive Documents*, 1859, Pt. I, p. 798).

[20] The U.S. Bureau of Census estimated that assessed values of taxable real estate were 64.03 per cent (1890), 47.6 per cent (1900), and 46.4 per cent (1904) of true value. The auditor's records for September 1892 indicated use by a local assessment officer of a 65 per cent ratio to get a "tax valuation" (Sept. 1892, letter books, p. 620, State Archive Building, Columbus, Ohio). Recognition was frequently expressed by tax officials of the practice of appraising real estate between 40 and 66 per cent of its true value. (*Proceedings of the First Annual Conference*, Tax Commission of Ohio, 1912, pp. 14, 23, 63.) Erosion of appraisals is clearly registered in farm lands assessed and equalized in 1870 and 1880 at $27.00 and at $24.06 per acre in 1900. The recorded sale of farm lands in bona fide deeds involved a mean acre price of $34.11 in 1880, $38.44 in 1890, and $34.18 in 1900 (Annual Report, Secretary of State, for conveyance statistics).

[21] Thus farm lands alone per acre sold in 1910 at nearly double 1900 values (1903, $37.34; 1907, $49.75; 1911, $60.42). By 1910 the ratio of assessed to market values had slipped to around 33 per cent. Average value of town lot deeds rose 20 per cent between 1895–1900 and 1908–12.

Dissatisfaction with assessments became widespread. Authority over assessment was shifted to a newly appointed state tax commission with a legislative mandate to raise appraisal standards up to market levels while ensuring that actual tax levies were not to be expanded.[22] The resulting decennial property assessment raised the assessed value of realty by some 250 per cent. Per unit values of newly erected buildings were

[22] Attached is an authoritative account of the process of lifting appraised values to nearly market levels:

"The work of the Commission in connection with the assessment of real property covered a period of more than four months, during which period the entire time of its members was devoted to the work. The county auditors' abstracts were analyzed, and the average values were ascertained and compared. Copies of the printed pamphlets issued by city boards of assessors and county auditors, showing the assessed value of the real estate in the cities, townships and villages, were secured and bound together by counties. County and State maps were procured, and the average value per acre in each township was marked on the county maps. These were combined to form a large wall map of the entire State. As the average values in every township in the State were shown upon this map, comparisons between townships in the same and other counties were readily made.

"The State was divided into convenient districts, containing from five to eight counties in each, and the county auditors from each district were called before the Commission on different days. These hearings, which extended over a period of three weeks, were informal in character, and the valuations in each county and all the counties in the district were inquired into and discussed by all the auditors present. The county auditors were requested to furnish a list of transfers extending over a period of three years, excluding therefrom so-called 'dollar sales' and forced sales. The auditors were requested to give the consideration stated in the deeds, or the consideration where it was known and not stated in the deeds, and the value at which each parcel was assessed. These transfers were analyzed and tabulated by the Commission, and after the county boards of equalization, which had been ordered reconvened, had completed their work, the county auditors were again called before the Commission by districts, the districts, however, being composed of a larger number of counties than in the first instance. The average selling value shown by the transfers, as compared with the average assessed value, was discussed with these county auditors, as were the relative values of the districts in each county. The relative values in all the counties were discussed and compared with all the county auditors present. Many persons familiar with values, members of boards of equalization and others appeared before the Commission, at its request, and others at their own instance.

"Members of city boards of equalization and city boards of land assessors were called before the Commission and inquired of as to the assessment in their respective cities. In determining the true aggregate value of the real property in the cities and villages, it also compared the per capita assessment in municipalities similar in character and population.

"Experts were sent into many of the counties, and, in some instances, persons familiar with local conditions and values were employed to make investigations for the Commission.

"Many boards of equalization made specific recommendations of changes thought by them necessary to properly equalize the districts with each other and to place the property on the duplicate at the true value. Other boards preferred to do this work themselves, notably in Adams and Franklin Counties and the larger cities, except Cincinnati. In these cases few changes were made by the Commission."
(*Report, 1911*, Tax Commission of Ohio, Columbus, pp. 66–68.)

increased by 198 per cent for residential and by 149–228 per cent for varying nonresidential classes. Contemporary beliefs, the express judgment of the U.S. Census Bureau after its independent survey of tax assessment in 1912, and our own evaluation of the appraised per unit values of new building all strongly indicate that assessor valuations in 1910–14 for old and new building were around 90 per cent of market values, a level of appraisal nearly identical with that prevailing in 1857–60.[23]

In order to align the whole time series of building value from 1857 to 1914, two special adjustments seemed called for. First, allowance had to be made for the Civil War inflation which over two years (1862-63) nearly doubled reported unit values of newly erected building. It was easy to compute this adjustment which restated 1857–62 values in post-Civil War appraisal standards (1867–70 base).[24] More of a problem was encountered thereafter. Did the current Kondratieff movement of building costs with its long decline to 1897 and its upward climb to 1909 affect reported assessment valuations? Did the erosion of appraisal standards,

[23] "As a result of carrying out the provisions of the law creating the tax commission . . . the assessed valuation of real property . . .was increased from about one third of the true value to the actual value." But the tables of value ascribed assessed values of taxable realty 90.0 per cent of estimated true value. (*Wealth, Debt and Taxation*, 1915, I, pp. 16, 619.) Our own evaluation of the level of the 1911–14 assessments concerned residential dwelling values reported by tax assessors for new building. We separately enumerated by two different methods counties which clearly undervalued. One method involved comparison of reported per unit dwelling values in the years immediately preceding revaluation with values in the years succeeding. We identified twenty and twenty-four deficient returns for 1911 and 1912. We established the deficiency by using the county's averaged relative standing of statewide per unit dwelling value for the standing nonfarm stock of 1890 and 1930, as disclosed by the Census returns. We found these relative standings of per unit values consistent with degree of urbanization and other relevant values. For 1910, 1911, and 1912, there were between 3000 to 5500 dwellings reported with clearly deficient value and the deficiency when applied to the reported totals resulted in per unit increases of 7.65, 8.07, and 11.03 per cent, respectively. We then computed for each county its estimated statewide average using its recorded per unit value and its mean relative standing of 1890–1930. With the reported statewide average for 1910–14 of $1790, we then arbitrarily established a trustworthy zone of estimates between $1500 and $2500. Utilizing only counties which between 1890 and 1930 had shifted in relative standing by less than 10 percentage points, we obtained 47 observations with a mean statewide per unit value of $1977. Using all 130 observations within the $1500–2500 range, the mean is $1909. From all this it seems clear that, either out of resistance to assessment at market levels or careless reporting, reported residential values for new building in the 1910–14 period understate true value by between 7 and 10 per cent.

[24] Our percentage adjustment derived from the ratio of building "pers" for 1867–70 to 1857–61 was 1.39. This is close to the boost in 1870 of 1860 property values by 43.1 per cent to correspond to the new level of postwar values. The price and cost-of-living indexes over the same years experienced a rise of a similar order of magnitude.

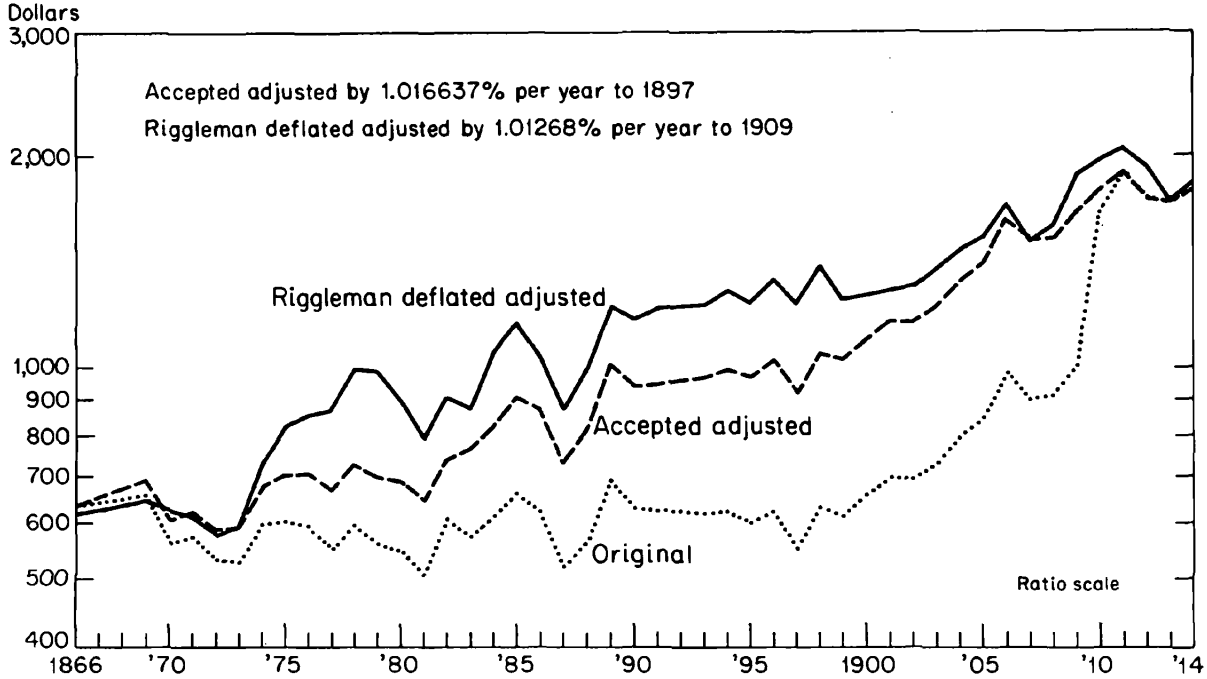
relative to market values, occur at a steady, or a varying pace and persistently through the period? The evidence was ambiguous and our judgments are tentative. One possible scheme of adjustment presupposed that assessor valuations reflected changes in current levels of building costs and that the erosion of appraisal standards was a steady and persistent process. This scheme of adjustment involved deflating by a convenient building cost index (Riggleman) and stepping up values from 1866 to 1909 at a constant rate to bring 1909 per unit values in line with the established 1910–14 level. The resulting series which reproduces the pattern of movement of the recorded original values is displayed in Chart 2 for unit values of residential building. This scheme of adjustment boosts considerably reported building values in the 1870's and again in the 1890's and scales down the marked rise in reported per unit values of over 50 per cent between 1897 and 1909. The aggregate cumulative level of production is raised considerably. It is felt that this scheme of adjustment embodies an outer limit of possible building values using input factors priced at a constant set of prices.

The other scheme of adjustment reflects another set of assumptions. These were that the process of assessment was carried out with the aid of valuation benchmarks which, after the Civil War inflation, were only slightly or irregularly influenced by shifts in building cost indexes of the magnitude encountered between 1870 and 1914. Since the level of building costs in 1910–14 was only 15 per cent higher than in 1868–72, the 1870–1914 period as a whole involved a nearly stable level of input factor prices. At the same time this scheme of adjustment presupposed that the erosion of appraisal values relative to market values did not persist through the whole period but varied by class of property with different cut-off dates. For some categories (e.g., residential), after 1897 assessment standards of new building seemed to pick up relative to assessment standards for old property. For other categories (e.g., industrial), there seemed to be a steady erosion of appraisal standards until 1909. Such disparate movements in assessment standards by class of property and region are commonly encountered in assessment history. Adjustments were made case by case largely by assuring continuity of level or trend of per unit values.

This scheme of adjustment for statewide residential per unit values is plotted in Chart 2 as accepted adjusted values. It reproduces all the movements of the original series which is merely given an upward bias scaled to link without a break the eroded 1907–09 to the accepted 1910–12 values. Comparable graphs for total residential building are shown in Chart 3. On the whole, this set of values, which from 1873 to 1911 runs

CHART 2

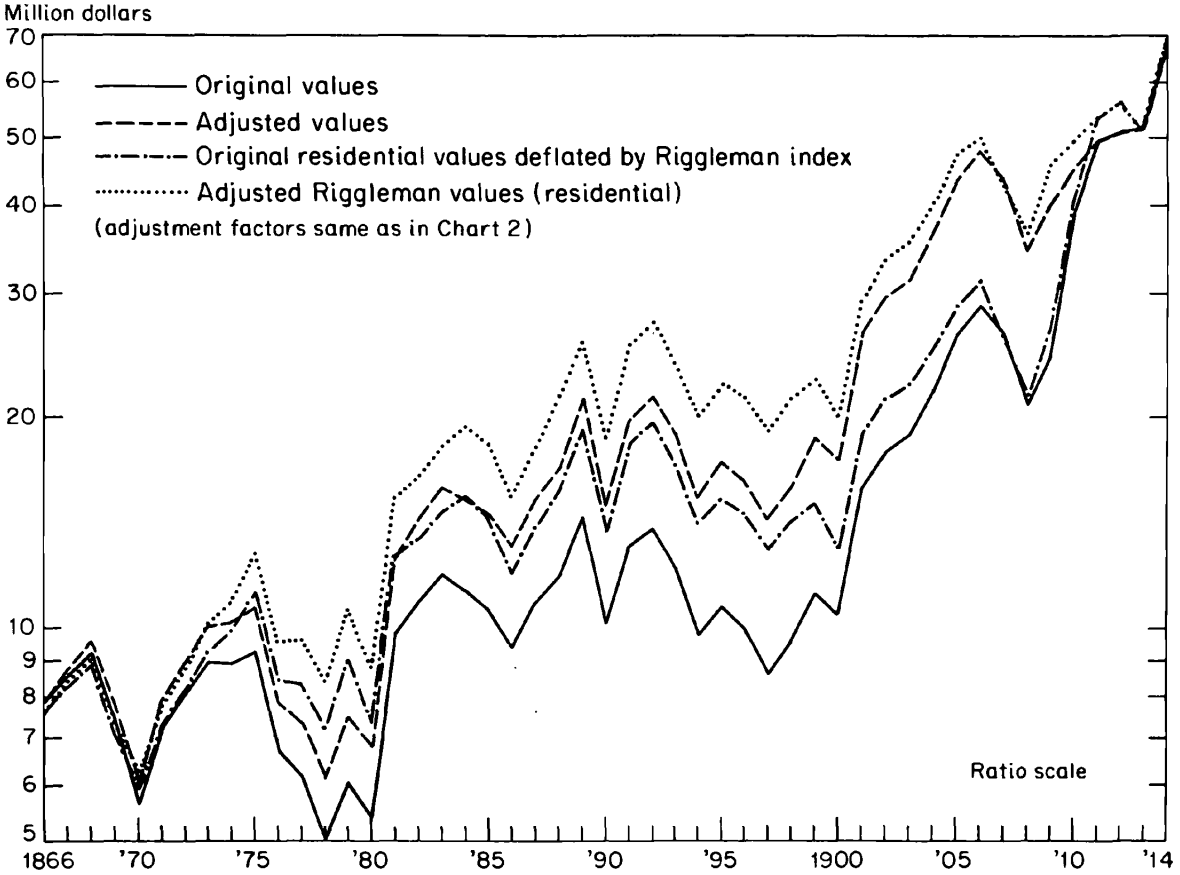
Residential Farm and Nonfarm Building Per Unit Values, Ohio, 1866–1914



Source: NBER files.

CHART 3

Ohio Statewide Residential Building, Original and Adjusted Values, 1866–1914



Source: NBER files.

midway between the originally recorded and the deflated per unit values, seemed more plausible and it was subjected to detailed statistical tabulation. In any case, it is felt that a trustworthy zone of annual movement for building activity was established for a period covering a vital growth phase of the American economy.

5. *Adjustments in Timing*

Building value indexes were also adjusted for timing to a calendar year record of building. The reported fiscal year data refer to "completions," unlike permit data which refer to "starts." The former (completions) needs to be shifted backward, the latter (permits) forward, to represent building activity.

The adjustment from a fiscal to a calendar year basis was hampered by shifting practice with regard to fiscal years.

	Period	*Fiscal Year Ending*
School Statistics	all	August 31
Assessor Reports	1857–70	July 1
	1871–72	May 1
	1873–79	April 12
	1880–81	July 13
	1882–93	April 12
	1894–	"for the year"

The assessor practice was in effect to make an early or late spring survey of construction undertaken in the preceding year(s) and completed—and hence put on the tax rolls—by the reporting date. Until 1870 but with difficulty thereafter, small structures could have been begun and completed within a reporting year. For most of our years most structures would have been begun in prior years and only completed in the reporting year. Hence a decision was made to regard building completions reported by assessors on a fiscal year basis as building activity carried on during the preceding calendar year. Thus the building report for completions during the year ending April 12 or May 1, 1874, would be credited to the calendar year 1873. School building was otherwise treated. It was felt that a significant proportion of school buildings could have been completed by August 31. Hence school reports were adjusted to a calendar year basis by shifting backward 35 per cent of building value and numbers to the prior year. This leaves open assessor reports which after 1894 bore no reference to fiscal year datings. Since no "break" in the reporting was indicated for 1893-94, the building reports "for the year" 1894 were

interpreted as applying to the year ending April 12, 1894, or thereabouts. A report issued in 1894 would hardly cover the data of the reporting year; hence predating seemed justified.

Besides adjustment to a calendar year basis, further backward adjustment is needed for nonresidential buildings which run into large unit values and for which correspondingly longer building times could be presupposed. A scheme for displacement has been worked out by the BLS for current building permit data and has been roughly approximated by Chawner for total building (displacing 33.33 and 50 per cent) and Blank for residential building only (displacing 10 per cent). We used a sliding scale formula which varied in 1857–60 between 10 per cent, for buildings with a mean value of $1,000 and under, and 50 per cent, for buildings with a mean value of $30,000 and over. The scale of percentages was reduced slowly by decades to allow for improved building practices which accelerated building time.[25]

6. *Farm Unit Residential Building Values, 1850–1912*

The values for residential building analyzed thus far include both farm and nonfarm construction. For many purposes a segregation of the values of farm dwellings, which exerted a general but uneven influence over the course of statewide unit dwelling values, is required. We have

[25] The displacement schedule is as follows (in per cent):

Mean Value of Building (dollars)	*1858–69*	*1870–79*	*1880–89*	*1890–1900*	*1900–09*	*1910–14*
Under 1000	10.0	9.5	8.9	8.5	8.0	7.5
1000–1999	13.1	12.4	11.8	11.1	10.5	9.8
2000–2999	16.2	15.4	14.6	13.8	13.0	12.2
3000–3999	19.2	18.2	17.3	16.3	15.4	14.4
4000–4999	22.3	21.2	20.1	19.0	17.8	16.7
5000–6999	25.4	24.1	22.9	21.6	20.3	19.1
7000–8999	28.5	27.1	25.7	24.2	22.8	21.4
9000–11,999	31.6	30.0	28.4	26.9	25.3	23.7
12,000–14,999	34.6	32.9	31.1	29.4	27.7	26.0
15,000–18,999	37.7	35.8	33.9	32.0	30.2	28.3
19,000–22,999	40.1	38.1	36.1	34.1	32.1	30.0
23,000–25,999	43.9	41.7	39.5	37.3	35.1	32.9
26,000–29,999	46.7	43.4	42.0	39.7	37.4	35.0
30,000 and over	50.0	47.5	45.0	42.5	40.0	37.5

already estimated by decade aggregates the approximate quantity of farm dwellings.[26] It was more difficult to arrive at a plausible set of values for farm dwellings.

We had available for each of the eighty-eight counties of the state average values of all dwellings erected in all locations—cities, villages, and farms—for the years between 1867 and 1910. The abundance of cross-section returns made it possible through multiple regression analysis to throw light on the strength of the influences which affected dwelling values. The object was to estimate the value of farm dwellings included in the totals or, conversely, to estimate the differential value of village and urban dwellings leaving farm dwelling value as a residual.

For this purpose, an annual estimate of urban and village population as a percentage of county population was extrapolated from decennial Census returns by individual counties. The two sets of population ratios would yield a biased and inaccurate version of the respective "weights," i.e., dwellings erected in urban and village centers as a percentage of the total. At the same time, the tendency to inverted correlation of the two ratios, if expressed in terms of total county population, might hamper measurement of the influence of urbanization and village shares on dwelling value. Hence mean dwelling values were regressed against urban population as a fraction of total and village population as a percentage of nonurban population. While the two sets of influences cannot be added mechanically, their separate contributions can be readily evaluated.

To test the influence of other variables, sample multiple regressions were run for selected individual years. The tested measures were average city size and farm land value per acre, and in both instances the separate influence of the two variables was inappreciable.[27] The tests, however, disclosed systematic and consistent relationships between mean dwelling

[26] See Gottlieb, *Estimates*, Table 11.

[27] Thus regression for thirty-seven nonurban counties in 1870-71 against village percentage and equalized dollar value per farm acre (mean $30.84) showed that at mean values acre values contributed only $14.56, or only some 4.5 per cent, to residual mean farm values, even though the range in per acre value by counties was relatively wide. For size of city, an index which combined urban percentage and average size of cities was devised for four Census years 1880–1910. Addition of the variable to the explanatory forces added practically nothing to the coefficient of multiple correlation adjusted for degrees of freedom. (Average coefficient for $R_{1.23}$, excluding size of city variable, was .485, and including the variable it was .489.) The direct simple correlation between dwelling value and city size was for the four years only .111, although the corresponding term for urban percentage alone was .474. As expected, the partial coefficients of city size, holding village and urban percentages constant, varied between −.2997 and −.0626 and averaged −.06, a statistically insignificant return.

values and urbanization and village percentages for both new housing and standing stock disclosed in the 1890 and 1930 Census returns.[28]

It was then decided to group the returns into the seven phases of Ohio statewide building cycles—1866–72, 1873–77, 1878–91, 1892–97, 1898–1904, 1905–09, 1910–14—and the period as a whole. The dwelling values used were unadjusted for the erosion of assessment standard between 1862 and 1909. Urban and nonurban counties were separately aggregated so that altogether there were sixteen separate multiple regression operations in which the full battery of correlation output was obtained. The principal output returns for the eight time periods are set forth for urban counties on a multiple regression basis in Table 3, for nonurban counties in Table 4. The results reached are significant in many contexts beyond the object of our present limited concern, estimation of value of newly erected farm dwellings in the state of Ohio.

It is necessary even for this limited concern to evaluate, however, the reliability of the regression returns. Our explanatory factors account for about 25 per cent of the dispersion of mean dwelling values around their own mean; the coefficient of correlation holds to a level of .47–.50, which is normalized for degrees of freedom. Both the regression coefficients and other output returns follow reasonably consistent time trends. The only exception here is provided by the 1910–14 period during which time the assessment and property valuation system of the state was recast. Counties did not move at a uniform pace to the newer levels of assessed value. Over a third of the county returns for 1911-12 showed clear-cut undervaluation which apparently was strong in rural communities. The conforming counties dominated the aggregates and generated relatively high urban and village differentials and correspondingly low residual values for farm dwellings. As expected, these low residual values in the constant term were associated with a relatively high standard error term and were disregarded since they grossly understate farm value dwellings.

[28] Although the results reached are superseded by the more inclusive regressions undertaken later, it is worth recording that a rise of 1 percentage point in the urbanization index involved the following percentage increase in average statewide dwelling value:

Year	*Number of Counties*	*Urban or Nonurban*	*Regression Coefficient*
	A. Newly Erected Dwellings		
1870–71	51	urban	1.23
1911–14	65	urban	.86
	B. Standing Stock Regressions		
1930	75	urban	.97
1890	70	urban	.75

The findings were more ambiguous for farm-village differentials, partly because of the small size of reporting nonurban counties in the later years.

TABLE 3

REGRESSION RETURNS (FORTRAN), MEAN DWELLING VALUE, OHIO,
SEVEN SUBPERIODS AND AGGREGATES, URBAN COUNTIES ONLY, 1866-1914

Item	1866-1914	1866-72	1873-77	1878-91	1892-97	1898-1904	1905-09	1910-14
Number of observations	3,158	221	325	968	413	486	318	251
Mean of variable								
X_1 (mean value, all newly erected dwellings)	614.5	549.9	509.1	511.1	513.7	594.1	687.4	1352.0
X_2 (urban population as per cent of total population)	30.32	21.94	21.66	27.31	33.32	35.57	38.50	40.20
X_3 (village population as per cent of nonurban population)	15.95	13.44	13.70	14.27	16.10	17.82	19.77	20.39
Standard deviation of variable								
X_1	385.5	255.7	230.2	241.2	253.9	321.2	336.8	619.8
X_2	19.31	16.37	16.33	17.38	18.37	19.57	20.46	20.82
X_3	7.40	7.60	6.13	6.42	6.84	7.38	7.48	8.03
Regression coefficients with standard error								
Constant	152.6	286.9	248.2	253.2	182.2	194.3	287.1	324.3
Standard error	±16.2	±28.6	±30.0	±19.6	±36.3	±42.3	±57.3	±99.8
b_2	8.61	7.09	5.37	5.84	6.10	7.96	7.12	16.10
Standard error	±.31	±.70	±.68	±.40	±.60	±.65	±.82	±1.49
b_3	12.58	7.98	10.56	6.89	7.94	6.55	6.39	18.66
Standard error	±.80	±1.51	±1.82	±1.07	±1.62	±1.73	±2.25	±3.87
Correlation coefficients								
$R_{12.3}$	.448	.4625	.3998	.4292	.4454	.4848	.4368	.5627
$R_{13.2}$	.27	.2627	.3063	.2027	.2347	.1696	.1573	.2911
$R_{1.23}$ (adjusted)	.5125	.492	.4879	.4635	.4666	.4898	.4489	.6074
$R_{2.3}$		-.08	.087	.037	-.100	-.100	-.006	.0886
Standard error of estimate	333.1			213.8	224.8	280.3	301.4	493.3

TABLE 4

REGRESSION RETURNS (FORTRAN), MEAN DWELLING VALUE, OHIO,
SEVEN SUBPERIODS AND AGGREGATES, NONURBAN COUNTIES ONLY, 1866-1914

Item	1866-1914	1866-72	1873-77	1878-91	1892-97	1898-1904	1905-09	1910-14
Number of Observations	880	221	98	237	106	108	64	46
Mean of variable								
X_1 (mean value, all newly erected dwellings)	425.8	467.8	367.8	378.1	356.1	366.9	517.2	768.0
X_3 (village population as per cent of nonurban population)	18.46	15.97	14.61	16.53	20.99	23.23	23.94	23.68
Standard deviation of variable								
X_1	226.2	223.0	172.3	178.0	180.3	163.5	280.9	302.7
X_3	6.969	6.345	3.987	5.740	6.459	7.211	6.382	6.185
Regression coefficients with standard error								
Constant	371.6	275.1	219.3	458.9	503.5	406.6	623.9	650.8
Standard error	±21.5	±38.2	±64.9	±34.9	±57.6	±52.9	±137.8	±179.6
b_3	2.934	12.07	10.16	-4.89	-7.02	-1.71	-4.46	4.94
b_3 Standard error	±1.09	±2.22	±4.29	±1.99	±2.63	±2.18	±5.56	±7.34
Correlation coefficients								
$R_{1.23}$ (adjusted)	.084	.3374	.2131	-.1438	-.2332	0	0	0
Standard error of estimate	225.5	210.4	169.2	176.5	176.2	164.5	284.0	307.9

If the regression model is now tested by computation of estimated values for the Ohio sample groups, the movement of actual and calculated values are quite close for the intermediate groups (II, III, and IV) and are systematically deviant only for Groups I and V (see Chart 4). The regression, apparently because of its linear form, attributes too much influence to urbanization at the lower end of the urban spectrum and too little influence at the upper end. Expenses in programming for a nonlinear multiple correlation model unfortunately ruled out for the time being a wholesale nonlinear regression to all our data. For present purposes the bias is not too serious, although it indicates the danger of extrapolation beyond the main cluster of our observations.

The regression results indicate two different versions of the value of farm dwellings. In the first place since the regression clearly indicates that, for nonurban counties, the village differential after 1877 was nonexistent or negative, then the mean value of dwellings of nonurban counties represents for those areas a possible measure of farm dwelling values.[29] The trouble is that the measure applies to an increasingly smaller group of counties (only thirteen in the 1905–09 period) not at all representative of the farming life of the state. Moreover, the 1910–14 value needs to be revised upward because of utilization of older standards of appraisal in rural areas.

For urbanized areas there is of course a measure yielded by the constant terms of the multiple regression. The constant term represents those influences on dwelling value not reducible to or associated with urban or nonfarm building, and thus should reflect the position of newly erected farm dwellings. Again, the 1910–14 low figure illustrates that rural assessment standards were slow to change.

These two value estimates may be checked against two independent measures. One of these is the mean value of newly erected barns and stables, which should fluctuate in close correspondence with farm dwelling values. A second check is the mean value of newly erected dwellings in our Group V, consisting of five northwest primarily rural counties in which farm population greatly outnumbered nonfarm population and in which only one out of five resident persons in 1920 dwelt in cities over 2,500 persons in size. These dwelling values, which for 1910–14 have been adjusted for rural undervaluation, certainly constitute a limiting set of values.

The four series involved are plotted in Chart 5. There is a definite

[29] While the village regression coefficients are negative—interestingly enough until the 1910–14 period—the standard error of most of the coefficients is high and the correlation coefficient adjusted for degrees of freedom is zero or below standard significance levels.

CHART 4

Mean Values of Residential Dwellings, Ohio Sample Groups for Long-Cycle Phases, Actual and Calculated, 1866–1914

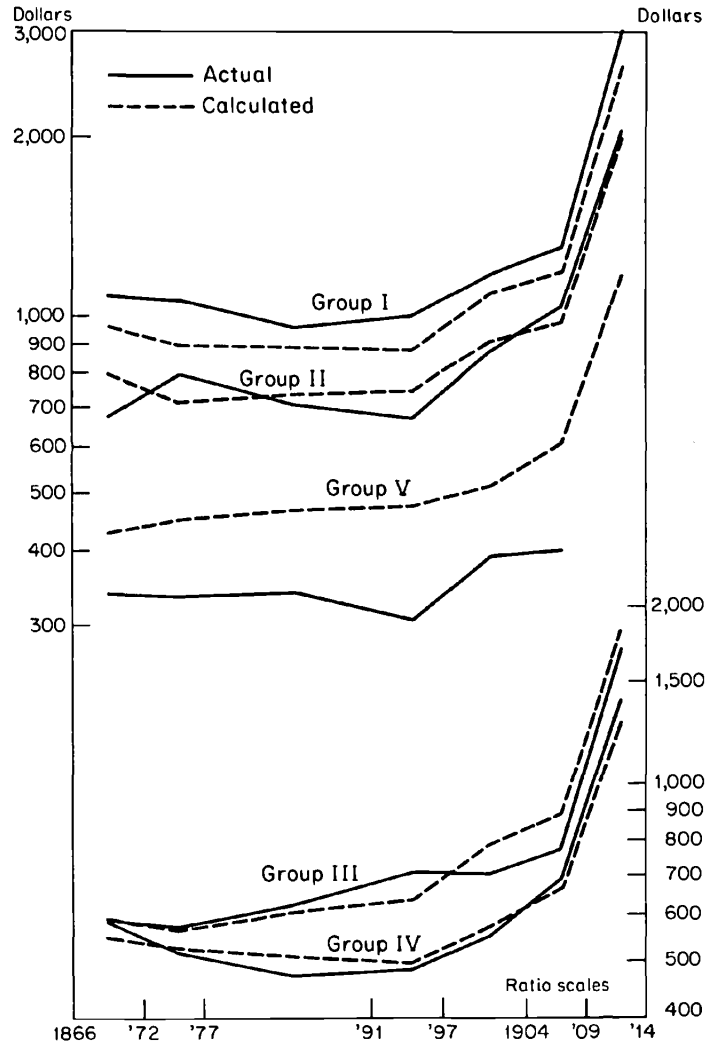
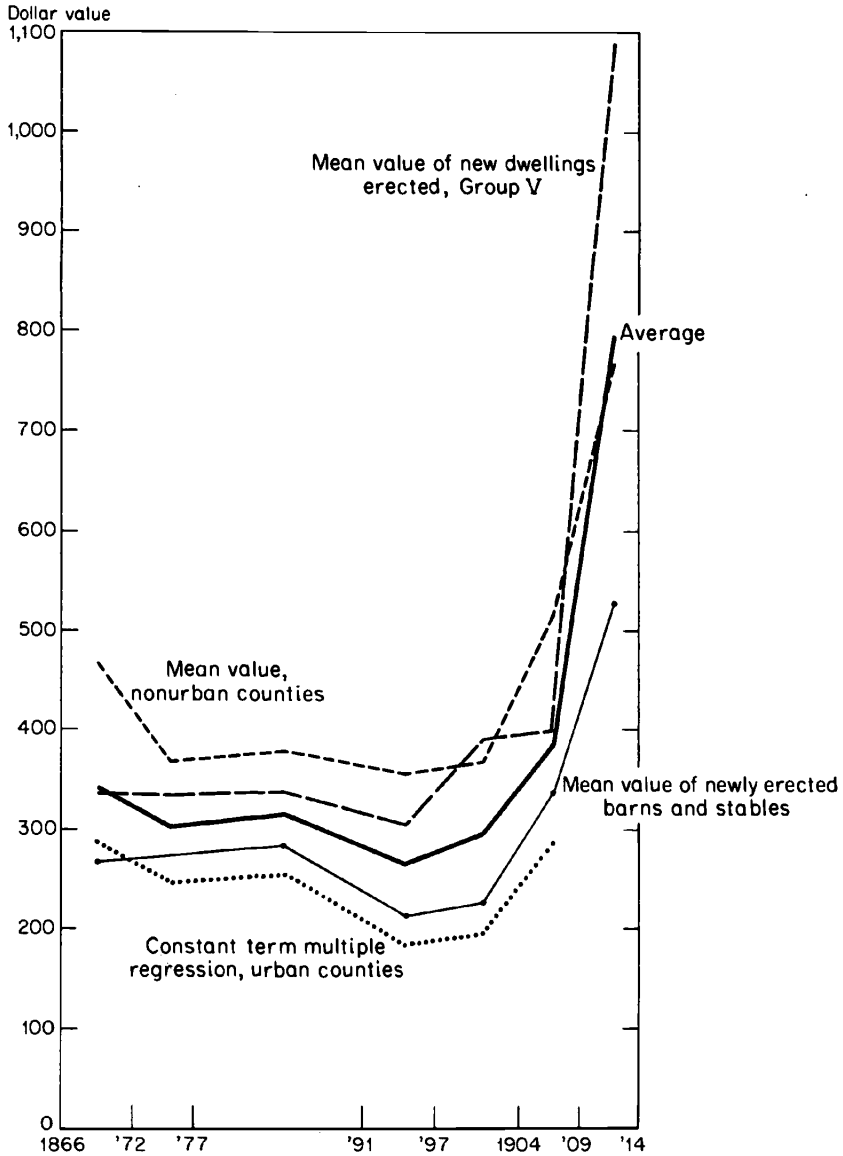


CHART 5

Variant Estimates of Mean Value of Newly Erected Farm Dwellings, Ohio, 1866–1914



family likeness of movement. The true figure probably lies somewhere in between. Hence, we indulged our penchant for "divide and average" and constituted an average value of farm dwellings erected in Ohio between 1866 and 1914. Values for individual years were interpolated linearly, yielding a schedule of per unit farm dwelling values from 1867 to 1914. Accepting the terminal values at 90 per cent of market, a formula was devised assuming a steady rate of erosion of assessment standards until 1907.

7. *Nonfarm Unit Residential Values*

These farm dwelling values, weighted by the decade share of farm to total dwellings, were then removed from statewide average values and new nonfarm values were computed. The decade sets of these values fitted together with little need for adjustment at or near transition years. The computed unit values of the 1870's, with perhaps excessive estimates for farm dwelling production, had to be reduced by 10 per cent. And the values for two individual years, 1880 and 1881, had to be raised by some 15 per cent. Otherwise, the only adjustments made were the extension to residential values of the allowance for 10 per cent undervaluation from market values and smoothing by a three-year moving average.

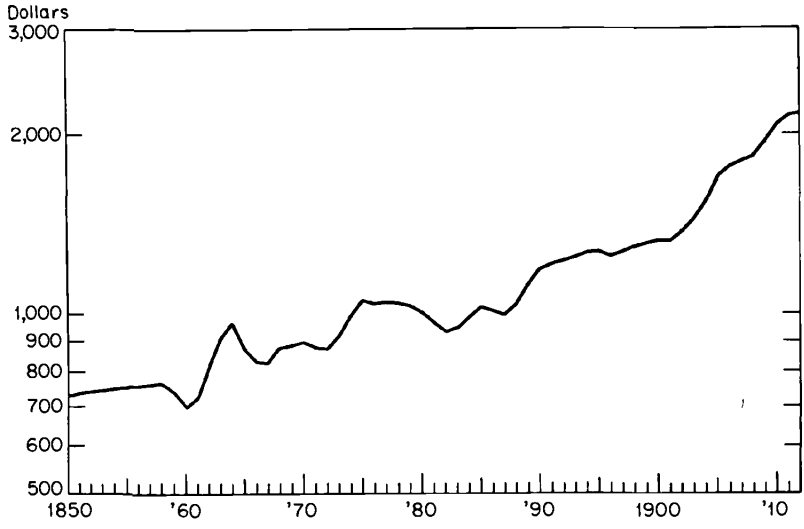
The resulting series of unit values was extended backward to 1858 by an index of the three-year moving average of unit building values of all private building. Residential numbers and values dominated the totals, and total unit and residential values conformed closely. Between 1850 and 1858, the 1858 unit dwelling value was arbitrarily dropped by small increments to a starting value of $728 in 1850. As adjusted and extrapolated, the entire schedule of per unit values is set forth in Chart 6 from 1850 to 1912.

There are five sets of independent evidence by which to evaluate the entire schedule of per unit dwelling values. The first set involves a comparison between nationwide and Ohio levels of nonfarm per capita income and wealth. Did the level and pattern of Ohio nonfarm living conform to that of the nation as a whole? The available measures are summarized in Tables 5 and 6.

The line-up of values in the tables suggests that Ohio nonfarm property values and incomes during the entire pre-1914 period were below the national level, possibly due to differences in size and character of urbanization or to an early concentration in Ohio of the mining industry. Per capita living levels fell short of the national level which, particularly in the years before 1900, was dominated by the older Atlantic seaboard

CHART 6

Per Unit Nonfarm Dwelling Values, Ohio, 1850–1912



Source: Table 8, col. 6.

TABLE 5

PER CAPITA WEALTH AND INCOME, COMPARISON OF OHIO AND U.S.A., 1840-1930

Year	Item	Ohio (dollars)	Ohio as Per Cent of U.S.A.
1840	Total nonfarm income per nonfarm worker	356	75.3
1880	Total nonfarm income per nonfarm worker	551	96.3
1900	Total nonfarm income per nonfarm worker	609	97.9
1900	Nonfarm residential real property, true value per family	1,671	85.7
1930	Average value, all nonfarm dwellings	5,138	102.3

Source: Gottlieb, *Estimates*, Tables 4 and 6; *Wealth, Debt and Taxation*, 1907.

TABLE 6

NONFARM WEALTH PER NONFARM WORKER, COMPARISON OF OHIO AND U.S.A., 1850–1912

Year	Ohio (dollars)	Ohio as Per Cent of U.S.A.
1850	432.5	85.8
1860	644.8	88.5
1890	1,696.0	91.5
1900	1,664.0	86.6
1912	2,256.0	92.6

Source: See Ohio wealth appraisals listed footnote 19; *13th Census of Agriculture, General Report*, U.S. Bureau of Census, pp. 83–91; *Wealth, Debt and Taxes*, 1907 and 1915. For nonfarm worker data in Ohio and U.S.A., see Gottlieb, *Estimates*, Table 10.

states. The differential, which in 1850 may have run as high as 15 per cent, narrowed as the 1900's approached and had disappeared by the 1920's.

From this perspective then, we can now consider the evidence bearing on our 1850 values, set at $728 in post-Civil War values or $523 in current dollars. The evidence includes a highly inferential estimate by Goldsmith of average values of nonfarm standing dwellings in 1850,[30] which perhaps need not be given much weight. Nor need we be concerned about the Ohio Census returns for a newly erected Ohio dwelling in 1840 which,

[30] Raymond Goldsmith, "The Growth of Reproducible Wealth of the United States of America from 1805 to 1950," *Income and Wealth of the United States*, Income and Wealth Series II, Cambridge, Eng., 1952, pp. 318 f. His estimate of $800 is the average nonfarm residential value (allowing only for a quarter of realty value of land for 1890) reduced to the 1850 levels of building cost. Goldsmith found the $800 consistent with average dwelling values for standing stock of New York State in 1855 and with an estimate of $300 for the cost of building a standard room. The 1890 wealth estimate is itself questionable and a safer base would be the estimate of $1034 (see Leo Grebler, David Blank, and Louis Winnick, *Capital Formation in Residential Real Estate: Trends and Prospects*, Princeton for NBER, 1956, p. 365) derived from the Census of Homes returns. This probably is excessive in two regards, allocation of land value and allowance for use of structure value. Adjusting the $1034 accordingly and converting to post-Civil War values yields an equivalent in used values for 1850 of between $850 and $900. New dwelling values would on this base run to around $1170–$1700 depending on the used-to-new ratio prevailing. This is, of course, only an 1850 equivalent of an 1890 value assuming no upward drift of dwelling values because of urbanization and the rise of per capita incomes. Just that assumption is in question. The Chicago estimate of building costs needs to be interpreted in the light of central city-statewide differentials, which for Ohio were 84.6 per cent (1866–70), 47.6 per cent (1890), 51.5 per cent (1910–14), and 43 per cent (1930). Moreover, the average size rental unit—and the share of rental units—must be determined.

when adjusted for changes in purchasing power, was $721.[31] This includes farm dwellings with their presumably lower values, but it also includes an undetermined amount of site improvements and lot values.

A more important check on the soundness of the Ohio unit values consists of the Grebler-Blank-Winnick unit values derived from urban permit statistics overlapping with our Ohio returns for the years 1889–1912. The two annual series, together with the Chawner series for 1900–12 and benchmark estimates of the average values of the nonfarm dwelling stock, are set forth in Chart 7. The discrepancy between the annual estimates is widest at the start in 1889. The Ohio values gradually climb from 51.5 per cent of the permit-derived value in 1889–91 to 81.5 per cent in 1910–12. The Ohio values would seem to reflect more closely the shift of value experienced by the average unit value of standing stock.

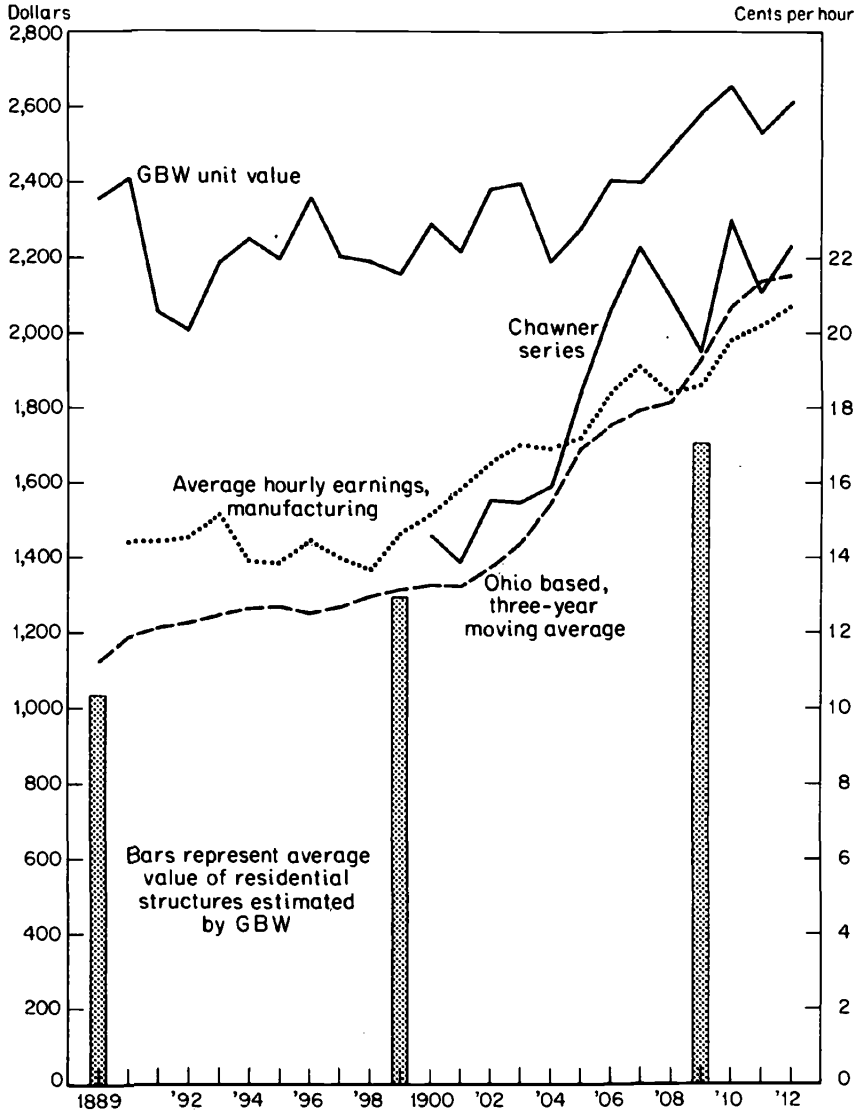
This striking difference in level and behavior pattern is traceable in part to divergences of statistical method and composition. For the level in 1910–12, the gap is partly attributable to the tendency noted earlier for Ohio levels of per capita housing to understate national per capita levels by 7–10 per cent over the years in question. Then there were substantial adjustments for undervaluation, site, and preliminary costs in the permit-derived data. These adjustments involved a markup of 127.44 per cent over originally reported findings. Our returns are adjusted for undervaluation only by 10 per cent and no allowances for builders' profit or site improvements were made. Then nonfarm nonurban building was attributed a unit building value of 66 per cent of the mean urban value. Wickens attributed rural dwellings of the same class only 47.6 per cent of the unit value in the 1920's of all urban dwellings.[32] In the light of the 1890 Census differentials and the persistent emphasis on urbanization in our Ohio materials, the Wickens allowance for rural-urban differentials seems more appropriate. Using it for the years 1890–94 and 1905–09

[31] See Gottlieb, *Estimates*, pp. 51 f., for conversion of the Census returns of $1012 per house in Ohio to $639. Allowing for inflated building costs of 1840 compared to 1850 (Riggleman's 1840 index is 72.0, 1850 is 58.5) and converting to post-Civil War values, we derive the $721. It is anybody's guess how much to allow in this for farm dwellings, log cabins, and land or site values. Even in the late 1850's, the Ohio statistics commissioner could assert that "many" of the dwellings built were log cabins. In 1840 the proportion of log cabins was higher. Local Ohio historians, when asked about the validity of the 1840 Census value, cautioned the present author about the role of log cabins. Even in New York State, the 1858 Census described 6.3 per cent of all dwellings in the state as log cabins. (*Census of the State of New York for 1855*, Albany, 1857, p. 247. *Ohio Executive Documents*, 1858, Pt. 2, p. 587.)

[32] David L. Wickens, *Residential Real Estate*, New York, NBER, 1941, p. 73 (ratio of $2315 to $4865).

CHART 7

Per Unit Nonfarm Dwelling Values, Average Values of Standing Nonfarm Stock, Average Hourly Earnings in Manufacturing, 1889–1912



Source: L. J. Chawner, *The Residential Building Process*, 1939, Table 4.5; Grebler, Blank, and Winnick, *Residential Real Estate*, pp. 72 and 426; A. Rees, *Real Wages in Manufacturing, 1890–1914*, Princeton for NBER, 1961, p. 4; and Table 8, col. 6.

reduced the permit-derived values by 10 and 6.2 per cent, respectively.[33]

Finally, the sampled cities were grouped in relatively few size classes which would tend to be dominated, at least for size classes under 100,000, by the larger cities in the class. Thus the survey returns for the size class 2,500–24,999 was unduly influenced by cities at the upper end of the class because few of the smaller cities were caught in the reporting network. The probable bias was compounded since a technique used to make up for deficiencies arising from small sample size was projection of the experience of an adjoining size class of the same division.[34] Since sample deficiencies preponderated among lower size groups in the early years of the study, the building rates for these groups were biased upward when deficiences were remedied.

If we can thus explain the difference in the 1910–12 level between the Ohio and the permit-derived data, how can we explain the radically different time trend? The Ohio values double over the period while the permit values, ignoring apparently erratic returns for 1889 and 1890, rose only by 28 per cent by 1910–12. The standing stock per unit values rose by 65 per cent. The rise in the Ohio series accelerates in the 1900's, thus reflecting the real estate boom and lift of values that marked that boom. One possible explanation is the downward bias on unit values generated by the rapid expansion of the permit sampling base. For the four northeast and north central geographic regions, the mean percentage of population covered by the sample within the size class rose from 18.3 to 44.7 per cent for size class III (cities between 25,000 and 100,000) and from .5 to 5.3 per cent for size class IV (cities between 2,500 and 25,000). As the sample expanded, the weight of the smaller cities in the size classes increased. This would automatically tend to lower per unit values, thus offsetting the upward trend induced by higher incomes and the over-all price rise.

For these reasons both the level and pattern of movement of the Ohio per unit values for the 1889–1912 period could be considered more like the national averages than the Grebler-Blank-Winnick permit-derived unit values. Our analysis thus confirms the judgment of Margaret Reid

[33] We used for these purposes the original estimates of urban residential construction derived directly from the permit records and adjusted by Blank's 127.44 per cent markup for undervaluation and omissions (David Blank, *The Volume of Residential Construction, 1889–1950*, NBER Technical Paper 9, New York, 1954, p. 41). The breakdown disclosed that the nonurban component was estimated to account for 43.5 per cent and 34.5 per cent of all units during 1890–94 and 1905–09, respectively.

[34] D. Blank reports that three alternative techniques were used to make up for sample deficiencies. The first technique cited involved utilization of building experience of an adjoining size class in the region. Only when "data for the given class and adjacent class were not available for a closely preceding or following period" were other procedures employed (*ibid.*, pp. 36 f.).

that these values "substantially overstate the value of new dwellings except during the forties and early fifties."[35]

A third item of evidence concerns the 1890 benchmark appraisal by the Census Bureau of the value of owner-occupied encumbered nonfarm structures.[36] These made up one-tenth of all nonfarm dwellings. Including land, the mean declared value was $3,250. Grebler, Blank, and Winnick allow 40 per cent for value of land by extrapolation from benchmark estimates of the 1920's and 1907.[37] Considering the rising tide of land values that marked urban growth in the nineteenth century with horse and carriage transportation, this allowance seems inadequate. Ohio decennial appraisals, which allowed for little growth in land values after 1870, yielded a share of land value in the appraised value of realty in towns and cities that declined from 60.7 per cent in 1859 to 51.2 per cent in 1900.[38] The order of magnitude for Wisconsin in 1916 was somewhat lower.[39] At a 53 per cent share for land value, the average value of a dwelling falls to $1,527.5. This value however applies to the tenth of nonfarm dwellings in 1890 that were owner-occupied encumbered structures. These dwellings have higher mean values than all nonfarm dwellings the more home ownership is extended to lower income groups and the higher the ratio of structure to dwelling value. Between 1890 and 1940, the home-ownership ratio increased from 37 to 41 per cent; and Grebler, Blank, and Winnick accordingly allowed the 63 per cent ratio of encumbered owner-occupied dwellings to all dwellings in 1940 to be scaled down to 55 per cent. If this allowance is accepted, the mean value of a nonfarm standing dwelling in 1890 is $840. This is reduced by 5 per cent

[35] See Margaret G. Reid, "Capital Formation in Residential Real Estate," *Journal of Political Economy*, April 1958, p. 139. Margaret Reid was stimulated primarily by her conviction that the Grebler-Blank-Winnick thesis of a long-term decline in per unit real dwelling values was not sustainable. She expressed belief that "the evidence presented in this article indicates an upward rather than a downward trend in the quality of housing since 1890" (*ibid.*, p. 132).

[36] It has been specifically noted that "the high average value of the owned mortgaged homes may be greatly affected by the number and size of the apartment houses in which the owner himself resides. Such an apartment or flat building, if mortgaged, would be included in the average." *Mortgages on Homes*, U.S. Bureau of Census Monograph 11, Washington, 1923, p. 82.

[37] See Grebler, Blank, and Winnick, *Residential Real Estate*, p. 364.

[38] Equalization reports for the years in question.

[39] See H. M. Groves and J. Riem, "Statistical History of the Property Tax Base in Wisconsin, 1916–1958," *American Journal of Economics and Sociology*, January 1961, pp. 127–148. Assessed value of land in 1916 made up 59.7 per cent and 50.4 per cent of total assessed realty in Madison and Milwaukee, respectively, and around 33–35 per cent is indicated for the state. Wisconsin assessment data also indicate that the land improvement ratio for residential property exceeded the ratio for all nonfarm realty by only 1 or 2 percentage points. (See *ibid.*, p. 138, Table 4.)

to convert structures to dwelling unit values.[40] If we then apply to this mean value the high-low and mean ratio that prevailed in benchmark years after 1919 between the mean values of used dwellings and newly erected dwellings, we derive a high-low range for new 1890 mean dwelling values of $1,110–$1,520. Used values should be relatively high at building cycle peaks if new building is to be discouraged.[41] This would point to a level of new values nearer the lower end of the range, i.e., near the level predicated in our Ohio series ($1,186).

The lower end of the range is also indicated by qualitative information on costs of building in the pre-1914 period. In 1913, what was called an "ordinary house, 26 by 40 feet on the ground and 30 feet from the bottom of the cellar floor to the top of the roof," with three bedrooms, two and a half stories, and 31,200 cubic feet of total space was estimated for urban building in a standard building manual at $3,120.[42] If allowances are made for lower costs in small towns and for the many smaller rental units in multiunit structures, the range of values is not far from our Ohio 1913 value.[43] In 1879 three prizes were awarded for designs for a "cheap frame house" two stories high with three bedrooms which would be erected on detailed specification for $1,000. Work included excavation, foundation, framing, finishing, and all materials. No heating or plumbing equipment was included.[44] In 1890 these houses would have cost $1,089, or well in the neighborhood of our Ohio unit values.

Still another absolute comparison is yielded by purchase information

[40] We use the magnitude for overstatement estimated by Grebler, Blank, and Winnick (*Residential Real Estate*, pp. 369 ff.) in 1930 in connection with Wickens' use of 1930 Census data. They estimated that the shift from structure to unit values amounted to 10 per cent of the owner-occupied inventory or to roughly 5 per cent of over-all dwelling values. Blank (*Residential Construction*, p. 50) noted the use of structure values in the 1890 Census.

[41] Used realty prices for Paris, Manhattan, and Berlin show positive reference cycles with a lead in timing for Berlin, a lag in Manhattan, and virtually no reference decline in Paris. Experience in Los Angeles from 1900 onward suggests that used prices conform to price shifts of new building with greater amplitude. See R. M. Williams, "The Relationship of Housing Prices and Building Costs in Los Angeles, 1900–1953," *Journal of the American Statistical Association*, June 1955, pp. 370–376. See also Grebler, Blank, and Winnick, *Residential Real Estate*, Appendix C.

[42] William A. Radford, *Radford's Estimating and Contracting*, 1913, p. 767.

[43] Wickens estimated that in 1930 dwellings occupied by owners are in general worth about one-third more per unit than those which are rented (Wickens, *Residential Real Estate*, p. 3). Grebler, Blank, and Winnick (*Residential Real Estate*, pp. 112 f.) illustrate the same relationship with data indicating that dwelling units in varied multiunit structures were valued at between 70 and 80 per cent of single-family dwellings over the years.

[44] *Carpentry and Building*, September 1879, "Competition Design for Cheap Dwelling Houses."

obtained in the 1934 Financial Survey of Urban Housing.[45] In that survey acquisition prices were obtained in twenty-one large and medium-sized cities from 981 sampled owner-occupants who acquired their dwellings (mixed new and old) in the 1890's. The mean purchase price was $2,633. Applying thereto the Grebler-Blank-Winnick allowance for land value yields a structure cost of $1,627. Cities of that size and character were related to the statewide average, according to the pattern of our Ohio studies, at near 140 per cent, which yields a general average of nonfarm housing values (mostly new) of $1,162, a value that fits in with the Ohio-based series but not the permit series.

While comparison with the three independent sets of evidence indicates that our Ohio-based series fall within the range of acceptability, the comparisons also reinforce the suggestion disclosed by the income and wealth benchmark measures that our Ohio series was below the national level, particularly in the earlier years of the period.

8. *Adjusted Time Series of Building in Ohio*

The various adjusted series for the value of Ohio building cumulated by decades are shown in Table 7. The originally reported value of total building is presented in column 1 adjusted only for inclusion of estimates of tax-exempt building up to 1872 and of school building between 1857 and 1914, for deficiencies, for appraisal slippage, and for conversion from "completions" to current activity. The values in columns 2, 3, 4, and 5 represent the broad categories of taxable new building as separately reported in Ohio assessor building statistics and adjusted on the same scale as total value of building. The estimates of the value of newly erected farm dwellings, listed in column 6, were not derived from the assessor building statistics but were contrived on the basis of other information to form nonfarm estimates consistent with our other magnitudes. The final column adds together the estimates of industrial, commercial, and residential (columns 2, 3, 4, and 5) and the estimates of exempt construction previously reported (column 3 of Table 2) less only the estimated allowance for residential farm building (column 6) to make up estimates of total nonfarm building.

These estimates of nonfarm building could, of course, be converted into total building by adding back the farm components. When so converted, they differ considerably from the originally reported total value of building. Our derived total (from adding components) is higher

[45] David L. Wickens, *Financial Survey of Urban Housing, Statistics on Financial Aspects of Urban Housing*, Washington, 1937.

TABLE 7

DECADE AGGREGATES OF ADJUSTED VALUE OF NEW OHIO BUILDING, 1850-1910
(thousand dollars)

Decade	Reported Total Building (1)	Industrial Building[a] (2)	Commercial Building (3)	Residential Building (4)	Barns and Stables[b] (5)	Estimated Value: Farm Dwellings[c] (6)	Estimated Value: Nonfarm Building[d] (7)
1860's	99,599	5,147		63,835	5,519	7,291	94,691
1870's	133,160	7,487	12,824	82,664	7,885	22,208	127,767
1880's	220,868	21,517	24,648	146,308	12,889	9,743	217,730
1890's	262,283	35,500	40,147	173,363	12,247	16,968	293,042
1900's	550,379	116,000	79,580	353,908	22,682	15,011	599,477
Total 1870-1910	1,166,690	180,504	157,199	756,243	55,703	63,930	1,238,016
Adjustment factor for erosion slippage	1.579 (1897)	3.359 (1909)	2.585 (1899)	1.668 (1897)	1.50 (1907)	1.946 (1907)	

[a]Including only manufacturing establishments, mills, and foundries, but not railroads, canals, or public utilities. Return for 1900's is scaled down from our adjusted yearly series by some 10 per cent because of a probable overestimate in our industrial value correction factor.

[b]Decade aggregates for number of barns and stables were multiplied by adjusted unit values for the four decades after 1870: $270, $333, $292, and $409. Estimates for 1860's based upon building during 1865-69 and an assumed value of $250.

[c]Derived by applying to our independently derived decade estimates of newly erected farm dwellings (Gottlieb, *Estimates*, Table 11) per unit values derived from mean estimates of the value of newly erected farm dwellings (see Section 7) interpolated linearly for intervening years, adjusted for appraisal slippage with a correction factor of 1.95 (1907) and converted to decade average values from 1870 onward: $344.7, $400.3, $432.4, $642.7. (A $300 estimate was used for the 1860's.)

[d]Sum of columns 2, 3, and 4, minus column 6 plus column 3 of Table 2. For purposes of the 1860's estimate, $10 million was allowed for commercial building.

in all decades and for the forty years between 1870 and 1910 by 16 per cent than the originally reported aggregates as adjusted. In small part this was because industrial and commercial building were adjusted individually for deficiencies which were not transferred to the totals. A more important reason for divergence is the inadequate allowances after 1872, as noted previously, for exempt building other than school construction.[46]

Finally, our procedure of adjustment for erosion slippage involved disparate individual adjustments for the different categories of building. The coefficients of adjustment, expressed as a multiple of the recorded value for a stipulated cutoff year, are listed at the bottom of Table 7 for each adjusted series. The series was raised at a steadily growing rate by the cutoff year to the stipulated multiple of the reported value. The adjustment for slippage may have been slightly more favorable to the individual types of building than to the reported total. On the whole, the derived aggregate is believed to afford a more accurate measure of total building than the reported totals. However, it was not found feasible to distribute into annual returns these more accurate aggregates. The originally reported totals were, of course, available on a yearly basis and all adjustments were made to the yearly returns. Hence our yearly Ohio series of total building shows an order of magnitude and yearly variations but tends to understate as much as 15 per cent after 1872. The yearly totals for total, residential, commercial, and industrial building and unit values for farm and nonfarm residential building are listed in Table 8. A full publication of the tabular returns with the appropriate charts must await a more detailed monograph.

[46] There are indications that the assessors did a better job of reporting church and public building than school building. Thus, assessor reports of county building for the two sets of years 1873–80 and 1900–09 amounted to 88 and 79 per cent of the county tax levy for building purposes. Considering that appraised values were adjusted for appraisal slippage, the total holds up. Comparison of decennial appraisal reports with cumulated church building reports also indicates that assessor reports on church building were less lax than those on school building. Thus, comparison of assessor reports of new construction cumulated over the 1870–90 period compared with net increments of outstanding appraised value of building showed much more under-reporting of school than of church construction, as can be seen from the following figures (in thousand dollars):

	Schools	*Churches*
Net change in value of appraised building over 20 years	6,930	4,509
Cumulated assessor reports on new building	5,932	6,981

TABLE 8

VALUE OF BUILDING, OHIO, BY TYPE, ANNUALLY, 1837-1914

Year	Aggregate Value of Building[a] (thousand dollars)				Unit Value of Residential Dwellings (dollars)	
	Total	Industrial	Commercial	Residential	All[a]	Nonfarm[b]
1837	13,165					
1838	11,177					
1839	7,002					
1840	13,104					
1841	14,892					
1842	7,415					
1843	4,816					
1844	4,618					
1845	4,786					
1846	4,954					
1847	5,978					
1848	8,975					
1849	9,938					
1850	10,015					728
1851	12,171					733
1852	14,740					737
1853	16,528					742
1854	14,403					746
1855	10,854					750
1856	8,106					755
1857	10,108					759
1858	8,557					764
1859	7,046	170				739
1860	7,892	115				695
1861	6,533	61		3,440		722
1862	5,486	238		3,598		817
1863	6,603	528		4,708		914
1864	6,968	586		4,304		964
1865	9,560	644		6,182		875
1866	11,800	702	925	7,926	640	828
1867	14,902	783	970	8,830	655	821
1868	16,291	756	1,359	9,376	673	875
1869	13,564	734	1,504	7,645	680	879
1870	10,987	619	897	6,202	607	892
1871	13,240	845	1,149	7,952	620	874
1872	14,762	1,208	1,456	9,031	588	872
1873	16,134	1,092	611	10,081	602	916
1874	15,980	771	1,503	10,245	683	993
1875	16,842	504	1,429	10,467	701	1,050
1876	13,191	499	987	7,797	700	1,040
1877	11,168	612	1,009	7,241	674	1,046
1878	9,119	455	1,191	6,260	726	1,041
1879	11,737	883	1,592	7,388	694	1,036
1880	11,764	1,463	1,293	7,289	685	1,001
1881	20,231	2,760	2,804	12,736	661	965
1882	23,404	2,528	2,218	14,423	787	935

(continued)

TABLE 8 (concluded)

Year	Aggregate Value of Building[a] (thousand dollars)				Unit Value of Residential Dwellings (dollars)	
	Total	Industrial	Commercial	Residential	All[a]	Nonfarm[b]
1883	23,837	2,021	2,025	15,788	769	940
1884	21,906	1,323	1,613	15,212	832	987
1885	20,887	1,811	2,358	14,365	902	1,024
1886	21,135	2,253	3,441	13,231	860	1,008
1887	22,843	2,108	2,851	15,430	743	992
1888	25,984	2,356	2,585	17,919	862	1,037
1889	28,877	2,894	3,460	19,915	967	1,120
1890	22,977	3,335	2,484	15,327	938	1,186
1891	29,811	3,714	3,883	19,830	944	1,207
1892	31,003	3,143	3,845	21,076	958	1,222
1893	28,260	2,946	4,067	18,648	968	1,242
1894	25,806	3,590	4,526	15,605	985	1,260
1895	26,599	2,688	4,226	17,570	999	1,265
1896	22,656	2,002	3,691	15,762	984	1,249
1897	21,432	3,173	3,745	14,899	960	1,266
1898	24,327	4,403	3,733	16,259	1,044	1,294
1899	29,412	6,506	5,947	18,397	1,024	1,309
1900	29,748	7,550	4,984	18,370	1,098	1,323
1901	41,102	11,062	5,868	26,702	1,156	1,321
1902	48,817	12,293	8,252	29,923	1,161	1,370
1903	49,200	8,342	9,868	31,797	1,227	1,437
1904	54,692	7,922	11,571	37,081	1,333	1,541
1905	65,250	15,080	8,859	44,015	1,429	1,693
1906	71,344	18,999	8,988	47,370	1,616	1,758
1907	65,201	15,793	8,610	42,675	1,504	1,795
1908	58,666	17,416	6,646	35,140	1,530	1,816
1909	66,359	15,185	5,934	40,835	1,674	1,926
1910	78,375	13,658	7,087	45,213	1,776	2,068
1911	91,131	14,543	7,950	49,893	1,883	2,139
1912	93,431	16,490	9,000	54,300	1,854	2,154
1913	89,192			52,913	1,735	
1914	107,047			67,799	1,792	

Source: NBER Series, No. 0148, 0150, 0163, 0164, 0223.

[a]At 90 per cent of market value.

[b]Adjusted to 100 per cent of market value, three-year moving average.

COMMENT

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As those of us who have had occasion to go prospecting for data are well aware, America's state and local documents contain virtually untapped mines of economic statistics. Manuel Gottlieb has not only struck a particularly rich lode buried in the *Reports of the Ohio Commissioner of Statistics* and kindred documents for that state, but has set up full-scale operations to exploit his find. In the present paper, he carries forward his earlier work on nineteenth-century building activity by utilizing assessment statistics in conjunction with other materials to fashion a series of estimates of new building in Ohio for the years 1837–1912. Specifically, Gottlieb provides us with a detailed account of the impressive amount of work that has gone into developing three major statistical series relating to the volume of construction in Ohio: (1) the "value" of total new building, (2) the "value" of new nonfarm residential building, and (3) the "value" of new commercial, industrial, and public (i.e., nonresidential) building. In each instance the final estimates are expressed in terms of 1870–1910 appraisal values, which Gottlieb considers tantamount to a constant price weighting of the various components of new building.

Use of this rather unorthodox standard of valuation appears to follow more directly from the nature of the original statistical deposit than from the particular techniques adopted in refining those materials. If the reliance upon property assessment data which this paper describes can be accepted, Gottlieb will have shown us a way of tapping a great vein of information. For, wherever property taxes were levied, at the state, the county, and municipal levels, there remain abundant deposits of assessed value statistics, many of which may be arranged in long time series disclosing, as is the case with the Ohio records, considerable historical detail.

Yet I remain rather more skeptical than Gottlieb as to the ultimate worth of nineteenth-century tax assessment records as bases for the estimation of stocks of real tangible wealth, or additions made thereto. It is, I suggest, generally symptomatic of the drawbacks inherent in this type of quantitative information that its use appears to require a great number of *ad hoc* adjustments, many of them guided only by adherence to the criterion of "assuring continuity of level or trend"—to cite Gottlieb's own description of the nature of the operation. Among the many difficulties posed by the character of the data with which Gottlieb has sought

to cope, those concerning the meaning of assessed values are both particularly vexing and especially important to an undertaking of this kind.

It is apparently difficult to determine just what correspondence actually existed between the values entered by the Ohio assessors for *new* structures and the variables usually explained by economic analysis, i.e., market prices and quantities. Gottlieb's paper presents evidence regarding ratios of assessed values to current market values for conglomerations of Ohio real estate property at several dates during the 1837–1912 interval, and it is presumed that these observations, though they relate to land as well as to old structures, may be taken as applying specifically to the relationships that existed between assessed values and market prices of new structures. That, however, is not the end of the problem, for, as Gottlieb's discussion makes clear, assessors did not seek to maintain a consistent or indeed even a changing relationship between the current market values and the appraised values of "property." Over the long run, appraisal rates appear to have reflected the Ohio assessors' appraisals of the condition of the real estate market as well as the particular property being assessed. The principal source of slippage cited by Gottlieb was occasioned by the assessment of the level of prices prevailing in the Civil War and postwar property market—against the fictional standard of "normal," nonspeculative values so cherished in Marshallian long-run equilibrium analysis. On the other hand, it is also pointed out that, within shorter time intervals, the valuations established for buildings in existence on the occasion of the last equalization of assessments were likely to have been those that constituted the proximate reference point in the determination of assessed values entered for new structures.

Waiving any questions concerning the collective ability of Ohio assessors to accurately describe the structure of future prices while establishing property valuations congruent to those set down in the recent past, neither adherence to the prospective nor the retrospective standard of valuation is particularly helpful in the present connection. No simple mechanical adjustments would suffice to retrieve the history of annual current market values from assessment data derived by application of the former—despite the fact that such application might be thought of as an expectational transform of previous market prices. At the same time, it is only reasonable to entertain serious doubts that the retrospective standard of valuation led Ohio assessors to appraise new structures in accordance with some base-year cost of the resources currently required to erect the buildings under consideration. Yet that is precisely what we are obliged to assume if the estimates based on undeflated assessed values (corrected only for "secular slippage" in appraisal rates) are to be admitted into the

company of conventional constant-dollar volume measures of gross additions to the stock of capital.

Beyond the difficulties and uncertainties surrounding efforts to adjust assessment statistics in order to eliminate the effects of shifts in assessment rates and appraisal standards over time, one encounters the problem of possible variations in assessment rates at given moments in time. Gottlieb's paper is rather ambivalent in its treatment of this issue. On the one hand, the general discussion seemingly proceeds on the tacit assumption that whatever actual assessment rates and appraisal standards happened to be, public awareness and pressure for fair treatment (although "just" values are not necessary market prices) tended to assure that they were uniformly applied to all taxable structures throughout the state. I do not know how reasonable a supposition about the assessment practices that prevailed in Ohio during the nineteenth century this may be, but, if Illinois' experience provides any guide, it would appear to bestow unwarranted praise upon the honesty and diligence of the average tax assessor. For example, land assessments in the Chicago central business district in 1896 were usually one-ninth of current market values; yet, in individual cases, assessments ranged from 1 per cent to 100 per cent of market value. Evidence at subsequent dates reveals similarly wide variations in assessment rates among different locations in Chicago and among different types of property and different owners, as well as among different urban places in Illinois.[1] If comparable variations existed in Ohio, they would not only jeopardize the validity of uniform adjustments of assessed values but, to the extent that the variations were of a systematic character, they would render disaggregations by type of property and location particularly treacherous.

On the other hand, Gottlieb reports having smoothed out the trends in assessed unit values for different categories of new structures individually, being prompted to do so because "assessment standards of new buildings *seemed* to pick up relative to assessment standards of old property" after 1897 in the case of dwellings, while, in the case of industrial buildings, "there *seemed* to be a steady erosion of appraisal standards until 1909." (The emphasis supplied is mine.) Assuming, of course, that the foregoing statements are not based solely on divergent movements in assessed unit values of different classes of property, it is a pity that Gottlieb's present paper does not make more use of his evidence of differential trends in ratios of assessed values to market prices for various categories of new

[1] Cf. *Report of the Illinois Tax Commission*, 1896, and Herbert D. Simpson, *Tax Racket and Tax Reform in Chicago*, Evanston, 1931, pp. 44–45; both cited in Homer Hoyt, *One Hundred Years of Land Values in Chicago*, Chicago, 1933, pp. 461–462.

buildings in Ohio. The latter would certainly seem to bear more directly on the question of the extent of the slippage in appraisal rates than do the ratios presented for Ohio real estate property *en masse*. In addition, the trends in the market value denominators of these ratios would throw further light on the secular decline in the prices of new industrial and commercial structures vis-à-vis prices for new houses, a relative price change that appears (from the recent work of Dorothy Brady) to have occurred in the U.S. during the decades that followed the Civil War. Moreover, the undisclosed magnitudes of cross-section variations in ratios of assessment value to market value are quite crucial; even if differential trend movements among the ratios implied by the assessment data have truly been rectified, a constant pattern of variation would still subject estimates of the aggregate volume of new construction to distortions caused by reliance on an inappropriate set of relative unit values in weighting the constitutent categories of new building.

The one major category of new construction for which assessed unit values could not be directly obtained from the Ohio data was farm residential building, and the specific technique employed by Gottlieb in closing the gap calls for some comment.

To obtain assessed unit values of farm dwellings Gottlieb sets up a model in which the mean unit cost of all kinds of dwellings in a given county is a linear function of (1) the proportion of the total county population living in urban places, (2) the proportion of the total nonurban population living in villages, and (3) a constant term. The idea underlying this approach is to employ the known locational distribution of the county population as proxy weights for the assessed unit values of farm, village, and urban dwellings, and, assuming the latter to be constants, estimate them by least squares regression analysis. The key assumption implicit in this approach—namely, that the annual ratio of the number of new dwellings to population is uniform across farm, village, and urban communities within a given county—may really be justifiable. But, if that is so, one rather wonders why investigators like Blank, Wickens, and Foster (let alone the Bureau of Labor Statistics, which also took up the work of estimating the total volume of residential construction from sample permit data) bothered to develop stratified sampling schema that classified communities according to size.[2]

[2] Cf. David M. Blank, *The Volume of Residential Construction 1889–1950*, National Bureau of Economic Research, Technical Paper 9, New York 1954; David L. Wickens and Ray R. Foster, *Non-Farm Residential Construction, 1920–1936*, NBER Bulletin 65, New York, 1937; *Construction Volume and Costs, 1915–1956*, a statistical supplement to *Construction Review*, U.S. Department of Commerce and Labor, 1958; *Techniques of Preparing Major BLS Statistical Series*, U.S. Department of Labor, Bureau of Labor Statistics, Bulletins 993, 1950, and 1168, 1954.

Suppose, however, that the implicit assumption is admissible. One could step up a regression model in which the mean unit value of all dwellings ($\bar{c}$) was a linear function of the proportion of the total population living in urban places (U/P), the proportion of the total population living in villages (V/P), plus a constant term. It would have the following form:

$$\bar{c} = a_0 + a_1(U/P) + a_2(V/P). \tag{1}$$

The constant term (a_0) in this function admits an unambiguous interpretation: it is the unit value of a farm dwelling. Similarly, the coefficient of the urban population share (a_1) is the urban-farm difference in the unit value of a dwelling; and the coefficient of the village population share in the total population (a_2) is the village-farm difference in unit value. All this is readily seen by invoking the assumption that new residential building is distributed exactly as is the population, writing the identity expressing the mean unit value of all dwellings as a weighted sum of the farm, village, and urban dwelling unit values, (c_f, c_u, c_v), thus,

$$\bar{c} = c_f[1 - (U/P) - (V/P)] + c_u(U/P) + c_v(V/P), \tag{2}$$

and then regrouping the terms to obtain the form of equation (1).

Note, however, that the regression model used in the paper differs from equation (1). Gottlieb reports that because the urban and village population shares in the total were found to be inversely correlated, to avoid multicollinearity he replaced the village share in total population with another variable, namely, the village share of the nonurban population. The revised model actually fitted was:

$$\bar{c} = a_0 + a_1(U/P) + a_2[V/(P - U)]. \tag{3}$$

Unfortunately, having done this, Gottlieb cannot legitimately then proceed, as he does, to interpret the estimate of the constant term in the revised regression model [equation (3)] as the unit value of a farm dwelling. There is, of course, one trivial case in which such an interpretation is legitimate—namely, when the proportion of the total population living in urban places is zero. This is especially significant in view of the vastly disparate estimates of the constant term that result when the model is applied to data for the urban counties in Ohio, on the one hand, and to data for the nonurban counties, on the other.

Finally, the estimate Gottlieb derived from this regression procedure was tossed into an average together with three other figures. The latter figures—being accorded three-fourths weight in determining the ultimate unit value for farm dwellings—would clearly concern us if we were particularly worried here about the precision of the final estimate obtained.

The issue raised above is, however, one that involves a principle of rather more general interest. The trouble would seem to have originated from a misplaced concern over the presence of multicollinearity. This econometric affliction is indeed troubling where one is primarily interested in securing a meaningful test of the statistical significance of regression coefficients; on the other hand, it does not lead to biased parameter estimates. In using a regression model such as that given by equation (1) to estimate unit values, it does not seem that one should be preoccupied with the question of whether or not a particular coefficient can really be taken to be significantly different from zero. Rather, one is attempting to decompose an aggregate into its *known* components; the general form of the appropriate regression model is derived from an identity, and cannot be in dispute. The two hypotheses that would, indirectly, be subjected to trial by the use of equation (1) are: the supposition that it is meaningful to talk about uniform unit values for each class of structures in the first place, and the more dubious assumption that the volume of new residential building was distributed among farms, villages, and urban places in precisely the same manner as the population.

Now it is one thing to call attention to the difficulties flowing from the character of assessed value statistics, or to note some particular technical defect in the way it has been handled, but it is quite another matter to venture assertions regarding the seriousness of such problems—that is, to appraise the over-all reliability of the final set of estimates that Gottlieb's paper presents. The latter issue can only arise legitimately once it is proposed that some particular use be made of these series: to evaluate the "reliability" of quantitative or any other sort of evidence *in vacuo* would be meaningless. After all, what considerations save those suggested by specific questions addressed to the data could serve to fix bounds within which inaccuracies—inevitably present in statistical reconstructions of the sort offered at this conference—are to be regarded as being of a tolerable order of magnitude? It is disappointing not to be able to find in Gottlieb's paper some definite indications of the context in which his estimates of three-quarters of a century of building activity in Ohio are meant to be evaluated. Being left, thus, at liberty to speculate on the question, it is entirely possible that I may unwittingly imagine these statistics will be used for purposes quite removed from those contemplated by their author. Yet, in view of the effort made in estimating them, we may at least be assured that this set of numbers was intended for ultimate service in capacities beyond that of providing corroborative detail for Margaret Reid's criticisms of the Grebler-Blank-Winnick data on unit real values of nonfarm dwellings.

Gottlieb's work will undoubtedly prove useful to inquiries into the role played by the instability of local construction activity in the generation and transmission of business cycles in Ohio's economy. Annual series relating to current expenditures on building (i.e., those derived from market prices) would, however, be rather more appropriate in that connection. Moreover, it would seem wise to hesitate before attaching particular significance to the precise pattern of turning points displayed by the annual series, if only in recognition of the rather arbitrary fashion in which the original observations relating to the completion of structures have been displaced backward in time. For each decade the percentage displacements are made to increase linearly with the absolute levels of assessed unit values, while over time the percentages displaced within each unit-value range decline from decade to decade in a strict arithmetic progression between 1858–69 and 1910–14. This is a convenient, but nontheless undocumented, specification of the course of technical change in the Ohio building trades.

The question of the extent of regional conformity with the long swing movements observed in new construction activity at the national level[3] obviously constitutes another context in which the Ohio building estimates are of immediate interest. Here, the common application of smoothing procedures would reduce the importance of imprecisions in annual observations. Yet, in attempting to ascertain the magnitudes of differences between relative amplitudes and durations of long-swing movements at the national and regional levels, it is presumably desirable to examine the movements of series that are in other respects closely comparable. Unfortunately, the mass of data available for the study of long swings in construction relate either to current values or to constant-dollar volumes obtained by the deflation of expenditure estimates; there is reason to suspect that, in comparison with the latter, the use of Gottlieb's assessment-derived estimates for Ohio might tend to promote an illusory reduction of the relative amplitude of regional fluctuations in the level of new building activity.

In a previous work, Gottlieb made use of annual data for the number of dwelling units erected in Ohio to fashion a corresponding aggregate series for the U.S. by projecting Ohio estimates to the national level. He has, I believe, shown commendable caution in not automatically following suit with the assessment value estimates described here. Can we trust that others will be equally judicious in their use of these statistics? Surely, their proper use would have been furthered had the present paper afforded

[3] Cf. Moses Abramovitz, *Evidences of Long Swings in Aggregate Construction Since the Civil War*, NBER, Occasional Paper 90, New York, 1964.

readers the benefit—even in most abridged form—of its author's insights into the specific differentiae of the nineteenth-century Ohio economy, particularly in their relationship to the history of building activity in that state.

REPLY *by Gottlieb*

The sense of apprehension with which Paul David evidently regards the use of property assessment statistics as a guide to building activity is, in my judgment, unfortunate. Property assessment figures are not a by-product of administrative operations, nor are they an information statistic gathered to appease curiosity seekers. They were used to apportion taxes among individuals and districts and hence were regarded seriously from the standpoint of accuracy and completeness of treatment of individual items, coverage, and summarization. Individual property assessments were listed in public records exposed to full public view and to pressures for equalized treatment; and consolidated assessment returns were meticulously examined at regular intervals by official bodies for disparities in assessment levels. In most communities, the basic facts on assessment process and outcome were matters of common knowledge among settled adult persons with property involvements. As a general rule it is true, as David asserts, that most assessment records, particularly of large and rapidly growing cities, will give erratic information on building because of the irregular revaluations of existing property and varying levels of assessment between assessment districts. But not always and surely not for all areas are property assessments so corrupt that a meaningful story cannot be extracted from them.

In Ohio, for reasons which I canvassed in the present paper and in an earlier study, assessment data have a high statistical potential. First, in Ohio the practice of revaluing existing properties was confined, substantially and by force of law and administrative practice, to the formal reassessment carried out every six years and after 1859 decenially by specially appointed appraisers. The shift of values arising out of revaluation can thus be largely isolated during most of our period from the shift in values reflecting new building net of demolitions. Secondly, at the opening (1846–59) and closing (1910–14) of our survey, a wide variety of evidence, including sales data, tax history, Census appraisals, and well-known facts, established nearly conclusively that realty assessments were adjusted to levels of market value. Contrary to David's impression, this approximation applied not only to land but also to improvements. And if old improvements or parcels of realty were valued for tax purposes at or near prevailing levels of market value, would not local pressure for

equalization require that new improvements (so readily tagged with a current value) be appraised for tax purposes on the same basis? This pressure was not presumed to have worked, as David implies, without imperfection. I found evidence of resistance to assessment at market levels in many of the rural counties, at least for newly built residential property, and I estimated that for 1910, 1911, and 1912 between 3,000 to 5,500 dwellings were reported with "clearly deficient values." Doubtlessly similar imperfections existed in the earlier period. Hence it was presumed that average reported values approximated 90 per cent of market value rather than market value itself. This implies, of course, that the deviance from market values would be skewed on the underside.

In the half century after the Civil War, the level of assessment under the influence of wartime inflation and lax tax administration drifted away from market value levels. Both old property and newly erected buildings were valued at less than market value; and both sets of values jumped after the assessment revolution of 1910. But there was no simple way to correct for drift from market levels. As noted in my paper, I found indications that Ohio building values were derived not from sale transactions but appraisals by assessors accustomed to valuation by conventional benchmarks which disregarded year-to-year shifting in building costs. At any rate deflation of these appraisals by a standard building cost index presented an implausible picture (Chart 2). Hence I chose not to deflate my building values between the Civil War and World War I but adjusted the pre-Civil War and post-World War I values to the level of what I came to term 1870–1910 appraisal values. I agree with David that this limits the usefulness of the final estimates and that application of more conventional deflation techniques would have been desirable. After the detailed series have been released, other investigators will be able to experiment with other adjustment and deflation techniques. But, however adjusted, the Ohio building statistics provide us with a significant new measure of building reaching back into the 1830's and carrying up to World War I.

My estimates of residential building values were in part constructed from an annual series of Ohio unit dwelling values covering both farm and nonfarm building. An effort was made to extract the farm component in these series by a regression of countywide dwelling values against index measures of urban and village population ratios. David states that use of these ratios presupposes that "the annual ratio of the number of new dwellings to population is uniform across farm, village, and urban communities within a given county." On the contrary, I expressly asserted that the population ratios "would yield a biased and inaccurate version

of the respective 'weights.'" These ratios were made wholly independent by computation on different bases, total population in one case and nonurban population in the other. This model produces a more reliable estimate of the respective parametric influence of urbanization and villages on dwelling values. David asserts that, with independent explanatory variables, the constant term in the regression equation no longer approximates farm values.

There is, I would contend, such an approximation if our regression coefficients of village and city influence can be reliably extrapolated to zero. In the test of the regression model for the Ohio sample groups, I pointed out that "the regression, apparently because of its linear form, attributes too much influence to urbanization at the lower end of the urban spectrum and too little influence at the upper end." Hence I would suggest the constant term in the urban county regression understates farm dwelling values less on account of the form of the village variable than on account of the linear form of the regression itself.

For the nonurban counties, our regression indicated that the village-farm differential was slight or nonexistent possibly because the suburban or satellite character of villages in urbanized areas was absent. Hence recorded mean values for these nonurban counties drawn chiefly from southeast Ohio were used to represent farm unit values. To facilitate evaluation of these two estimates of farm dwelling values, I added to the comparison another set of mean dwelling values for a slightly urbanized group of counties located chiefly in northwest Ohio. These three measures were then contrasted for balance with mean statewide values of barns and stables. Of the four measures plotted (see Chart 5), only one depended upon our regression. I found the four measures exhibited—and readers can judge for themselves—"a definite family likeness of movement." David can quarrel with my surmise that "the true figure probably lies somewhere in between" the series plotted. For the margins of accuracy needed for my projection and considering the variety of evidence brought to bear on the question, I would reaffirm that judgment. How one derives from there on some acceptable allowance for farm value, by averaging or some other method, is of secondary importance. What I averaged, in any case, was not two "disparate" regression estimates, one of them "meaningful," but one regression set of estimates and three sets of actual values believed to approximate farm dwelling values within some meaningful range.

Minerals and Fuels