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5. DERIVATION OF THE NEW ESTIMATES

THE BASIC sources of building data used in this project to estimate residential construction were the various building permit surveys conducted by the Bureau of Labor Statistics in cooperation with the Works Project Administration during the years 1938-40. In these surveys data on each building permit granted[1] in a large number of cities were transcribed. The time period covered by these transcriptions varied among cities, but no data for any city were gathered for years prior to 1870 or after 1930. For many cities, the data collected covered a continuous period of years; for others, there were significant gaps.

In the transcriptions, permits issued for the construction of new buildings were distinguished from those issued for other purposes, e.g. additions and alterations, repairs, demolitions, etc. Permits granted for new buildings were further classified by type of structure. The first major separation was between residential and nonresidential buildings, and within residential, between housekeeping and nonhousekeeping dwellings. Housekeeping dwellings were further classified into ten subgroups, e.g. one-family detached, one-family attached, two-family, side by side, etc.[2] Nonhousekeeping dwellings were divided into three subgroups, viz., hotels, lodging houses, and other nonhousekeeping dwellings. Nonresidential buildings were classified into 15 groups, e.g. institutions, office buildings, including banks, stores and other mercantile buildings, etc. For each permit issued for the construction of new buildings, the number of the permit, the date of issuance, the type of structure, the estimated cost of the project as given by the permit,[3] and, for residential structures, the number of dwelling units were listed on the transcription sheets.

When the permit survey projects were discontinued in 1940, these transcription sheets were stored with the Bureau of Labor Statistics. When the National Bureau of Economic Research organized its present study of capital formation and financing in the United States, use of the full set of collected data was made possible.

Through a cooperative arrangement between the Bureau of Labor Statistics and the National Bureau, BLS undertook to summarize the data in a form appropriate for processing. The data summarized were restricted to permits issued for new buildings, since the coverage of the permit data on additions

[1] In several cities, notably New York, the data were obtained from permit applications rather than permits issued.

[2] The full list of subgroups was one-family detached; one-family attached; two-family, side by side; two-family, two-decker; three-family, three-decker; four-family; apartments (five or more units); one- and two-family with commercial unit; three- and four-family with commercial unit; apartments with commercial unit.

[3] When building permits are applied for, the applicant is usually required to estimate the total cost of the complete project.

and alterations, etc., was generally agreed to be inadequate. Although monthly data would have been desirable for some purposes, the time and money required would have been beyond the resources of this study; accordingly, BLS provided annual totals.

For each city in the sample for each reporting year, the following data were derived by BLS from the transcription sheets:

1. Total new building permit valuation
2. Total dwelling units and total permit valuation for housekeeping residential building
3. Total dwelling units and total permit valuation for one-family structures without business
4. Total dwelling units and total permit valuation for two-family structures without business
5. Total dwelling units and total permit valuation for three-or more-family structures without business
6. Total dwelling units and total permit valuation for one-and two-family structures with business
7. Total dwelling units and total permit valuation for three- or more-family structures with business
8. Total nonhousekeeping residential permit valuation
9. Total nonresidential permit valuation

Although, again, it would have been desirable for many purposes to have the nonresidential data divided into several subgroups, the time and money required would have been far beyond the reach of this project. The division of housekeeping residential data into one-family, two-family, and three- or more-family structures was chosen to correspond with the classification of the current BLS estimates.

The summary data for the historical building permit surveys were supplemented by BLS with corresponding permit data for the 1920-30 decade for cities which were not included in the transcriptions, but were already available in the BLS files.

In addition, BLS obtained from Census reports population data for each reporting city, covering the initial and terminal censal years in each decade in which data for the city were available.

The summary sheets containing the annual permit data and the population figures for each sample city were then transmitted to the National Bureau of Economic Research. The data were there transferred to punch cards and processed by IBM equipment into the various forms necessary for the expansion of the city data to urban and nonfarm totals.

The total number of cities covered in the sample was 421.[4] The maximum number at any one time was 344 cities in 1920. The coverage of the sample

Table 9

NUMBER OF REPORTING CITIES IN BUILDING PERMIT SURVEY,[a] AND THE PROPORTION OF TOTAL URBAN AND TOTAL NONFARM POPULATION ACCOUNTED FOR BY SUCH CITIES, BENCHMARK DATES, 1890-1925

YEAR	NUMBER OF REPORTING CITIES [b]	% OF TOTAL URBAN POPULATION ACCOUNTED FOR BY REPORTING CITIES [c]	% OF TOTAL NONFARM POPULATION ACCOUNTED FOR BY REPORTING CITIES [c]
1890	25	22.0	14.5
1895	41	29.3	19.7
1900	68	35.6	24.0
1905	97	38.7	27.1
1910	148	45.0	31.6
1915	220	54.1	39.6
1920	344	68.9	50.3
1925	278	66.5	49.6

[a] For description of survey, see text.

[b] New York City's five boroughs treated as separate cities.

[c] Both the population of the reporting cities and the total urban and nonfarm population in 1895, 1905, 1915, and 1925 were defined in each case as the population at the following censal date.

at various benchmark years during the years 1890-1925, roughly the period for which new estimates of nonfarm residential construction are presented in this paper, is described in Table 9. The reporting cities accounted for about one fifth of the total urban population in 1890, about one third in 1900, one half in 1910, and about two thirds in 1920. They accounted for a somewhat smaller percentage of nonfarm population at these dates. The full list of cities in the survey and the years for which permit data are available for each city, as well as the proportion of urban population in city size classes and geographic divisions accounted for at bench mark dates, 1890-1920, are given in Appendix A, Tables 22 and 23.

From the tabulations of city data prepared by the National Bureau, the Institute for Urban Land Use and Housing Studies developed estimates of urban and nonfarm construction volume. In the course of this derivation, no adequate technique could be developed for expanding of the nonresidential data. Accordingly, the nonresidential segment was excluded from the scope of the project, and the data in this paper were restricted to residential construction.

Estimates of Urban Residential Construction Based on Population Relationships

To obtain estimates of residential construction in urban areas, the reporting cities were classified each year into four city size classes in each of the nine census divisions. These population size classes were as follows: I – 500,000 or more; II – 100,000 to 499,999; III – 25,000 to 99,999; and IV – 2,500 to 24,999. Even narrower size classes might have been desirable, but the

[4] The permit series of each of New York City's five boroughs started at a different date. Accordingly, each borough was treated as a separate city in all of the calculations in this project.

data were not sufficient to support greater detail. In some regions for some years, even this number of classes had to be reduced because of lack of data.

Since the classification was based on population at the nearest censal year, each city was placed each year in the size class in which it fell at the nearest censal date. Thus, a city in size class IV (2,500 to 24,999) in 1910 remained in size class IV in these calculations for the years 1905-14. For 1915 the city was placed in the size class determined by its 1920 population and remained there through 1924.

Three sets of data were obtained annually for each size class in each division: First, the number and permit valuation of housekeeping dwelling units started and the permit valuation of nonhousekeeping facilities started in the sample cities were summed. Second, the population of the reporting cities at the nearest censal year was summed. Third, the total population of all the cities in the size class at the nearest censal year was obtained from Census reports. From these data, the first set of annual estimates of urban residential construction was derived.

The basic procedure in obtaining these annual estimates was a simple expansion of the sample data in each size class in each division on the basis of population relationships between reporting cities and the sum of reporting and nonreporting cities. The ratio of total population of the size class to the population of the sample cities was applied to the sample data to yield estimates of total building in the given class for the given year.[5]

Exceptions to this procedure were employed when there were no sample data in a given size class in a given year, or when the reporting cities provided too small a sample for a reliable basis for expansion. In most of these cases one of three alternative techniques was used.

One technique involved the derivation of an average ratio between the building rate for the given size class and the building rate for an adjoining size class in the same division in some closely preceding or following period for which sample data were available in both classes. Application of this ratio to the building rate for the adjoining size class in the given year yielded an estimated building rate for the given size class. The estimated building rate was multiplied by the total population of the size class to obtain an estimate of total building in the class for that year. In these cases, the year-to-year movement of the estimated volume of construction in a size class for which data either were not available or not used was determined by the movement of building in the adjoining size class during the period in question.

[5] This is arithmetically equivalent to constructing annual building rates for the reporting cities, i.e. the number of units started or the permit valuation of units started or the permit valuation of nonhousekeeping facilities started per person, and applying these rates to the total population in the size class to yield estimates of total building in the size class. The further one gets away from the censal year, the more biased is the estimated building rate of the sample, owing to the use for an entire decade of the population in the censal year. However, the same bias is present in the total population figure for the size class, and the application of the biased building rate to the biased population figure will yield an unbiased building estimate for the size class if the sample and universe populations are subject to the same rate of growth.

When data for the given class and adjacent class were not available for a closely preceding or following period, a second procedure was employed. A ratio between building rates in the given size class in an adjacent division and an adjoining size class in that division in the given year was calculated. This ratio was then applied to the building rate for the corresponding adjoining size class in the given division to yield an estimated building rate for the given size class. The product of the estimated rate and the population of the given size class was the estimated building volume for the size class. This procedure again linked year-to-year movements in a given size class to movements in an adjoining class in the same region.

A third variant was employed in the few cases where no data were available for a division for a given year.[6] Ratios were calculated between building rates for each size class in the given division and building rates for corresponding size classes in an adjacent division in some closely preceding or following period. The ratios were applied to the building rates for the adjoining division in the given year to obtain estimated building rates for the given division. The estimated rates were multiplied by the total population of each size class in the given division to yield estimates of building volume. This procedure in effect linked the annual movements of building in a division for which data were unavailable or unusable to the movements of building volume in an adjoining division.

An example of the general technique employed in obtaining estimates from simple population relationships is given in Appendix B.

In the South Atlantic division for the 1920-29 decade, estimates were derived separately for Florida and for the division excluding Florida, since the inclusion of Florida, which was affected strongly by the land boom of the 1920's, might have distorted the divisional totals for this period. Since no data were available for the Pacific division prior to 1895, no estimates based on population could be made for this division for these years. Instead, estimates were based on change in population; the procedures are described in Appendix E.

Estimates of Urban Residential Construction Based on Change in Population Relationships

The expansion of sample data on the basis of the nearest censal population implicitly assumes the same rate of population growth in reporting and nonreporting cities in any size class. It further assumes, in estimates based on ratios between building rates in two adjoining size classes, that the two size classes had the same relative rates of population change in the year for which estimates were made as in the period from which the ratios were derived. To reduce any error resulting from these assumptions, a new set of estimates

[6] These cases were restricted to the East South Central division and were of primary importance during the early years under study.

was made for three sample divisions,[7] in which the expansion of sample data was based on relationships between decade *changes* in population in reporting and nonreporting cities. Limitations of time precluded extension of this technique to the remaining divisions. From the estimates for the three sample divisions, however, correction factors were developed which were applied to the remaining six divisions to yield the final urban estimates.

The choice of divisions was based on the following three criteria: first, geographical diversity, with one division from the major Census regions of the North, the South, and the West; second, adequate sample coverage for the greater part of the period under study; third, reasonable representation of the three major regions. The first two criteria suggested the selection of the South Atlantic and Pacific divisions. In the choice of a sample division for the North, the Middle Atlantic and New England divisions were possible alternatives, but it was felt that the New England division would be less representative of the North than the Middle Atlantic division.

The three sample divisions represented a major portion of the urban population and urban residential construction over the period under study. In the 1910-19 decade, for example, the Middle Atlantic and South Atlantic divisions accounted for about half the urban population of the North and South and at least as large a proportion of the urban residential building. The Pacific division accounted for three quarters of the urban population of the West. Accordingly, somewhat more than half of the final estimate of urban building was derived from direct application of the change-in-population technique. Less than half was derived indirectly by use of the correction factors computed for the three sample divisions.

To obtain the new set of estimates, three types of annual data were required: building data for the sample cities, decade data on population change for all the cities in each size class, and "annexation" data for all the cities in each class.

The basic classification procedure was identical to that used in the first urban estimates and described earlier, i.e. cities were assigned each year to the size class in which they fell at the nearest censal date. Accordingly, the annual classification of the construction data of the reporting cities was the same as that used in the earlier estimates.

The required data on changes in population between censal dates for groups of identical cities could not be obtained directly from summary Census tables, since these tables report the population for city size classes defined in terms of the population as of the given censal year. The change between 1910 and 1920 in the total population of size class II in the Middle Atlantic division, for example, would be affected by the reclassification over the decade of cities into and out of this size class. Therefore, it was necessary to determine the population of each city in each of the three divisions for each censal year,

[7] The Middle Atlantic, South Atlantic, and Pacific divisions.

1890-1930, and to recompute size class populations on a consistent basis. The procedures followed in these calculations are described in Appendix C.

After decade population changes had been estimated both for reporting cities and for the sum of reporting and nonreporting cities in each size class in each of the three sample divisions for each year, 1890-1929, the estimates were adjusted to eliminate the effect of annexations. The increase in population of any city between any two census dates includes the total population of any annexed areas, if annexations took place during the decade.[8] But the existing population of the annexed areas already was occupying dwelling units at the time of annexation. Accordingly, the population increases, estimated from census figures, had to be reduced by an amount sufficient to eliminate the distorting effect of annexations on population changes.[9] The adjustment procedure is discussed in Appendix D.

From the data on population change (adjusted for annexations) for the sample divisions and the corresponding construction data, estimates of total urban construction were derived as follows: Annual expansion factors were calculated representing the ratio between the total decade population change (adjusted for annexations) of each size class and the decade population change (adjusted for annexations) of the reporting cities in each class. These factors were applied to the construction data for the reporting cities to obtain the new estimates of total residential building in the given size classes. An example is given in Appendix E.

When sample data were unavailable or when the corrected change in population of the reporting cities represented too small a proportion of the corrected population change of a size class, alternative procedures were employed. The principal alternative was to estimate building rates for the given size class by the use of ratios between the building rates for the given size class and an adjoining size class in the same division in some closely preceding or following period. Special procedures were employed for the Pacific division for the years 1890-99, and for the South Atlantic division for the years 1920-29; they also are discussed in Appendix E.

After estimates based on change in population (adjusted for annexations) had been computed, annual correction factors were developed for each construction series for each of the three sample divisions. These factors are the ratios of estimates based on decade population change to the estimates

[8] The decade changes in population also reflect any detachments which took place during the decade. But investigation indicated that there were relatively few detachments over the period under study and that an insignificant number of people were affected by them. Accordingly, detachments were disregarded throughout the project.

[9] The error that would have been involved in using population change date without correction for annexation varied considerably among the three sample regions. This potential error was relatively small in the Middle Atlantic division, never exceeding 3.3 per cent except for the 1920's, but was somewhat larger in the other two divisions. It was as high as 17.1 per cent for the Pacific division around 1900 and almost as high for the South Atlantic division in the same period. The size of this potential error, which was avoided in this study by correcting for annexations, was a function of the magnitude of annexations in a given year, and its direction depended upon whether the bulk of annexations took place in reporting or nonreporting cities.

based on censal population. Since decade *changes* in population provide a more accurate basis than censal population counts for expanding construction data from reporting cities, the correction factors measure the bias involved in the use of censal population counts in the estimates for the three sample divisions.

The annual correction factor for each of the three residential construction series for the Middle Atlantic division was then applied to the equivalent estimates for the New England, East North Central, and West North Central divisions over the entire period, 1890-1929.

Annual correction factors derived from the South Atlantic division were applied to the estimates for the East South Central and West South Central states for 1890-1919. For 1920-29, however, the factors used for the East South Central division were derived from the South Atlantic division, excluding Florida; and the corrected estimates for the West South Central division were obtained directly by using population change data for this region. The corrected estimates for the South Atlantic division represent the sum of separate estimates for Florida and the remainder of the division.

Since, as pointed out above, estimates based on censal population could not be made for the Pacific division for the years 1890-94, it was impossible to calculate correction factors for these years. Therefore, the annual average factors for the Pacific division for the 1895-99 period were applied to the 1890-94 data for the Mountain states. For the years 1895-1929, the annual factors for the Pacific division were applied to the appropriate estimates for the Mountain states.

The correction factors varied over the period and among the divisions. In general, the corrections for the Middle Atlantic division were within plus or minus 5 per cent for each construction series, except for 1890-94 and 1910-20; in those years the ratios of the final to the original estimates ran somewhat under 0.95. The correction for 1920 resulted in a considerable reduction of the original construction estimate. In the South Atlantic division, the ratios ran between 0.72 and 0.88 for almost the entire period, 1890-1919, rising above 1.00 only after 1920. This indicates that the original series was somewhat overestimated during the first three decades and underestimated during the last decade. In the Pacific states the correction ratios rose steadily over the entire four decades, from about 0.40 in the 1890's, to between 0.80 and 0.90 in 1910-14, and ending at about 1.14 in 1925-29. However, the factors for the Pacific division, which showed the largest change of any of the three sample divisions, were applied to only the Mountain division, which accounted for a negligible proportion of total nonfarm residential building over the entire period.

The corrected series on urban residential construction in the nine geographic divisions were summed to yield annual estimates of the volume of urban construction in the United States, 1890-1929, which are presented in

Table 10

ESTIMATES OF URBAN RESIDENTIAL CONSTRUCTION IN THE UNITED STATES, 1890-1929

	NEW PRIVATE PERMANENT HOUSEKEEPING DWELLING UNITS		NEW PRIVATE PERMANENT NONHOUSEKEEPING RESIDENTIAL FACILITIES
	Number Started (in thousands)	*Permit Valuation (in millions of $)*	*Permit Valuation (in millions of $)*
1890	185	$409	$11
1891	169	309	10
1892	215	407	6
1893	151	292	7
1894	150	311	5
1895	175	358	6
1896	145	311	9
1897	165	337	15
1898	148	295	7
1899	159	319	8
1900	124	241	9
1901	180	368	40
1902	157	329	39
1903	166	356	22
1904	206	407	16
1905	332	701	24
1906	319	679	58
1907	283	596	23
1908	272	603	38
1909	322	756	31
1910	283	630	30
1911	288	631	52
1912	311	710	47
1913	307	698	30
1914	308	681	40
1915	316	746	26
1916	319	781	56
1917	175	438	31
1918	86	220	8
1919	230	865	46
1920	153	621	42
1921	346	1,327	59
1922	539	2,146	136
1923	668	2,727	163
1924	677	2,853	150
1925	737	3,263	280
1926	710	3,055	281
1927	589	2,673	121
1928	521	2,357	186
1929	333	1,526	352

For description of estimating procedure, see text.

Table 10. The expenditure estimates shown in this table have not been adjusted for undervaluation, preliminary costs, or builders' profits, i.e. they are permit valuations and are not converted to a work-put-in-place basis.

Table 11

INDEXES OF NUMBER AND PERMIT VALUATION OF URBAN HOUSEKEEPING DWELLING UNITS STARTED IN REPORTING CITIES, AND NUMBER OF CITIES UNDERLYING INDEX VALUES, 1870-1929
(1929 = 100)

	No. Started	*Permit Valuation*	*No. of Cities* [a]		*No. Started*	*Permit Valuation*	*No. of Cities* [a]
1870	27.8	16.0	1	1900	49.3	20.8	67
1871	39.3	20.2	1	1901	75.1	30.3	68
1872	27.3	13.0	1	1902	49.5	21.7	73
1873	25.8	8.9	1	1903	59.9	24.1	81
1874	24.5	8.0	1	1904	83.6	32.6	89
1875	24.9	8.5	3	1905	134.0	53.2	97
1876	21.0	7.1	4	1906	121.3	52.7	104
1877	17.5	6.6	5	1907	102.9	45.6	112
1878	16.3	7.3	5	1908	92.0	43.5	119
1879	21.4	10.8	4	1909	118.5	60.4	130
1880	32.1	12.4	4	1910	106.7	53.3	144
1881	36.4	16.9	6	1911	106.4	50.9	156
1882	38.2	18.6	7	1912	105.9	52.7	169
1883	52.9	19.6	7	1913	96.2	47.2	183
1884	63.5	20.2	10	1914	93.2	44.4	205
1885	71.8	25.6	12	1915	101.0	50.4	215
1886	82.1	29.1	12	1916	101.3	54.2	229
1887	91.1	32.8	13	1917	48.3	26.9	236
1888	74.7	25.2	14	1918	24.6	13.5	255
1889	88.3	33.3	20	1919	68.6	55.3	271
1890	84.5	31.7	24	1920	47.2	43.6	234
1891	67.9	24.7	29	1921	94.2	83.3	266
1892	77.8	29.3	32	1922	155.5	140.3	270
1893	55.1	20.5	31	1923	193.7	178.5	273
1894	54.4	20.9	34	1924	193.9	187.1	275
1895	73.6	27.7	39	1925	208.1	207.0	276
1896	58.7	23.3	43	1926	192.3	190.1	296
1897	75.4	28.0	47	1927	172.8	173.3	306
1898	65.3	25.0	52	1928	155.5	153.9	312
1899	84.9	33.6	63	1929	100.0	100.0	314

[a] New York City's five boroughs are treated as independent cities throughout. For method of obtaining indexes, see text.

Comparison of Urban Estimates with Basic Sample Data

In Table 11, chain indexes of urban housekeeping dwelling units started and the permit valuation of such units, calculated directly from the basic permit data used in this study, are presented for the period 1870-1929. The indexes were computed by first deriving relatives of the aggregate number of dwelling units authorized and the aggregate permit valuation of such units in identical cities in the sample between pairs of successive years.[10] These relatives were then chained together, and indexes were obtained by using the year 1929 as a base period.

The coverage of the indexes indicated in Table 11 changed over time as the

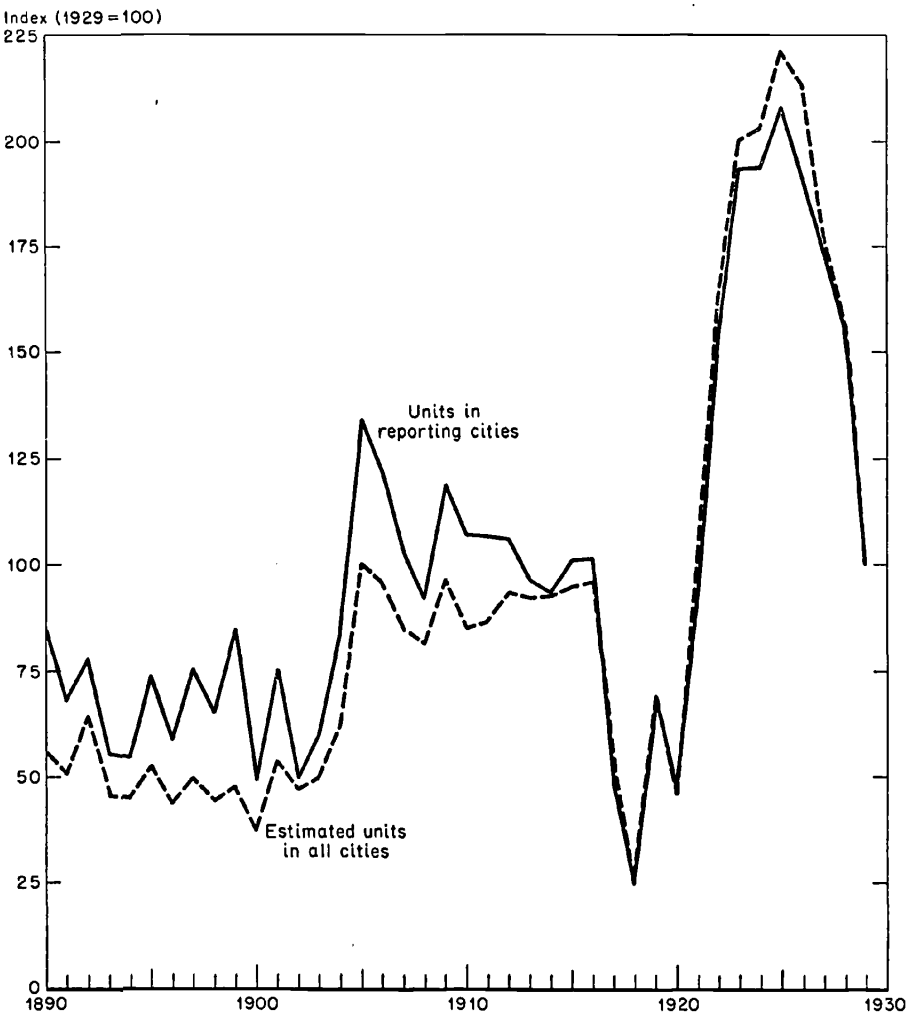
[10] The permit data for New York City were adjusted to exclude lapses in permit applications for three- or more-family structures. See Appendix F for details.

sample of reporting cities varied. The number of cities underlying the indexes increased rapidly through the 1880's and 1890's; by 1900, 67 cities were included; by 1910, 144 cities; by 1920, 234 cities; and by 1929, 314 cities.

The indexes provide a direct summary of the permit data, unaffected by the expansion procedures used in the derivation of the urban construction estimates. Thus, they permit a direct analysis of the movement of urban residential construction as defined by official permit records of all reporting cities available for this project, within the limitations of the chain index technique. A comparison between these indexes and the new urban estimates presented in Table 10, converted to index form, provides an opportunity for determining how well the movement of the aggregate series conforms to that of the sample data themselves. This comparison is drawn in Charts I and J for the period 1890-1929.

Chart I

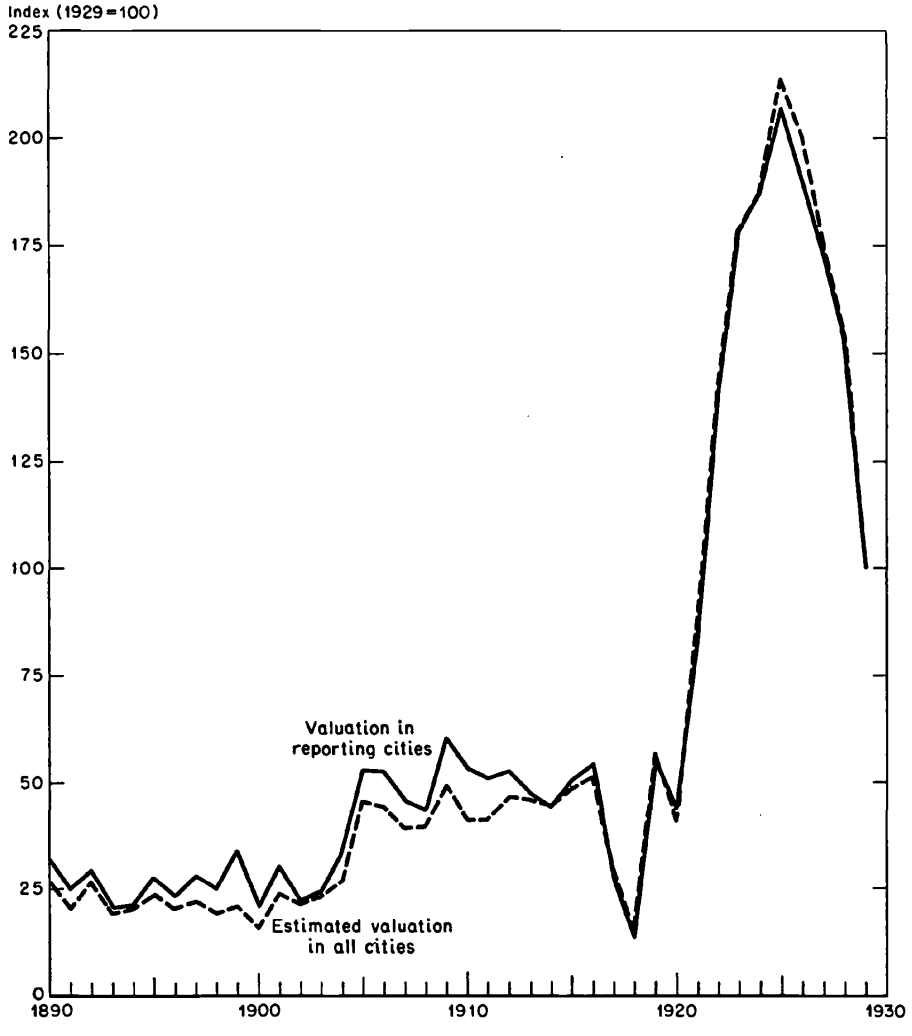
INDEXES OF NUMBER OF URBAN DWELLING UNITS STARTED, 1890-1929



Source: Tables 10 and 11.

Chart J

INDEXES OF PERMIT VALUATION OF URBAN DWELLING UNITS STARTED, 1890-1929



Source: Tables 10 and 11.

In general, the indexes based on the permit data and those derived from the aggregate urban estimates show quite close conformity, although the indexes based on the permit data appear somewhat more volatile in the early years. There is a small difference in long-run trend between the two sets of series, with the indexes based on aggregate estimates showing a somewhat greater rise over the period. This difference may be due to biases in the chain indexes, or more probably to the fact that the aggregate estimates correctly weight the sample data by the population or population change of the urban strata they represent. In contrast, the chain indexes involve a simple summation of the sample data without regard to their representativeness. At any rate, there is no evidence that the expansion techniques employed in the derivation of the urban estimates have done any violence to the underlying sample data.

Estimates of Nonfarm Dwelling Units Started

The estimation of construction activity in rural nonfarm areas presented the most difficult problem of the entire project. Except for the most recent years, there are no building permit data for the volume of residential construction in rural areas; permit systems are relatively new and even now relatively rare in such areas.[11] Accordingly, construction estimates for rural areas had to be made on some synthetic basis.

Two such bases were available. One was David L. Wickens' decade estimates of nonfarm dwelling units constructed, 1890-1929.[12] These estimates could have been accepted, and the urban estimates prepared in this study subtracted from them, to yield decade estimates of rural nonfarm starts. These starts could then have been allocated annually in accordance with the movement of the urban series and a permit valuation series inferred.

Wickens' technique consisted essentially of calculating decade increments in the Census counts of families (now called households) and adjusting these increments for decade changes in the number of farm families and for nonfarm demolitions, conversions, and changes in vacancies, to yield the number of dwelling units constructed. The adjustments for the pre-1920 decades were based at best on extremely scanty evidence. Errors in these adjustments are carried over into the final estimates; indeed, for vacancies, they are magnified several fold. The wide potential margins of error in Wickens' figures are illustrated in Appendix G. They were considered sufficiently serious to warrant the selection of the second basis, i.e. population data, for estimating rural nonfarm construction.

If the new urban series is reasonably accurate, and if population is a dominant factor in determining the level of residential construction (as was assumed in the derivation of the urban series), then the relationship between urban and rural nonfarm population should yield a reasonable estimate of rural nonfarm construction. One possible technique was simply to derive a rural nonfarm series by applying to the urban series the censal ratios of rural nonfarm population to urban population. But population *growth* is a better indicator of construction activity than absolute population, and rural nonfarm population and urban population grew at different rates in each of the four decades under study.[13] A simple population expansion would have yielded estimates of rural nonfarm building and, therefore, total nonfarm building, which had different margins of error in each decade. Therefore, decade ratios

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[11] Theoretically, it would be possible to use the F. W. Dodge data on construction contracts awarded *in lieu* of building permits. However, for the difficulties of using the Dodge data for that portion of the 1890-1929 period for which such data are available, see David L. Wickens, *Residential Real Estate* (National Bureau of Economic Research, 1941), pp. 56-59.

[12] Wickens, *op. cit.*, pp. 53-56.

[13] Based on urban-rural classification as of the beginning of each decade, urban population growth was estimated in this project at 27.5 per cent in 1890-99, 32.0 per cent in 1900-1909, 24.5 per cent in 1910-19, and 23.2 per cent in 1920-29; rural nonfarm population growth was estimated at 44.7 per cent, 38.6 per cent, 22.3 per cent, and 28.1 per cent in the respective decades.

of rural nonfarm population *growth* to urban population *growth* were estimated, and these estimates were used to expand the urban construction totals to nonfarm totals.

Direct Census data do not provide measures of the decade increases in urban and in rural nonfarm population on a consistent basis even for those years in which rural nonfarm population is identified.[14] In 1920, for example, Census figures for urban and rural nonfarm population are based on the 1920 classification of areas. In 1930 the figures are based on the 1930 classification. The apparent decade increase in urban population is overstated by the population in 1930 of those areas reclassified from rural to urban status. The increase in rural nonfarm population is correspondingly understated.

Instead of direct Census reports, a report based on Census figures was used for the period subsequent to 1900.[15] This report presents the percentages of total United States population accounted for by urban and rural areas at the beginning and end of each decade, with the urban-rural classification based on that existing in the initial decade year. The urban percentages could be applied directly to the Census counts of the United States population and the decade increment calculated. The derivation of the increments in rural nonfarm population was somewhat more complicated, for it was necessary to segregate the rural nonfarm population from the total rural population, which includes, of course, the population living on farms.

This problem was solved in two steps. First, the percentages of United States population accounted for by rural population were applied to the Census figures on total United States population to yield estimates of rural population at the beginning and end of each decade, based on areas classified as rural at the beginning of each decade. Second, the rural farm population, as counted by Census in 1920 and 1930, was subtracted from the estimates of rural population to yield estimates of rural nonfarm population. For 1910 the official estimate of farm population made by the Bureau of Agricultural Economics, adjusted slightly to exclude the estimated number of urban farm population, was used.[16] For 1900 another and less reliable BAE estimate of farm population,[17] similarly adjusted, was used.

For the decade 1890-99, it was necessary to estimate the 1890 and 1900 rural and urban population, classified as of 1890. The 1900 estimates were derived by modifying the previous figures for 1900 by the estimated rural population reclassified during the decade. The 1890 estimates were based

[14] Rural nonfarm population was first identified in the 1920 Census. A 1910 estimate can be made by subtracting from the Census count of rural population in that year, the official U.S. Bureau of Agricultural Economics estimate of farm population (subject to a minor adjustment for the urban farm population).

[15] Warren S. Thompson, *The Growth of Metropolitan Districts in the United States, 1900-1940* (U.S. Bureau of the Census, 1948), p. 6.

[16] *Historical Statistics of the United States, 1789-1945* (Bureau of the Census, 1949), p. 29.

[17] Martin R. Cooper, Glen T. Barton, and Albert P. Brodell, *Progress of Farm Mechanization*, Department of Agriculture *Miscellaneous Publication No. 630* (1947), p. 5.

directly on Census data, adjusted for urban farm population and for annexations of rural areas by areas that were classified as urban in 1890.[18] The rural nonfarm population in 1900 was obtained by subtracting the BAE farm population estimate, adjusted for urban farm population, from the estimated 1900 rural population. Similarly, the 1890 rural nonfarm estimate was based on the 1890 rural population estimate, minus the BAE farm population estimate, adjusted for urban farm population.

Of all the adjustments involved in these estimates, that for reclassification was by far the most important. Reclassification of population from rural to urban status averaged about 2.0 million per decade for the four decades in question. The other adjustments ranged between 0.1 million and 0.2 million per decade.

From the estimates of the decade increments in urban and rural nonfarm population, ratios of the increase in nonfarm population to the increase in urban population were computed for each decade. These ratios, as pointed out above, were based on the rural-urban classification as of the beginning of each decade. This classification although consistent does not conform to the classification used in the development of the urban series, for which population in the *first half* of each decade was defined as that specified by the preceding Census, and population in the *second half* of the decade as that specified by the following Census. Therefore, rural nonfarm areas which were reclassified to urban status during a decade were implicitly rural during the first half of the decade and urban during the second half. The direct use of the derived rural-urban ratios for a full decade would then have overestimated rural population growth and, therefore, rural nonfarm building.

Accordingly, estimates were made of the relative amounts of rural nonfarm and urban population growth for each decade, based on the rural-urban classification at the *end* of each decade. The estimates involved the same adjustments utilized in the first estimates plus an assumption that reclassified rural areas grew at the same rates as non-reclassified areas. This assumption permitted estimation of the population at the beginning of each decade of those areas classified as rural at the end of each decade.[19]

Finally, for each decade ratios of the increase in nonfarm population to the increase in urban population were computed. The theoretically correct procedure at this point would have been to utilize the ratios based on beginning-of-decade relationships for the first five years of each decade and the ratios based on end-of-decade relationships for the last five years of each decade. But the latter ratios contained a greater margin of error than the former, since they were based on an assumption about rates of growth of

[18] The annexation adjustment was very minor, amounting to only about one-tenth of the reclassification adjustment, and was made in order to be consistent with Thompson's procedure which credited urban areas at the beginning of each decade with the annexations of rural areas made during the decade.

[19] It is possible that reclassified areas grew somewhat more rapidly than non-reclassified areas. If this is true, then the second set of estimates slightly underestimates rural nonfarm growth.

reclassified and non-reclassified areas. Therefore, instead of using these end-of-decade ratios for five years of every decade, an average of the two ratios for each decade was used in expanding the urban series to nonfarm totals.[20] For each of the four decades a ratio was chosen which lay approximately midway between the ratio based on the classification at the beginning of the decade and the ratio based on the classification at the end of the decade, but adjusted slightly toward the former or latter figure, depending on which half of the decade was characterized by greater construction volume in urban areas.

The final expansion ratios were 1.770 for 1890-99; 1.527 for 1900-1909; 1.370 for 1910-19; and 1.422 for 1920-29.[21]

The expansion ratios for each decade were then applied to the annual estimates of urban housekeeping dwelling units started to yield annual estimates of total nonfarm dwelling units started.

Two Basic Assumptions in Expansion Procedure

The expansion procedure involves at least two basic assumptions which may be subject to question. One is that the amount of rural nonfarm residential construction bears the same relationship to the increase in rural nonfarm population that urban construction bears to the increase in urban population. It has been argued that such an assumption leads to some overstatement of rural nonfarm construction because of the difference in the rate of decline of household size in urban and rural areas.[22] It appears to be true that average household size in urban areas was decreasing significantly, while that in rural nonfarm areas may not have decreased and, in fact, may actually have increased over the 1890-1930 period.[23] However, in the first place the data for the early decades are not very precise. Second, and more important, the relationship between the number of new households formed and the increase in population is determined not by the direction of movement in, or the rate of change of, average household size, but by the level of the average household size of the addition to population, or, more precisely, the incremental household size. Although urban average household size declined from 1890, the decline was from such a high level and was so gradual that the incremental

[20] This procedure results in a slightly lower estimate of nonfarm building during the first half of each decade and a slightly higher estimate during the second half, when measured against the results obtained by using the separate ratios for each half-decade. The differences generally amount to about 1 or 2 per cent.

[21] These ratios are much higher than the expansion ratios which would have been obtained if Census and other data had been used directly, without allowance for the effect of reclassification of areas from rural to urban status. Such ratios would have been 1.38 for 1890-99; 1.29 for 1900-1909; 1.16 for 1910-19; and 1.25 for 1920-29.

[22] Wickens, *op. cit.*, p. 43.

[23] Average urban household size: 1890 – 4.81; 1900 – 4.61; 1910 – 4.47; 1920 – 4.23; 1930 – 3.97. *The American Family* (National Conference on Family Life, May 1948), p. 10.

Average rural nonfarm household size: 1890 – 3.4; 1900 – 3.7; 1910 – 3.8; 1920 – 4.2; 1930 – 3.9. Rough estimates derived for this study from data in *The American Family;* Cooper, *et al., loc. cit.;* and *Historical Statistics of the United States,* p. 29.

household size was probably quite high, though declining. The probable rise in the average size of rural nonfarm households over at least a portion of the 1890-1930 period was from such a low level that the rural nonfarm incremental household size was probably lower than that for the urban population over most of the period. The data are too crude to permit any confidence in precise calculations, but it is more than questionable whether the expansion technique used here involved any overestimate of residential building in rural nonfarm areas. In fact, if a judgment is required as to the bias inherent in the technique employed, it seems most reasonable to state that the technique somewhat underestimated rural nonfarm building in the 1890-99 and 1900-1909 decades, slightly underestimated it in the 1910-19 decade, and probably was reasonably accurate in the 1920-29 decade. The errors, in any case, are probably small.

The second basic assumption in the expansion technique is that the variation within any decade in rural nonfarm building was proportional to the variation in urban construction. Since no data on rural nonfarm construction are available for the period in question, this assumption cannot be tested. It is important to note, however, that rural nonfarm building as estimated for this study represented only about one third of total nonfarm construction during the period covered.[24] Thus, only very wide differences in the timing or relative amplitude of the urban and rural nonfarm building cycles would affect the nonfarm totals significantly. Since all data from urban permit records indicate that the building cycle was a highly pervasive phenomenon, it seems reasonable to assume that differences in cyclical behavior between the urban and rural nonfarm segments were minor. If rural nonfarm building was more stable than urban building or had different turning points, the new series would overstate the amplitude of the nonfarm residential building cycle. If the rural nonfarm construction cycle had the same timing but greater relative amplitude than the urban cycle, the new series would be more damped than the true nonfarm construction cycle.

Estimates of Permit Valuation of Nonfarm Dwelling Units Started

To obtain estimated expenditures for rural nonfarm dwelling units started, the population change ratios required adjustment. This adjustment involved an allowance for the lower average valuation of rural nonfarm dwelling units compared with building permit valuation of urban dwelling units.

In the past, rural nonfarm dwelling units have generally been lower in value than urban units, partly because of lower labor costs and partly because of lower quality or smaller size. Census data yield considerable evidence of this relationship for existing units, and Wickens presents some evidence for new units. On the basis of these data the average valuation of rural nonfarm units

[24] Rural nonfarm residential building accounted for a slightly higher proportion in the 1890-99 decade, and a slightly lower proportion in the 1910-19 and 1920-29 decades.

was estimated at 66 per cent of the average valuation of urban units for all years covered by the new series.

Wickens, in deriving estimates for expenditures on residential construction for the 1920's, was faced with the same problem since he also lacked permit data on rural nonfarm construction expenditures. Using slim evidence from the 1931 President's Conference on Housing, however, he estimated that in the 1920's rural nonfarm units averaged 66 per cent of the average cost of urban dwelling units located outside metropolitan districts.[25] Wickens' definition of rural nonfarm areas was not synonymous with that of the Bureau of the Census – and therefore with that employed in this study – and his ratio applied only to nonmetropolitan areas. Nevertheless, calculation of the ratio of the average cost of all rural nonfarm units to the average for all urban units in Wickens' final estimates for 1920-29 yields a ratio of 65.7 per cent.

According to the 1940 Census, the ratio for the average value (including land) of all existing rural nonfarm owner-occupied dwelling units to the average value (including land) of existing urban owner-occupied units was 58.3 per cent.[26] Since land-to-structure ratios are typically lower in less populated areas, the 1940 ratio for dwelling units exclusive of land would probably lie not far from Wickens' 66 per cent estimate.

There remained a question as to whether this ratio should be varied over time. Examination of the scanty historical data (Table 12) on the ratio of the average value per standing rural nonfarm dwelling unit to the average value per standing urban dwelling unit yields no firm basis for suggesting a trend in the ratio.

It will be noted that there are incomparable elements in the entire set of ratios, which make interpretation of the movement of the ratios extremely difficult. These discrepancies relate to the use of average versus median values and structure versus dwelling unit values, and to the difference in rural nonfarm and urban coverage over the period.

The only ratio in Table 12 which is based on average dwelling unit values and which involves full coverage of the urban and rural nonfarm owner-occupied segments is that for all owner-occupied nonfarm units in 1940, viz., 58.3 per cent. The ratio for one-family owner-occupied mortgaged units in 1940 is quite close: 57.4 per cent. The 1930 ratio, which is the lowest in the whole period, is based on median values. The 1940 ratio based on median values is quite close to the 1930 ratio and considerably lower than the other 1940 ratios. Even though there is a structure-dwelling unit discrepancy involved, this relationship suggests that a 1930 ratio based on average values would come close to the 1940 ratios.

The 1890 and 1920 ratios are more confusing. The 1920 ratio of 67.3 per cent is biased upward by the inclusion of structures in cities with popula-

[25] Wickens, *op. cit.*, pp. 52-53.

[26] *Sixteenth Census of the United States, Housing,* Vol. II, Part 1, p. 45.

Table 12

RATIO OF AVERAGE VALUE PER RURAL NONFARM DWELLING UNIT TO AVERAGE VALUE PER URBAN DWELLING UNIT, 1890, 1920, 1930, 1940

(dwelling unit values include land)

		Value	*%*
1890	*Nonfarm owner-occupied mortgaged structures*		
	a) Average value per structure, rural nonfarm and cities under 8,000	$2,244	
	b) Average value per structure, cities of 8,000 or more	4,373	
	c) Ratio of *a* to *b*		51.3
1920	*Nonfarm owner-occupied mortgaged structures*		
	a) Average value per structure, rural nonfarm and cities under 25,000	3,905	
	b) Average value per structure, cities of 25,000 or more	5,805	
	c) Ratio of *a* to *b*		67.3
1930	*Nonfarm owner-occupied structures*		
	a) Median value per structure, rural nonfarm	2,661	
	b) Median value per structure, urban	5,743	
	c) Ratio of *a* to *b*		46.3
1940	*Nonfarm owner-occupied dwelling units*		
	a) Median value per unit, rural nonfarm	1,715	
	b) Median value per unit, urban	3,501	
	c) Ratio of *a* to *b*		49.0
	d) Average value per unit, rural nonfarm	2,408	
	e) Average value per unit, urban	4,131	
	f) Ratio of *d* to *e*		58.3
1940	*Nonfarm one-family owner-occupied mortgaged dwelling units*		
	a) Average value per unit, rural nonfarm outside of metropolitan districts	2,702	
	b) Average value per unit, urban and rural nonfarm inside metropolitan districts	4,705	
	c) Ratio of *a* to *b*		57.4

Sources

1890: *Eleventh Census, Report on Farms and Homes,* p. 79; 1920: *Fourteenth Census, Mortgages on Homes in the United States, 1920,* Census Monograph II, p. 102; 1930: *Sixteenth Census, Housing,* Vol. II, Part 1, p. 49; 1940: *Ibid.,* pp. 45, 49, and Vol. IV, Part 1, pp. 19, 24, 29.

tions between 2,500 and 25,000 in the rural nonfarm category. The ratio is biased downward because it is based on structure values; this bias affects the denominator of the fraction, urban average values, more than the numerator, rural nonfarm average values. The net effect is probably some upward bias.

The 1890 ratio of 51.3 per cent has similar offsetting biases, viz., the use of structure values and the inclusion of structures in cities with populations between 2,500 and 8,000 in the rural nonfarm category. The biases are probably smaller in the 1890 data than in the 1920 data, and the direction of the net effect in 1890 is difficult to judge.

There might have been some rise in the ratio between rural nonfarm and urban valuation between 1890 and 1920 or 1940, and possibly some fall between 1920 and 1940. But all the ratios are based on land plus structure values. Since there is strong likelihood that the differentials in land ratios between rural nonfarm and urban areas narrowed between 1890 and the decade of the 1920's, the ratio of dwelling unit values exclusive of land may

well have remained roughly constant over this period. At any rate, there is no strong evidence to the contrary.

The expansion factors for the nonfarm housekeeping expenditure series were therefore reduced to allow for an average cost of rural nonfarm units of 66 per cent of the average for urban units. The revised factors were then applied to the urban permit valuation series to yield a series on permit valuation of nonfarm dwelling units started.

Adjustment for Undervaluation

It is generally accepted that permit values typically understate the final construction cost of residential structures. The reasons usually ascribed for such undervaluation include the fact that real estate tax assessments and permit fees are often based on permit values and that certain types of equipment, such as wiring and plumbing and heating equipment, are sometimes not included in the permit cost estimate.[27] Permit values may be understated somewhat more than average in periods of rising construction costs and somewhat less in periods of declining costs.

There are scattered data on the average percentage of undervaluation in various areas over the last thirty years. These data are sufficiently adequate to establish a reasonable estimate of undervaluation for the period since 1920, although there is some margin of error inherent in such an estimate.

Wickens concluded that average construction costs per dwelling unit for the period 1920-36 were about 18 per cent higher than permit values.[28] Chawner raised his preliminary estimates of residential construction volume by 17.6 per cent to allow for undervaluation.[29] Long questioned the heads of building departments in 50 cities and found that of the 35 willing to provide quantitative estimates of undervaluation, 29 indicated undervaluation of 25 per cent or less; and of these, 21 estimated undervaluation between 15 per cent and 25 per cent. Long also quoted a 1938 BLS study stating that the average contract price (excluding land, overhead, and sale profits) of single-family houses in 8 cities was 16 per cent higher than average permit values.[30] BLS field surveys in the post-World War II period indicated that the average ratio of estimated construction costs of nonfarm dwelling units to average permit valuation ranged between 1.10 and 1.17 during the period April 1948–September-November 1950.[31] For the same period the equivalent ratio for

[27] "Construction Statistics Analyzed: Permit Records and Contract Records Compared" (release by F. W. Dodge Corp., July 20, 1936), as cited in Wickens, *op. cit.*, pp. 51-52.

[28] Wickens, *op. cit.*, p. 51. The data, however, seem to indicate a somewhat higher level of undervaluation.

[29] Lowell J. Chawner, *Construction Activity in the United States, 1915-37* (Department of Commerce, 1938), pp. 44-45.

[30] Clarence D. Long, Jr., *Building Cycles and the Theory of Investment* (Princeton University Press, 1940), pp. 97-98.

[31] Kathryn R. Murphy, "Lag in the Use of Residential Building Permits," *Housing Research*, Winter 1951-52, p. 50. Construction cost differs slightly from previous definitions, since it includes operative builders' profits on construction operations.

rural nonfarm units varied between 1.08 and 1.14. For the period September-December 1945–September-November 1950, the ratio for urban units ranged from 1.12 to 1.25.

On the basis of this evidence, Wickens' 18 per cent estimate for the 1920's appears reasonably accurate. There is a possibility that the ratio has been somewhat lower in recent decades, perhaps because of the increasing effectiveness of permit regulations. It would seem logical to conclude that undervaluation was at least 18 per cent in the decades prior to 1920, and possibly somewhat higher.[32] In the absence of any data for the pre-1920 period, it was decided to utilize the 18 per cent ratio for the entire period covered by the present study, with the realization that this procedure might involve some understatement of construction expenditures in the early decades. Accordingly, each annual estimate of nonfarm housekeeping permit valuation was raised by 18 per cent.[33]

Adjustment for Preliminary and Other Costs

The official joint estimates by the Bureau of Labor Statistics and the Department of Commerce of housekeeping residential construction expenditures, which are derived primarily from permit data, have until recently failed to take account of certain components of such expenditures which are included in the purchase price paid for residential facilities by their first purchasers. These omissions cover items which are excluded in the estimate of cost on building permit applications; they comprise architects' and engineers' fees, land development costs, and operative builders' profit margins on construction operations. In May 1950, however, revisions of the housekeeping residential construction series, 1915 to date, were published, incorporating estimates for these components of final construction expenditure.[34] The official housekeeping series will continue to be calculated on the revised basis.

Each of these three percentage adjustments is calculated separately in the revised BLS-Commerce series, and two of the three are varied annually. But the combined effect of the three was relatively constant over the three decades, 1915-44. The average adjustment per decade ranged from 8.3 per cent to 8.9 per cent, although there was some cyclical variation within each decade. The stability of this ratio over the three decades, although partly a result of the estimation procedure and the very scanty data upon which the adjustments were based, indicates little secular movement over time. Since no data at all exist for earlier decades, it was decided to use the post-1914 adjustment ratio

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[32] Long, however, concluded that there was no particular change in undervaluation over time. (*Op. cit.*, pp. 97-98).

[33] The undervaluation adjustment was applied to both the urban and rural nonfarm components. Since the latter had been computed as a ratio to permit values in urban areas, it was necessary to apply the correction for permit undervaluation to it as well.

[34] Department of Commerce, *Construction and Construction Materials,* Statistical Supplement, May 1950, pp. 6, 79-81. The adjustment for builders' profits has been included in the undervaluation allowance since 1945.

for the pre-1915 data, adjusting it downward slightly on the assumption the costs under consideration were somewhat less important in the early years.[35] Accordingly, the new housekeeping series (adjusted for undervaluation) was further raised by eight per cent in each year, 1890-1914. For the post-1914 years, the actual BLS-Commerce adjustment ratio was used.

It is important to note that "speculative profits of operative builders still are not included conceptually in estimates of the value of . . . construction," in the official housekeeping series.[36] Therefore, since the new series developed for the present study uses essentially the same adjustment factors, such profits are conceptually excluded from this new series as well. If construction expenditures are defined to include all elements (except raw land and separable equipment) in the purchase price of new residential facilities, then both the new series and the official series may generally understate such expenditures because of this exclusion, or at least, be more damped than a series so defined.

Conversion to Work Put in Place

The BLS-Commerce housekeeping expenditure series for 1915-50 represents neither the construction cost of dwelling units started in that period nor the construction cost of units completed or sold to the first purchaser in that period, but the "cost of materials put in place or otherwise consumed, the wages of workers who placed the materials, and appropriate charges to the work for overhead and profit" in that period.[37] Since the new series, after the undervaluation and preliminary cost adjustment, still represented the construction cost of units started in each year, it had to be converted to a work-put-in-place basis for comparability with the official series.

The BLS-Commerce series in recent years has been compiled on a monthly basis and converted to work put in place by application of empirically derived patterns of lags in starts and of construction operations. The series prepared for this study was computed with annual, not monthly, data; therefore, these patterns could not be used for conversion purposes. Rather an estimate had to be made of the average carry-over into the following year of the construction cost of units started in a given year.

Here again little published data are available for recent periods and none for early periods. However, in discussion with the writer, officials of the Bureau of Labor Statistics estimated that the carry-over in housekeeping residential construction was about 15 per cent in 1950 and 1951, and somewhat higher in 1949, because of a late peak in that year.

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[35] This procedure may involve some slight underestimate of total expenditures since the BLS-Commerce adjustments indicated the possibility of some downward secular trend in the adjustment ratio. Their adjustments were as follows: 1915-24, 8.9 per cent; 1925-34, 8.6 per cent; 1935-44, 8.3 per cent.

[36] *Construction and Construction Materials,* Statistical Supplement, May 1950, p. 80.

[37] Roland V. Murray and Bruce M. Fowler, "Estimating Expenditures for New Construction," *Techniques of Preparing Major BLS Statistical Series,* (Bureau of Labor Statistics, Bulletin No. 993, 1950), p. 50.

Chawner, in deriving his estimates of residential construction expenditures for the years 1915-37, utilized a one-third carry-over ratio.[38] These estimates, adjusted for undervaluation and preliminary costs and slightly modified for the years 1915-19, are still the 1915-28 segment of the BLS-Commerce series. But Wickens, after analyzing monthly data for the early 1920's and 1930's, concluded that "a much smaller adjustment than a one-third – two-thirds allocation of annual totals "[39] would be correct for those years. The one-third adjustment apparently is far out of line with experience.

If the 15 per cent adjustment is accepted as representative of recent years, then a slightly smaller ratio for the pre-1930 period seems most logical.[40] Therefore, the housekeeping series developed here, after all adjustments, was converted to a work-put-in-place basis by carrying over into the following year 10 per cent of the construction cost of dwelling units started in any given year.

This carry-over ratio is probably most accurate for periods of rapidly changing building activity and for periods in which apartment building was at a low level.[41] It may tend to understate the amount of carry-over in years in which apartment building was important and in years of stable building activity. But the latter years are precisely those in which the proportion of carry-over has least effect on the final figures. In any case, the possible error in the final figures is very small. For example, if the true carry-over in a given year were 20 per cent, the proper expenditure estimate for that year would differ from the estimates in this paper by only 10 per cent of the net difference between construction expenditures in the year preceding and the year following the given year. And the error over any period of years would be imperceptible.

Lags, Lapses, and Under-reporting

Since the new series is derived from annual data, the adjustment for the time lag between the issuance of a permit and the actual start of construction is of secondary importance. The lag itself is typically of short duration. BLS surveys, covering ten cities in 1929 and 14 cities in 1931, indicate that the average elapsed time between permit issuance and start of construction was less than seven days in those years.[42] Even in postwar years, when builders faced unusual difficulties, between half and two thirds of the dwelling units authorized were started during the month of permit issuance; at least 90 per cent were usually started by the end of the second month following the month

[38] Chawner, *Construction Activity . . .*, pp. 43-44.

[39] Wickens, *op. cit.*, pp. 59-60.

[40] The proportion of residential building accounted for by operative builders and the scale of operations of all builders were smaller in the pre-1930 period than in recent years. This suggests that continuity of construction activity was less important to builders in earlier years and that construction operations were more rarely carried on during the unfavorable winter months.

[41] For details of this view, see Wickens, *loc. cit.*

[42] "Elapsed Time in Building Construction," *Monthly Labor Review*, January 1933, pp. 161-62.

of permit issuance.[43] Consequently, no special adjustment was made for this lag.

Conceptually, dwelling units which are authorized but whose permits are allowed to lapse should be excluded from the series developed for this study. However, it seems generally agreed that, historically, lapses have been of small magnitude. The above-mentioned BLS-surveys indicate that only 2.2 per cent of permits granted in 1929 and 3.3 per cent of permits granted in 1931 were allowed to lapse.[44] In the post-World War II period, lapses reached 4.5 per cent in September-December 1945 and 7.5 per cent in March 1946, but declined to between 1.0 per cent and 2.0 per cent thereafter.[45] Wickens made no allowance for lapses (except for multifamily dwellings in New York City) in his estimates for the 1920's.[46] Apparently the Bureau of Labor Statistics made no allowance for lapses (or lags in building) until 1945, when materials shortages and other difficulties caused considerable distortion in usual construction patterns. However, Chawner's estimates of residential building, 1915-37, do involve some adjustment for lapses.[47]

Similarly, dwelling units built in cities with permit systems but not included in the permit records should be added to the series used in this study. Such underreporting may be a result of inadequate enforcement of permit regulations or a consequence of the fact that municipal boundaries and the boundaries of the area under permit regulation were not always coincident in the past. Wickens felt that under-reporting was not insignificant even in the 1920's.[48] Probably such under-reporting was of greater importance in the early decades under study than in the later ones. But there is no quantitative information available to measure the importance of this lack of coverage in the primary data, and no existing series has been able to make adjustment for it.

Lapses and under-reporting tend to cancel each other out. Since it is impossible to make any firm estimate of the net effect of the two variables, it was decided not to make any allowance for either, except for lapses in New York City which are very important in certain years and relate primarily to multifamily structures and for which specific data are available, and for Florida for 1925 and 1926. This omission probably results in some underestimate of construction, particularly for early years. The special adjustments for lapses are described in Appendix F.

Estimates of Nonhousekeeping Residential Construction Expenditures

The expansion of the urban estimates of the permit valuation of nonhousekeeping residential facilities to nonfarm totals was based on a technique

[43] Murphy, *op. cit.*, p. 48.

[44] "Elapsed Time in Building Construction," *op. cit.*, p. 160.

[45] Murphy, *op. cit.*, p. 48.

[46] Wickens, *op. cit.*, pp. 45-46.

[47] Chawner, *Construction Activity . . .*, p. 43.

[48] Wickens, *op. cit.*, p. 46.

different from that employed in the expansion of the urban housekeeping estimates. In the latter case, relative growth in urban and rural nonfarm population provided the expansion factors. In the case of nonhousekeeping construction, this procedure appeared unsatisfactory.

Nonhousekeeping construction during the period covered by the estimates prepared for this study was probably comprised primarily of hotels, although other types of building have bulked large in more recent years.[49] The permit data underlying the new series indicated a very high concentration of nonhousekeeping building in the larger cities, which is understandable in view of the importance of hotels in the total. Since a very small proportion of total nonhousekeeping residential construction took place in small cities, probably an even smaller proportion took place in rural nonfarm areas, particularly in the years prior to 1920 when the automobile was still of little importance. Allocating to rural areas an amount of construction indicated by the importance of rural population (or population growth) relative to urban population (or population growth) would result in an overestimate of rural nonfarm nonhousekeeping construction. Accordingly, such rural construction was estimated by applying annual per capita building rates derived from cities of less than 25,000 population to the decennial estimates of rural nonfarm population prepared for this study. While the procedure involves some underestimate of rural construction during the 1920's, it probably errs on the opposite side during the earlier years. However, the effect on the nonfarm totals of the latter error is undoubtedly very small, since the building rates for small cities were themselves extremely low during these years.

Permit values for nonhousekeeping construction are subject to an understatement of final construction cost similar to that applying to housekeeping permit values. But it seems impossible to determine whether the understatement is of the same magnitude or whether it has varied over time. In the absence of any evidence on either question, the correction factors for undervaluation and preliminary costs that were applied are the same as those used in the derivation of the housekeeping series. This results in some uncertainty as to the accuracy of the level of the nonhousekeeping series, although the movement of the series is probably reasonably correct. The only test which can be applied is a comparison of the new series with that developed by the Department of Commerce for 1915 to date; this comparison is made below.

There are no guides to the proportion of annual carry-over of nonhousekeeping construction for the years under study. Wickens does not attempt to convert his nonhousekeeping series to a work-put-in-place basis. It would have been possible to use the proportion of carry-over applied in the Depart-

[49] When the Commerce Department raised its hotel series to cover all nonhousekeeping construction, it added between 10 and 16 per cent to cover other types of construction, e.g. motels, tourist courts and cabins, dormitories, summer cottages, etc., during the 1920-28 period. For more recent years, total nonhousekeeping residential construction was estimated at several or more times the original hotel estimates. See Section 2 for further discussion.

ment of Commerce estimates for recent years, but the nature of nonhousekeeping residential construction has changed so much since the 1920's and earlier years that such a procedure would have been hazardous. Chawner makes no explicit adjustment for the time pattern of nonhousekeeping building, since such building is included as part of his total residential series, for which a one-third carry-over was employed.[50] In deriving his estimates of commercial building construction, he used a one-half carry-over adjustment.[51] In the absence of any firm evidence on this question, a carry-over ratio of one third was accepted and applied to the nonhousekeeping series to yield the final work-put-in-place estimates. Although this procedure may involve some bias in year-to-year movement, it should not in any way obscure the broad trends in the series.

The Problem of Linking the Series

The initial year of the official BLS-Commerce series on housekeeping dwelling unit starts is 1920; and the first year of the official series on expenditure for housekeeping dwelling units and for nonhousekeeping residential facilities is 1915. These series are generally accepted as the best existing estimates of residential construction since those dates and, indeed, represent the only important estimates of housekeeping residential construction since 1930 and of nonhousekeeping residential construction since 1915.[52] The primary function of the new series developed in the present study was the extension of these series into earlier years for which only the crudest of estimates were heretofore available.

Since the permit data made available for this study extended through 1929, it has been possible to determine whether the estimating techniques employed in this study yielded results roughly equivalent to the official series. Also, it has been possible to determine more precisely the years in which the new estimates should be linked to the official series.

Linking the Housekeeping Residential Construction Series

The official series on nonfarm dwelling units started for the decade 1920-29 was taken directly from Wickens' *Residential Real Estate* (p. 60). For this decade the new series prepared for this study is about 460,000 units above the official total (see Table 13). Recent examination of Wickens' data by government statisticians indicates that his decade estimate is probably too low, perhaps by as much as 400,000 units. However, the percentage difference of about 7 per cent between the two series is not very great; and in general the

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[50] Chawner, *Construction Activity . . .*, p. 43.

[51] *Ibid.*, p. 48.

[52] Although there are other estimates for the first 10 or 15 years covered by the official series, notably those by Chawner, they are not in general use today and will not be discussed in this paper. For a comparison of the new series with existing series for the years prior to the official government estimates, see Section 4.

Table 13

ESTIMATES OF NEW PRIVATE PERMANENT NONFARM HOUSEKEEPING DWELLING UNITS STARTED, 1920-1929

(*in thousands*)

	NEW SERIES	BLS - COMMERCE DEPT. SERIES	DIFFERENCE
	(1)	(2)	(3)
1920	217	247	−30
1921	491	449	42
1922	767	716	51
1923	950	871	79
1924	963	893	70
1925	1,048	937	111
1926	1,010	849	161
1927	837	810	27
1928	741	753	−12
1929	473	509	−36
	7,497	7,034	463

Source: The data in column 1 are the estimates prepared for this study; the figures in column 2 are from Department of Commerce, *Construction and Building Materials,* Statistical Supplement, May 1952, p. 46.

annual movement of the two series is quite similar.[53] There is no reason to conclude that the estimating techniques of this study lead to any basic incomparability between the new series and the official series which would prevent utilization of the new series for the pre-1920 period.

Although there are differences between the series for the 1920's, they do not appear to be very serious, particularly for an analysis of broad trends in construction. Wickens used a highly refined technique in obtaining his estimates, and his sample of building permit data was roughly equivalent to that used in this study. External evidence affords no possibility of determining with any precision the degree of error in either of the two series. Thus, neither series can be demonstrated to be clearly superior. In view of the long and widespread use of the official series, it was concluded that there would be little advantage in substituting the new series for the 1920's, even though the possibility of some understatement for this period remains.

The new series and the official series on dwelling units started, then, could be linked in 1920. But, since the link for the housekeeping expenditure series is 1921 — for reasons detailed below — it seemed advisable, for the sake of consistency, also to link the starts series in 1921. Thus, the final series on dwelling unit starts (presented in Appendix A) consists of the new estimates prepared for this study, 1889 to 1920, and the official BLS-Commerce estimates, 1921 to date.

A comparison of the official estimates of expenditures on housekeeping residential construction (which cover the period 1915 to date) and the new series (Table 14) shows that the new series lies somewhat above the official

[53] The new series is somewhat higher in the early years of the decade and somewhat lower in the last years. Most of this difference is accounted for by a bias correction made by Wickens, based on his view that there was an increasing proportion of residential building in suburban nonreporting areas as the decade progressed. See Wickens, *op. cit.,* p. 49.

Table 14

ESTIMATES OF EXPENDITURES FOR NEW PRIVATE PERMANENT NONFARM HOUSEKEEPING DWELLING UNITS, 1915-1929

(in millions)

	NEW SERIES	BLS - COMMERCE DEPT. SERIES	DIFFERENCE
	(1)	(2)	(3)
1915	$1,192	$1,040	$152
1916	1,255	1,170	85
1917	769	1,000	−231
1918	391	760	−369
1919	1,258	1,645	−387
	$4,865	$5,615	−$750
1920	$1,072	$1,710	−$638
1921	2,051	1,795	256
1922	3,363	2,955	408
1923	4,386	3,960	426
1924	4,672	4,575	97
1925	5,300	4,910	390
1926	5,059	4,920	139
1927	4,460	4,540	−80
1928	3,897	4,195	−298
1929	2,643	3,040	−397
	$36,903	$36,600	$303

Source: The data in column 1 are the estimates prepared in this study; the figures in column 2 are from Department of Commerce, *Construction and Building Materials,* Statistical Supplement, May 1952, p. 6.

series for 1915 and 1916, below for the years 1917-20, above for 1921-26, and below for the years 1928-29. For the five years 1915-19, the official series is $750 million higher than the estimates prepared for this study; for the 1920-29 decade, it is about $300 million below.

Prior to the revisions in the official series published in May 1950, the BLS-Commerce estimates for the years 1920-28 were taken directly from Chawner.[54] The 1915-19 estimates were slightly revised versions of Chawner's figures. The 1929 estimate, which was 16 per cent below Chawner's estimate, appears to have been a revision of Chawner's figure for that year. This revision was made because of the procedure by which Chawner's data were linked to the post-1929 series derived from another source.

The May 1950 revisions, which were discussed earlier, involved the expansion of the earlier series to cover architects' and engineers' fees, land development costs, and operative builders' profits, none of which had been included as components of construction expenditures in Chawner's estimates. The revised estimates of construction activity for the 1915-28 period, therefore, are still essentially based on Chawner's data.

Chawner's estimates for the 1921-29 period were derived by expanding the published BLS permit data for the 1920's – essentially the same data used both by Wickens and in the present study for this decade. For the years prior

[54] Chawner, *Construction Activity . . .*, p. 43. For the official series prior to revision, see *Construction and Construction Materials,* Statistical Supplement, May 1949, p. 6.

to 1921, Chawner extrapolated his 1921-22 average by use of the series on the dollar value of residential contracts awarded, prepared by the F. W. Dodge Company.

There is considerable evidence that the Dodge data, particularly for the period for which they provided the basis for Chawner's estimates, are less reliable than building permit data for the purpose of developing residential construction estimates.[55] Therefore, the Chawner estimates for the 1915-20 period, and the BLS-Commerce revised series for the same years, are probably inferior to the estimates presented in this study, which are derived from permit data. This conclusion is supported by the fact that the new starts series, derived by the same basic procedures as the expenditure series, conform very closely to the BLS estimates for these years and agree in movement with Chawner's own dwelling unit series. The major difference in movement between the new housekeeping expenditure series and the equivalent BLS-Commerce series is found in 1919-20; the official series for 1920 shows a slight rise over 1919 in work put in place, while the new series shows a decline. But this divergence is attributable solely to the different techniques used in converting authorizations to work put in place. Chawner carried over into the following year one third of the adjusted construction cost of units started in each given year; in general, this proportion appears to be much too high. The present study has used a one-tenth carry-over, on the basis of data from recent years and consequent judgment as to relationships in the pre-1930 period. At present, there is no way to obtain direct information on the actual carry-over in 1919-20 and therefore no way to test the alternative assumptions for those years.

For the years 1921-29, the conformity of the BLS-Commerce and the new series is reasonably close. The official series shows a very slight rise between 1925 and 1926, while the new series shows a decline; but this disagreement again is accounted for by the different proportions of carry-over inherent in the two series. As pointed out above, the official series is about $300 million lower, for the 1920-29 decade as a whole, than the series prepared for this study; for the years 1921-29, it is lower by about $950 million, or about 2.7 per cent of the nine-year total. The new series again lies somewhat above the official series in the early years of the decade and somewhat below in the later years.

The differences between the two series for the period 1921-29 were not significant enough to affect the broad trends in residential construction. Therefore, because of the already wide acceptance and use of the BLS-Commerce series, it seemed desirable to accept the official series for the entire period 1921 to date. However, because of the superiority in coverage and technique

[55] See Wickens, *op. cit.*, pp. 56-59, for a discussion of the deficiencies of the Dodge data for this purpose. In general, the Dodge data excluded contracts in the western states, as well as all contracts for small dwellings.

of the new series for 1915-20 and the close agreement of this series with other data in those years, it was decided to substitute the new estimates for the official series for that period. Accordingly, the housekeeping expenditure series used in the analysis in Section 2 consists of estimates prepared for this study for the years 1889-1920 and estimates of the BLS-Commerce series, 1921 to date. The choice of 1921 as the linking year for the dwelling unit series is consistent with this procedure.

It should be pointed out, however, that the general agreement of the official series and the new series in the 1920 decade is partly a result of a double counting error in the official series. Buried in the footnotes to Chawner's table on dwelling units started is the statement that "hotels, clubs and lodging houses [are] included in the statistics of dollar value for all residential building."[56] Thus Chawner's estimates of nonhousekeeping residential construction are included along with the estimates of housekeeping construction in Chawner's series on residential construction expenditures. This inclusion is nowhere specified in the text discussion or in the footnotes to the table on residential construction expenditures. Chawner's expenditure estimates for the years 1920-28 were directly accepted by the Department of Commerce and were presented in the official BLS-Commerce series until the May 1950 revisions.[57] The revisions of May 1950 involved the addition to

Table 15

ESTIMATES OF EXPENDITURES FOR NEW PRIVATE NONHOUSEKEEPING RESIDENTIAL FACILITIES, 1915-1929

(*in millions*)

	NEW SERIES (1)	COMMERCE DEPT. SERIES (2)	DIFFERENCE (3)
1915	$40	$40	$0
1916	60	60	0
1917	51	65	−14
1918	20	45	−25
1919	43	75	−32
	$214	$285	−$71
1920	$56	$130	−$74
1921	69	125	−56
1922	145	205	−60
1923	201	230	−29
1924	201	255	−54
1925	308	355	−47
1926	366	410	−44
1927	227	330	−103
1928	213	260	−47
1929	382	245	137
	$2,168	$2,545	−$377

Source: The data in column 1 are the estimates prepared in this study; the figures in column 2 are from Department of Commerce, *Construction and Building Materials,* Statistical Supplement, May 1952, p. 6.

[56] Chawner, *Construction Activity . . .*, p. 41.

[57] See, for example, Housing and Home Finance Agency, *Housing Statistics Handbook* (1948), p. 17; and *Construction and Construction Materials,* Statistical Supplement, May 1949, p. 6.

the existing series of estimates for architects' and engineers' fees, land development costs, and operative builders' profits. Thus, the current official series for expenditures on housekeeping units for 1920-28 still carries within it an estimate for nonhousekeeping expenditures, despite the fact that the Department of Commerce currently presents a separate series on expenditures for nonhousekeeping facilities, 1915 to date, which is composed of an earlier series on hotel construction and a set of estimates, included for the first time in the May 1950 series, for motor courts, tourist cabins, vacation cottages, and other elements of nonhousekeeping construction.[58] If the current official series for housekeeping construction for the 1920's were corrected to eliminate the inclusion of nonhousekeeping expenditures, the resulting series would be significantly below the new estimates for that period.[59] In that case, it might be necessary to use the series prepared for this study for the 1920-29 period.

Linking the Nonhousekeeping Residential Construction Series

The movement of the new estimates of expenditures for nonhousekeeping residential facilities accords reasonably closely with the current Commerce series over the period 1915-28 (see Table 15). The new series, however, shows a very great rise in 1929, compared with a continued decline in the Commerce series. The rise is obviously incorrect. It results almost solely from the large

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[58] In a letter to the writer, dated July 18, 1952, Arnold E. Chase, chief of the Production and Requirements Branch, Building Materials Division, Facilities and Construction Bureau, National Production Authority, stated the position of the Department of Commerce on this question, as follows:

"We have investigated the apparent double counting caused by the introduction of nonhousekeeping construction activity as a separate item in the Commerce series and have made the following findings:

1. Estimates of the value of hotel construction were introduced into the Commerce series under nonresidential building in the Fall of 1945.
2. The possibility of duplication was raised at that time. Although it was known that B.L.S. permit data included some hotels, clubs, and lodging houses, there was considerable doubt that the factors used in developing estimates of total residential [building] made specific allowances for the nonhousekeeping types.
3. It will be noted that no mention of hotels, etc. was made in Table 12 of the Chawner publication. Footnote 1 to Table 10 states 'The number of family units does not include hotels, clubs and lodging houses included in the statistics of dollar value for all residential building shown in Table 12.' This can be interpreted to mean either 'all hotels are included in Table 12' or 'those hotels which are included in Table 12.'
4. It was not possible to determine the value of hotels, etc. included in Table 12.
5. The new series for hotels was developed from a different source than that used in deriving the residential estimates in Table 12.
6. It was felt that the new series was of a much greater magnitude than the value of hotels, etc. included in Table 12, therefore subtracting the new series from the residential estimates would over-correct for the duplication and the net error would be greater.
7. After considering the above it was decided to make no adjustment to the residential series."

[59] In the official estimates prior to the May 1950 revisions, hotel construction for the period, 1920-28, amounted to 6.6 per cent of the estimates for housekeeping construction. In the revised series, nonhousekeeping expenditures for the same years were about 6.9 per cent of housekeeping expenditures.

number of hotels for which permits were applied for in Manhattan in that year; very few of them, if any, were ever started.[60]

The new series, however, lies below the Department of Commerce series over the 1915-28 period, except for the first two years. It runs consistently lower over the 1919-28 decade, the discrepancy ranging between $29 million and $60 million in eight of the ten years. It is likely that this underestimate is a real one and that it results from a substantial underestimate in the new estimates of rural nonfarm nonhousekeeping construction, e.g. resort hotels, tourist cabins, etc., in the 1920 decade. As described above, the rural nonfarm segment of the new series was based on building rates for cities under 25,000 in population, and this technique probably underestimates the impact of the automobile on nonhousekeeping residential construction in the 1920's.

The two series agree exactly for 1915 and 1916 and come reasonably close in 1917. If the error in later years is attributable to rural nonfarm nonhousekeeping building which resulted from the growth in automobile ownership, then the estimates for the pre-World War I years, when the automobile was relatively unimportant, should be reasonably accurate. The conformity in 1915-17 is at least not inconsistent with this conclusion. Hence, the new series could be linked directly with the Department of Commerce series without any adjustment. The link could have been made in 1915 or 1916 but the simplest procedure, and that finally followed, was to link in 1915 and retain the entire Department of Commerce series, 1915 to date.

Extrapolation of Series

For analytic purposes it was desirable to have the several housekeeping series start in the peak year around 1890. Since the new series based on permit data and population relationships do not begin until 1890, it was necessary to derive rough estimates of construction for the years prior to 1890 to be able to determine the turning point year in each series. For this purpose the 1890 estimates for the dwelling unit starts and housekeeping expenditures series were extrapolated by use of the chain indexes listed in Table 11. These indexes were based on the year-to-year percentage changes in starts and expenditures in reporting cities.

From these extrapolations it appears that the peak year for dwelling units starts was 1892, but that the peak year for housekeeping expenditures was 1889. Accordingly, while all the annual series given in Section 2 start in 1889 for consistency, all cycle measures for dwelling unit starts begin in 1892.

The nonhousekeeping data for the years prior to 1890 were not considered

[60] The permit data for New York City referred to permits applied for, rather than permits granted. Nonhousekeeping residential permits amounting to $237 million were applied for in Manhattan in 1929. The bulk of these permit applications were for hotels. Even before any upward adjustment, this amount is about equal to the Department of Commerce estimate of nonhousekeeping work put in place in that year in the entire country.

sufficiently reliable to provide a means for extrapolation. Since all final series in this report are presented on a work-put-in-place basis, the first year for which an annual nonhousekeeping estimate could be made was 1891. Estimates of the carry-over into that year of work put in place could be derived, since an estimate of authorizations in 1890 was available; but as no estimate of authorizations was made for 1889, an estimate of work put in place in 1890 could not be derived.

Type of Structure Estimates

The series on the number of dwelling units started, classified by type of structure, was derived by methods similar to those used in the derivation of the total starts series. In accordance with the classification of dwelling unit starts in the BLS-Commerce series for more recent years, the annual number of starts were classified into one-family dwelling unit starts, two-family unit starts, and three-or more-family unit starts. Also in accordance with the official classification, one- and two-family units with business were included in the two-family category, and three- or more-family units with business were included in the three- or more-family category.

For the three sample divisions, Middle Atlantic, South Atlantic, and Pacific, the annual estimates were obtained by applying the percentage distribution by type of structure of the sample data in each size class to the final estimate of total dwelling units started in the size class.[61] For each division the estimates of the number of each type of unit were summed annually to yield divisional type of dwelling unit estimates.

For the six remaining divisions, the estimates were obtained by applying the dwelling unit percentage distribution of the sample data in each size class to the original estimate of dwelling units started in the size class, derived on the basis of censal population relationships. The annual estimates by type of structure for each size class were summed for each division and converted to percentages of the divisional total. These percentages were applied to the final corrected estimates of dwelling unit starts in each of the six divisions.

In those size classes for which no sample data were available, the percentage distribution of dwelling units by type of structure was estimated by graphic interpolation or extrapolation. The interpolation or extrapolation was based on a comparison of the relative levels of the percentage distributions by type of structure in the given size class and an adjoining size class in adjacent periods, and on the movement of the distribution in the adjoining size class during the given years. Data were completely lacking in the East South Central division during the early years, and data for size class IV in this division were unavailable for any years. In these cases the percentage distribution in the South Atlantic division was adopted.

[61] This procedure is equivalent to estimating the number of units in each type of structure built in each size class by applying to the sample data the expansion factor used in deriving the total dwelling unit estimates.

The annual estimates of dwelling units, by type of structure, for all nine divisions were then summed to yield urban estimates of one-family, two-family, and three- or more-family units started, 1900-20.

No permit data on rural nonfarm dwelling units were available. However, the overwhelming bulk of such units have always been in one-family structures. Accordingly, the distribution of the rural nonfarm housing inventory in 1940, as reported by the 1940 Housing Census, was used to allocate rural nonfarm construction by type of structure. If the Census category of "one- to four-family structures with business" is distributed in the same proportions as the "one- to four-family structures without business" categories, the distribution of rural nonfarm units in 1940 was as follows: one-family, 85.7 per cent; two-family, 11.4 per cent; three- or more-family, 2.9 per cent.[62]

It is realized that the rural nonfarm units in 1940 do not include all rural nonfarm units constructed in earlier years; by 1940, many had been reclassified to urban status. Similarly, rural nonfarm units counted in 1940 include many units built after 1920. But the preponderance of single-family units in the total indicates that any error involved in the use of this distribution for the 1900-20 period is very small. If anything, the distribution underweights the one-family component, since the suburbanization movement in the 1920's and 1930's and the large number of two-family structures built in the 1920's probably contributed to a higher proportion of two-family and three- or more-family structures in the 1940 inventory than was characteristic of rural nonfarm areas in the pre-1920 period.

The 1940 distribution was applied to the annual estimates of rural nonfarm building, and the resultant estimates of units by type of structure were added to the urban estimates, to yield nonfarm totals of units in one-family, two-family, and three- or more-family structures, 1900-20.

No attempt was made to estimate expenditures for housekeeping dwelling units by type of structure. There are no official estimates of this distribution, and there would be no way to extend such a series, derived from the permit data used in this study, to cover the years since 1929.[63] In addition, there are no data available to indicate the magnitudes of the undervaluation and preliminary cost adjustments by type of structure.

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62 *Sixteenth Census of the United States, Housing,* Vol. II, Part 1, p. 11. One-family structures with business are included in the two-family category.

63 Some estimates of expenditures by type of structure are available for a sample of larger cities, but these series are not representative of all nonfarm residential construction because of the growing importance of suburban construction in recent decades.