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APPENDIX C

HOUSE PRICES AND CONSTRUCTION COSTS

ADJUSTMENT of residential wealth and residential construction expenditure estimates to a constant price level in principle requires the use of a price index of residential construction. However, no national market price index covering a reasonably long period of time exists, although house price indexes have been constructed for several cities, usually covering a relatively few years.[1] Consequently, in this study, as in others, a construction cost index is used as a substitute, on the view that the movement of such an index is a reasonable reflection of changes in new house prices. This appendix attempts to assess the validity of this assumption and to judge the margins of error involved in the use of a construction cost index.

Possible Divergence between Cost and Price Indexes

It could be reasoned that significant short- and long-term divergencies might arise between a valid index of the market price of homes and indexes of construction cost. These divergencies can be assigned to two causes: technical problems in defining and measuring construction costs and real deviations between new and old house prices.

Construction cost indexes usually exclude builders' profits and, often, overhead charges, or they add a constant percentage to direct cost to cover these items. The apparently wide short-term variability in builders' profits thus permits significant differences between the movement of prices of new homes and cost indexes. To the extent that there has been a secular movement of builders' profits and overhead costs which is not taken account of in construction cost indexes, even secular divergencies may arise.

More important, technical problems inherent in devising construction cost indexes involve at least the possibility of deviations between such indexes and a true price index of new homes. Most residential construction cost indexes apparently are derived as some form of weighted average of materials prices and wage rates. They differ in the number of materials and labor skills covered and in the degree to which the weights are based on specific, rather than generalized, types of con-

[1] For example, for Toledo, William Hoad, "Real Estate Prices," unpublished doctoral dissertation, University of Michigan, 1942; for Washington, unpublished data from the Housing and Home Finance Agency, quoted in Ernest M. Fisher, *Urban Real Estate Markets: Characteristics and Financing*, National Bureau of Economic Research, 1951, p. 54; and for Ann Arbor, Herman Wyngarden, *An Index of Local Real Estate Prices*, University of Michigan School of Business Administration, Bureau of Business Research, 1927.

struction. The weights are usually unchanged, or changed little, over the entire period covered. Such indexes suffer from several defects. One such defect results from the fact that indexes of this kind cannot take fully into account the changing importance of the relative price movements of the new materials and equipment that have been added to the house over time. In addition, for early years there is a serious question as to whether actual prices and wage rates, rather than nominal prices and rates, have entered into such indexes. Finally, such indexes are unable to take into account changes in site productivity.

If these technical problems were solved, cost indexes would properly measure the changes in prices of *new* homes. However, discrepancies between such cost and price indexes and an index of *old* home prices could still arise. Because of the interconnection between the markets for new and old homes, their price movements should be in close conformity at most times. Nevertheless, divergencies could appear at the trough of the building cycle, when the prices of existing homes may sink below the price at which new houses would be offered on the market if there were any building activity. Indeed, it is for this reason that construction volume sometimes declines to more or less negligible levels. Discrepancies could also appear in the upswing of the cycle during short periods when new construction lags behind the increase in demand for dwelling units; existing houses may command premiums at such times because of their immediate availability. At either cycle stage the divergencies may last as long as several years.

A New Price Index, 1890-1934

To test the differences in movement between the construction cost index used in this study, and presented in Table B-10, and the prices of homes, a house price index for 1890-1934 was developed for this study and compared with the cost index. The data for the price index were derived from the *Financial Survey of Urban Housing*,[2] which collected financial and other information for a sample of residential structures in 61 cities in 1934. Detailed information in the *Survey* is available only for 22 cities. The 22 cities are widely scattered geographically, with at least 2 cities representing each of the 9 census divisions except the East South Central division, which had only 1 city in the 22-city sample. One set of questions asked each owner of a residential structure related to: (1) value of the property in 1934, (2) year of acquisition by the then-present owner, and (3) original cost to owner at time of acquisition. This information was summarized for each city and a table presented for each of the 22 cities, listing the

[2] Dept. of Commerce, 1937.

number of properties included in the 1934 sample which were acquired in each year from 1890 to 1933, the total acquisition cost of properties acquired in each such year, and the value of each group of such properties in 1934. Separate data for all owner-occupied and all tenant-occupied structures and for all single-family owner-occupied houses and all single-family tenant-occupied houses were presented, rather than over-all figures for all residential properties.

The data selected for analysis were those relating to single-family owner-occupied houses, on the view that this relatively homogeneous group, which comprises the most important portion of the nonfarm housing stock, would show a more consistent pattern than the other categories. The all-owner-occupied category might have been a reasonable alternative, but was rejected because it was less homogeneous than the single-family owner-occupied category. The two tenant-occupied segments were rejected because they included too small a number of properties and because the all-tenant-occupied group was too heterogeneous. The tenant- and owner-occupied data could not be combined because they were based on two separate samples and the size of the two samples did not reflect the proportion of owner-occupied and tenant-occupied properties in the respective cities.

A relative for each year was calculated for each city, based on the ratio of the total acquisition cost of the single-family owner-occupied houses acquired in each given year in a given city to their value in 1934. The median relative for each year was then determined.[8] This series of median relatives, based on 1934 values equal to 100, was converted to a 1929 base; the converted series is presented in Table C-1.

The assumptions underlying the final index warrant clarification before any comparisons are drawn. It is assumed, first, that the acquisition cost estimates are reasonably accurate. In all likelihood, the estimates of acquisition cost for properties acquired in the early years of the period studied have some margin of error. It is also assumed that the year of acquisition has been accurately reported; here again, there undoubtedly are significant error margins for the early years, with a tendency for respondents to report acquisitions in years which are multiples of five. Finally, it is assumed that the movement between

[8] To determine the effect of the specific averaging procedure on the final results, a test was performed on the data for a single year in each of the four full decades covered. The relatives for each such year were combined in the form of the median, positional mean, unweighted arithmetic mean, unweighted geometric mean, and weighted arithmetic mean (in which the weights were the number of households in each city at the nearest census year). The range of results in each year was relatively small, so the simplest measure, the median, was used in the computations for the final series. Individual city relatives based on less than four properties were disregarded in the computation of the median.

median relatives of two successive years approximates the movement in prices of a single sample between the two years; it will be remembered that each relative, before conversion to a 1929 base, actually represents the movement in prices of a separate sample between the given year and 1934.

TABLE C-1

Unadjusted Price Index of One-Family Owner-Occupied Houses, Twenty-two Cities, 1890-1934[a]
(1929 = 100)

	Index		*Index*
1890	61.3	1913	75.3
1891	55.3	1914	78.1
1892	56.3	1915	71.7
1893	58.7	1916	78.5
1894	68.4	1917	80.1
1895	62.1	1918	85.2
1896	53.8	1919	93.7
1897	55.5	1920	102.7
1898	59.1	1921	100.4
1899	56.5	1922	101.8
1900	64.6	1923	103.3
1901	54.2	1924	103.5
1902	63.9	1925	108.9
1903	64.9	1926	104.5
1904	67.9	1927	100.6
1905	59.5	1928	102.1
1906	70.6	1929	100.0
1907	77.9	1930	95.7
1908	70.3	1931	87.9
1909	68.7	1932	78.7
1910	74.2	1933	75.7
1911	72.5	1934	77.9
1912	75.3		

[a] Yearly median of twenty-two city relatives, excluding those relatives based on fewer than four properties.

The validity of the 1934 value estimate probably does not seriously affect the movement of the price index, except for the 1934 value itself. It would affect this movement only if the degree of underestimate or overestimate of value in 1934 were correlated with length of holding.

The constructed price index applies to both new and old houses. The relative for a given year relates the acquisition cost of properties purchased in that year to their value in 1934, regardless of whether the acquisition was of a new or an old structure. An examination of the data indicates that somewhat more than one-half of the properties in the 1934 sample which were acquired in the 1890-1899 decade were new houses, almost one-half in the 1900-1909 decade were new houses, and about one-quarter in the remaining years were new houses. It was suggested earlier that there should be no reason for any difference in the price movement of new and old houses, other than in periods of depressed building activity or in short periods during the upswing of the cycle when consumer ignorance and relative availability may play a role. At other times the movement of prices of houses of varying age and quality should be roughly similar. And the price variations of new housing, once it has entered the housing stock, should be the same as the original stock, subject to the differential depreciation rates applying to structures of different ages.

The index in its present form is subject to two major offsetting biases, viz. value losses due to depreciation and obsolescence and value increments in the form of structural additions and alterations. The price relative for 1904, for example, before conversion to a 1929 base, measures the change in price of a given set of properties between 1904 and 1934; this change is affected by the thirty years of depreciation operating on these properties and is somewhat smaller than the change in price that would be measured if this group of properties in 1934 had the same age structure as they had in 1904. Conversely, any structural additions or alterations to the properties between time of acquisition and 1934 would tend to make the actual price rise larger between these two periods than the theoretically correct price movement.

The level of depreciation rates on single-family houses is analyzed in detail in Appendix E. Empirical evidence cited there supports the generally accepted view that value losses due to depreciation and obsolescence typically outweigh value gains due to additions and alterations. Therefore, the present index must be biased downward as the net result of these two kinds of value change.

Further corroboration for this view is found in a comparison of two sets of house price indexes for Cleveland and Seattle (Table C-2). One set of indexes comprises the series of relatives for these two cities, which, together with the relatives for the remaining 20 cities, provided the basis for calculating the 22-city price index. These indexes are subject to the same biases for depreciation and additions as the 22-city index itself.

The second set of indexes was derived so as to exclude this bias. It is based on three-year moving averages of prices paid for new owner-occupied single-family homes in Cleveland and Seattle, derived by Garfield and Hoad from special tabulations of unpublished data from the *Financial Survey of Urban Housing*.[4] From these tabulations Gar-

[4] Frank R. Garfield and William M. Hoad, "Construction Costs and Real Property

field and Hoad were able to compute average prices paid for new homes (including the lots) of specified types in each city in each year covered. The authors focus attention on the price movement of five- and six-room frame houses, on the assumption that changes in the transaction-mix would affect the averages but little, since an analysis of the distribution of prices paid for various types of homes purchased in Cleveland in 1924 indicated that these were relatively homogeneous types of structures. The series for six-room frame houses in each city, converted to indexes with a 1929 base, are given in Table C-2.

The properties underlying the Garfield-Hoad indexes may have been subject to changes in size and quality of structure and in land ratios which would result in divergencies between these indexes and a valid house price index. But such changes were probably severely limited in extent due to the stated homogeneity of the properties over time with regard to size and type of structure and construction, i.e. six-room single-family frame houses. And the restriction of the data to new houses specifically excludes any biases due to depreciation, obsolescence, or additions and alterations.

A comparison between the two sets of indexes shows a significantly greater rise in the Garfield-Hoad indexes between the pre-World War I period and the late twenties than in the price indexes for Cleveland and Seattle underlying the twenty-two-city price index. This difference is fully consistent with the existence of a downward bias in the twenty-two-city index due to the effects of depreciation gross of additions and alterations.

The depreciation rate for the housing inventory, used in calculating net capital formation in this study, is derived from the FHA data in Appendix E. These data indicate that the decline in value of single-family houses over the first fifty-two years of life, resulting from the net effect of depreciation and obsolescence on the one hand and additions and alterations on the other, approximates that resulting from a 1.2 per cent linear rate of depreciation. Since the twenty-two-city index is based on movements in the prices of structures plus land, the depreciation correction for this index also requires a rate based on structures plus land. The relevant linear rate, derived from the same data, is about 1.0 per cent.[5]

For reasons discussed in Appendix E, a curvilinear rate of deprecia-

Values," *Journal of the American Statistical Association*, December 1937, pp. 643-653.

[5] Average FHA valuation of property whose structures were built before 1900 = $4,033. Estimated current replacement cost of building plus FHA land value = $8,829. $4,033/$8,829 = 45.7 per cent, or a decline in value of 54.3 per cent. The average annual decline in value (over a 52-year period), therefore, was approximately 1.0 per cent. See Table E-1 for details.

TABLE C-2
House Price Indexes, Cleveland and Seattle
(1929 = 100)

	CLEVELAND		SEATTLE	
	Garfield-Hoad Price Index (1)	*Price Index Underlying 22-City Index* (2)	*Garfield-Hoad Price Index* (3)	*Price Index Underlying 22-City Index* (4)
1907	35.4	64.7		
1908	36.6	60.8		
1909	40.2	66.5	56.9	76.4
1910	43.9	59.1	58.8	74.4
1911	45.1	57.7	56.9	82.9
1912	46.3	62.0	64.7	73.6
1913	47.6	63.8	62.7	78.0
1914	50.0	72.2	64.7	86.9
1915	51.2	70.0	66.7	86.9
1916	53.7	71.0	64.7	77.7
1917	58.5	77.2	62.7	76.3
1918	67.1	89.7	66.7	82.1
1919	76.8	89.6	78.4	92.6
1920	86.8	104.7	88.2	95.7
1921	87.8	102.9	86.3	92.5
1922	91.5	104.6	99.8	88.3
1923	96.3	101.1	100.0	94.2
1924	100.0	113.1	117.6	96.7
1925	102.4	112.9	109.8	102.9
1926	103.7	114.5	107.8	98.0
1927	102.4	106.1	99.9	98.2
1928	101.2	111.0	102.0	99.6
1929	100.0	100.0	100.0	100.0
1930	95.1	94.3	88.2	92.5

Column	Source
1, 3	Index derived from three-year moving averages of prices paid for new six-room frame house and lot. Frank R. Garfield and William M. Hoad, "Construction Costs and Real Property Values," *Journal of the American Statistical Association*, December 1937, pp. 643-662.
2, 4	Index of prices of one-family owner-occupied homes. Derived from data in *Financial Survey of Urban Housing*, Dept. of Commerce, 1937. Index is one of twenty-two underlying twenty-two-city price index.

tion is more appropriate for residential structures than a linear rate. The compound rate of depreciation, which yields about the same remaining value after 52 years as a 1.0 per cent linear rate but which approximates more closely the path of declining value of residential structures as they age, is about 1⅜ per cent. Accordingly, the twenty-two-city index was corrected for a 1⅜ per cent compound rate of depreciation. The series so calculated, adjusted to a 1929 base, is presented in Table C-3.

TABLE C-3
Price Index of One-Family Owner-Occupied Houses, Twenty-two Cities, Adjusted for Depreciation, 1890-1934

	Index		Index
1890	36.0	1913	60.5
1891	32.9	1914	63.7
1892	34.0	1915	59.2
1893	35.9	1916	65.8
1894	42.4	1917	68.0
1895	39.0	1918	73.3
1896	34.3	1919	81.7
1897	35.9	1920	90.8
1898	38.7	1921	90.0
1899	37.5	1922	92.5
1900	43.5	1923	95.2
1901	37.0	1924	96.7
1902	42.4	1925	103.1
1903	45.5	1926	100.4
1904	48.3	1927	97.9
1905	42.9	1928	100.7
1906	51.6	1929	100.0
1907	37.7	1930	97.1
1908	52.8	1931	90.4
1909	52.3	1932	82.0
1910	57.3	1933	80.0
1911	56.7	1934	78.3
1912	59.7		

Source: Index in Table C-1, corrected for 1⅜ per cent compound annual depreciation.

Generally speaking, the corrected price index shows an upward secular drift from 1890 to about 1916, a more rapid rise to 1920, a smaller rise to 1925, and a decline thereafter to 1933. Between 1890 and about 1925, short cycles of about four years in duration are discernible in the data, with peaks appearing in 1894, 1900, 1904, 1907, 1910, 1914, 1920, and 1925.[6]

Price Index Compared with Construction Cost Index

No residential construction cost index covers the entire period from 1890 to 1934, but the Boeckh residential construction cost index, based on twenty cities, starts in 1910 and can be extrapolated back to 1890 by the use of building materials and building wage rate indexes. The Boeckh index is one of the few adequate construction cost indexes available and is the only one aimed specifically at measuring

[6] The short cycle in house prices approximates closely in length the short cycle that Long found in building activity. Clarence D. Long, Jr., *Building Cycles and the Theory of Investment*, Princeton University Press, 1940, p. 104.

changes in cost of construction of residential structures.[7] This index is used throughout this study as the deflator for housekeeping residential construction and is presented in Table B-10.

The construction cost index for 1890-1934 and the corrected house price index (Table C-3) for the same period are compared in Chart C-1. This comparison suggests two important conclusions with regard to the relationship between construction costs and house prices. Except for the period 1916-1922,[8] the price index shows more short-run variability than the cost index. The latter is quite stable over the pre-1916 period, partly perhaps as a result of its construction, while the price index shows substantial fluctuations. Between 1905-1909, for example, the price index rises more than 34 per cent and declines almost 10 per cent, as compared with the cost index, which rises only 15 per cent between 1905 and 1907 and declines only 3 per cent between 1907 and 1908. The same relationship holds for the period after 1922; the price index falls 5 per cent between 1925 and 1927 while the cost index remains almost unchanged. In sum, it seems quite clear that in most periods the market price of homes fluctuates more widely over the short run than do construction costs as measured by standard construction cost indexes. As a result, the annual movements of any construction series deflated by a construction cost index are subject to some margin of error.

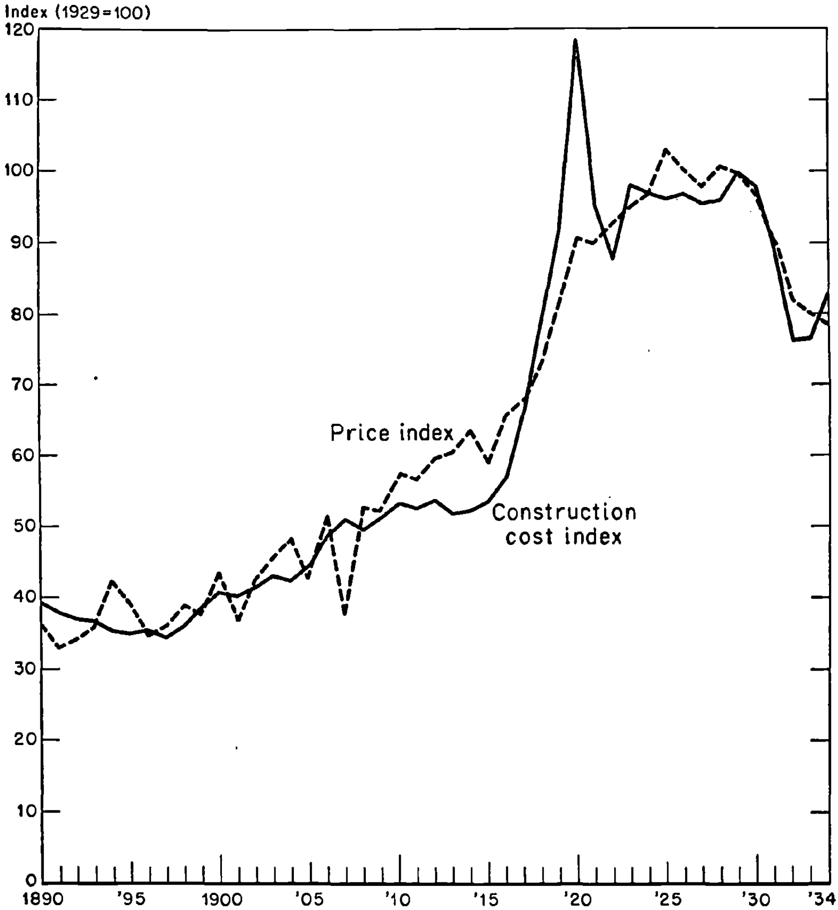
But for the purposes of this study, the most important fact is that the long-run movements of the two indexes are remarkably similar. Thus the construction cost index in 1921-1929 is about 245 per cent of its level in 1895-1905; the corrected price index in 1921-1929 is about 241 per cent of its level in 1895-1905. It must be remembered that the price and depreciation data underlying the corrected price index are derived from independent sources and that both sets of data are completely independent of the cost data underlying the construction cost index. In view of this independent derivation, the virtual identity of the long-run movements of the two series over four and a half decades argues strongly that the construction cost index measures with quite reasonable accuracy the secular movement of house prices.

Only if there were major increases in site productivity not reflected

[7] E. H. Boeckh & Associates actually construct ten indexes for different types of structures, both residential and nonresidential, for various cities. Two of these indexes, for frame and for brick one- to six-family structures, for twenty cities have been combined by the several successive federal housing agencies into a single residential cost index. This is the index referred to in the text.

[8] The cost index rises to a much sharper peak in 1920 than does the price index. This sharp rise in 1920 is found in all construction cost indexes and probably reflects a real difference in construction costs and prices in that year. It seems to have been a result of a unique set of supply and transportation difficulties in the winter and spring of 1920.

CHART C-1
Price Index of One-Family Owner-Occupied Houses, Twenty-two Cities, Adjusted for Depreciation, and Residential Construction Cost Index, 1890-1934



Source: Tables B-10 and C-3.

in the construction cost index and not offset by other biases might this view be questioned. A detailed examination of the derivation of the Boeckh construction cost index suggests that long-term changes in productivity (and possible long-term changes in builders' profit margins) are not reflected in any significant measure in the index. The extrapolators used in Table B-10 are certainly subject to the same criticism. Since it might well be expected that changes in residential construction techniques and equipment over the period of almost a half century under study have yielded important increases in productive efficiency, it is necessary to examine the possibility of an upward bias in the construction cost deflator used throughout this study.

Productivity Bias

The measurement of productivity changes in residential construction is a highly complex problem, the pursuit of which lies far beyond the scope of this study. It is possible, however, to draw a tentative conclusion based on some limited evidence on this point.

Analysis of changes in productivity of the building industry (including nonresidential building) was undertaken recently by Colean and Newcomb.[9] They drew a comparison over the last four decades between two building cost indexes, one based on a weighted average of building wage rates and materials prices,[10] the other derived as a simple average of cost indexes of four well-known building contractors. These four indexes attempt to measure changes in building cost based on "actual estimates for building comparable structures."[11] The authors state: "Since the *Engineering News-Record* index is a combination of wages and materials prices according to a fixed relationship, while the combined contractor index is based on estimates of the actual cost for erecting comparable structures, a comparison of the two should at least suggest the changes in cost that result from changes in efficiency."[12]

The two indexes are presented in Table C-4. There is some short-term difference in movement between the two series, with the ratio of the contractor index to the *ENR* index rising during the first World War, declining gradually through the middle and late twenties and the thirties, rising again through World War II and the early postwar years, and declining during the late forties. This variation tends to confirm the widely held belief that efficiency in the building industry declines when the industry is under the strain of expanding output rapidly and rises under conditions of stable or declining output.[13]

However, there is no pronounced long-term trend in the ratio between the two series. With both indexes on a 1913 base, the ratio between the indexes was at 101 in 1950 and 103 in 1951. At no time did the ratio fall below 90 or rise above 111. To the extent that the contractor indexes reflect the gains in productivity in building con-

[9] Miles L. Colean and Robinson Newcomb, *Stabilizing Construction: The Record and Potential*, McGraw-Hill, 1952, pp. 69-74 and 247-248.

[10] The *Engineering News-Record* building cost index.

[11] Colean and Newcomb, *op. cit.*, p. 71. The four contractors are The Austin Co., Fruin-Colnon Contracting Co., George A. Fuller Co., and Turner Construction Co.

[12] *Loc. cit.*

[13] Some portion of this variation may also be due to the inclusion in the labor-materials index of nominal prices and wage rates. The contractors' indexes probably always reflect actual prices and wage rates.

TABLE C-4

Comparison of (1) Construction Cost Index Based on Average of Materials Prices and Wage Rates and (2) Average of Indexes Based on Cost of Erecting Comparable Structures
(*1913 = 100*)

	Engineering News-Record *Index*	*Average of Contractor Indexes*	*Ratio of Column 2 to Column 1*
1913	100	100	100
1914	92	102	111
1915	95	113	119
1916	131	128	98
1917	167	151	90
1918	159	176	111
1919	159	184	116
1920	207	232	112
1921	166	187	113
1922	155	174	112
1923	186	196	105
1924	186	198	106
1925	183	199	109
1926	185	200	108
1927	186	195	105
1928	188	193	103
1929	191	192	101
1930	185	182	98
1931	169	163	96
1932	141	147	104
1933	148	148	100
1934	167	163	98
1935	166	163	98
1936	172	169	98
1937	196	189	96
1938	197	187	95
1939	197	184	93
1940	203	191	94
1941	211	210	100
1942	222	229	103
1943	229	236	103
1944	235	237	101
1945	239	246	103
1946	262	292	111
1947	313	346	111
1948	345	375	109
1949	352	371	105
1950	375	379	101
1951	401	413	103

Source: Miles Colean and Robinson Newcomb, *Stabilizing Construction: The Record and Potential*, McGraw-Hill, 1952, pp. 247-248.

struction over the last forty years, these gains do not seem to have played any major long-term role.

A similar analysis of construction cost indexes (including nonbuilding construction) was undertaken by Chawner in 1935.[14] In this analysis he compared a composite construction labor-materials price index, which he derived on the basis of generalized construction weights, with a number of construction cost indexes for various kinds of construction, each of which represented the movement of actual construction costs of contractors, as given in the unit bids of successful contractors, or the movement of labor-materials prices with allowance made for changing productivity as recorded by contractors' experience.

A comparison of the movements in the composite labor-materials index and in cost indexes for heavy construction showed a significantly greater rise in the labor-materials index for the period 1915-1933, indicating the important influence of technological change in this field. The composite labor-materials price index rose from about 47 in 1915 (1923-1925 = 100) to about 79 in 1933, an increase of about 68 per cent.[15] A construction cost index for heavy railroad construction (grading, bridges, tunnels, engineering) rose from about 62 to 68 over the same period, a rise of approximately 10 per cent. The composite labor-materials index fell from about 90 in 1922 to 88 in 1934, while an index for highway construction fell from about 95 to about 78.

However, a comparison of the composite labor-materials index with three indexes of *building* construction cost revealed much less long-term difference in movement.[16] The labor-materials index rose from about 48 in 1910 (1923-1925 = 100) to about 88 in 1934; over the same period the building cost index of the Turner Construction Co. rose from about 48 to about 86. From 1913 to 1934 the labor-materials index rose from approximately 49 to 88, while the building cost index of the American Appraisal Co. rose from 48 to 76; even this difference appeared only in the final two years of the series, for in 1932 the two indexes were at 76 and 73, respectively. The largest difference was found between the labor-materials index, which rose from about 47 in 1915 to about 79 in 1933 (a rise of about 68 per cent), and a construction cost index for railroad stations and buildings, which rose from 52 to 77, or 48 per cent, in the same period. But here again the difference was greatest in the last year or two of the series.

A reasonable inference to be drawn is that productivity has increased

[14] Lowell J. Chawner, "Construction Cost Indexes as Influenced by Technological Change and Other Factors," *Journal of the American Statistical Association*, September 1935, pp. 561-576.

[15] The values were presented in chart form; there may have been some slight error in reading the values from the charts. *Ibid.*, p. 572.

[16] *Ibid.*, p. 571.

significantly in heavy construction but much less so in building construction. There may have been some increase in productivity in building construction but apparently not one of great magnitude. It is likely that the increases in productivity in building have been concentrated largely in the construction of large buildings, and that residential construction, particularly construction of single-family houses, has shared least in this rise, except possibly in the last few years.

Colean and Newcomb, in offering some explanation for the apparently negligible increase in productivity in building construction over the past decades, support the view that there is no major upward bias in standard construction cost indexes.[17] They point out that building wage rates have probably risen by a greater amount than is recognized by construction cost indexes, since the latter are generally based on union rates and union rates are much more widely applicable to the construction labor force in recent years than twenty or forty years ago. Further, the increase in the proportion of skilled workers employed in construction has seldom been taken into account in deriving cost indexes; this phenomenon is partly a result of the increasing complexity of building construction and partly a result of the increasing application of union rules. Finally, Colean and Newcomb point out that "real costs per unit of output probably have been increased [since the early thirties] by a lowering of the productivity of the labor force due primarily to its increased average age."[18]

Colean and Newcomb indicate that as a partial offset to these factors which increased costs over and above increases in union wage rates and materials prices, "increased hourly payments to a labor force of increasing age and decreasing strength have been accompanied by some compensating cost-decreasing factors. There has been increased use of processed materials, such as metal lath in place of wood lath, and accurately cut rather than rough-cut lumber. There has been increased use of power at the site—power saws, cement trucks, electric drills, bulldozers, even power hoists. But the evidence, unsatisfactory as it is, indicates that on balance these cost-decreasing factors have not offset the cost-increasing ones. Labor cost in construction has risen more than wages, hourly or annual, of nonbuilding labor; and it now probably requires more man-years of work for the average worker to pay for the labor going into a house than it required in 1925 or 1915."[19]

Conclusions

The conclusions to be drawn from this analysis of house prices and construction costs can be summarized in the following manner. The

[17] Colean and Newcomb, *op. cit.*, Chap. IV.
[18] *Ibid.*, p. 60.
[19] *Ibid.*, p. 69.

twenty-two-city price index and the construction cost index show significant short-term divergencies. These suggest that market prices of homes fluctuate more widely than construction costs, the difference in rise or fall perhaps amounting to as much as 10 per cent in a period of several years. For short-term analysis, then, some margins of error are involved in using the cost index as an approximation of a price index.

With regard to long-term movements, however, the construction cost index conforms closely to the price index, corrected for depreciation. There is little evidence that the productivity bias in the cost index is of major significance. For long-term analysis the margin of error involved in using the cost index as an approximation of a price index cannot be great.