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Volume Author/Editor: Manuel Gottlieb

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Introduction

The history of efforts to give acceptable statistical representation to United States nonfarm building experience is full of endeavors which have illuminated or charted different aspects of a varied, a shifting, and an only partly explored field of building experience. Four different investigators have worked over building permit records of the nineteenth century and have prepared time series of urban residential or urban building: Riggleman (1934), Newman (1935), Long (1940), and Blank (1954). Others have prepared adjustments of the broadly based series of Riggleman and have developed variants: Isard (1947), and Colean and Newcomb (1952).¹

All these efforts have been carried up to—in some cases beyond—the 1930's; five involved measurement of total urban building as recorded in building permits. Blank and Long provided separate measures of residential building permits, Blank in the form of number of dwelling units and Long in the form of number of residential permits. Both residential and nonresidential building have moved in long swings, but the rhythm and character of those swings differed somewhat in the two types of building, so that any series representing the value of total urban building must be used cautiously as an index of residential building.

¹ See John R. Riggleman, "Variations in Building Activity in United States Cities" (unpublished thesis, Johns Hopkins University, 1934); W. H. Newman, "The Building Industry and Business Cycles," *Studies in Business Administration*, University of Chicago Press, 1935, Vol. V; C. D. Long Jr., *Building Cycles and the Theory of Investment*, Princeton University Press, 1940; Walter Isard, "The Economic Dynamics of Transport Technology" (unpublished thesis, Harvard University, 1947); M. L. Colean and R. Newcomb, *Stabilizing Construction: The Record and Potential*, New York, McGraw-Hill, 1952, Appendix N, "Building Cycles," pp. 219-243; David Blank, *The Volume of Residential Construction, 1889-1950*, Technical Paper 9, New York, National Bureau of Economic Research, 1954.

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While these variant measures of our urban building history were being designed, overlapping series of measures were being worked out by other investigators for urban building activity since 1900, 1915, and 1920. Utilizing all available building permit materials and other information on construction, and using the technique of stratification of universe and checking against controlling census-derived figures, David Wickens developed a highly regarded and widely used residential building series for the period 1920-36.² Working independently, Chawner elaborated a residential building series going back to 1900 on the strength of permit records and Dodge contract information.³ Official statistical agencies in the Departments of Labor and Commerce have developed residential and other building series carried back to 1915 and maintained currently. For the period 1889-1919, the official agencies have adopted the Blank residential building series, while, conversely, Blank and his National Bureau associates, Grebler and Winnick, have accepted the Wickens-Labor Department permit-derived residential unit series for the post-1919 period.⁴ The 1889-1939 composite will be termed BLS-NBER series.

Meanwhile, Simon Kuznets and Robert Gallman developed over-all construction series going back quinquennially to 1840 and available on a smoothed annual basis since 1869. These measures are based upon decennial totals for construction materials produced in this country and destined for domestic use, with annual interpolators derived from annual series of particular types of building materials or quinquennial state census recordings of construction materials produced. The Kuznets and Gallman series show different rhythms and characteristics for some decades of the nineteenth century.⁵

The biases of all building-permit-derived series are now well known. Until recent years, those series, in effect, provided a record of building experience only within the covered central cities of metropolitan areas. Since building permits were not generally required in suburban and

² See final version as presented in David L. Wickens, *Residential Real Estate*, New York, NBER, 1941, pp. 41-50.

³ L. J. Chawner, *The Residential Building Process*, Washington, 1939, and *Construction Activity in the United States 1915-1937*, Washington, 1938.

⁴ *Nonfarm Housing Starts 1899-1958*, Department of Labor, Bull. 1260, 1959.

⁵ See R. Gallman, "Commodity Output, 1839-1899," in *Trends in the American Economy in the Nineteenth Century*, Studies in Income and Wealth, Vol. 24, Princeton for NBER, 1960; Simon Kuznets, *Capital in the American Economy: Its Formation and Financing*, Princeton for NBER, 1961, Apps. B and C.

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satellite communities within metropolitan areas, the series did not catch noncentral-city building until those communities were annexed. Adequate allowance for the effect of annexations has always been difficult to make.⁶ In addition, the patterns of building in central cities and in satellite and rural areas may diverge significantly. Adequate allowances for divergent rhythms of building in cities of different size classes have proved difficult to make. Finally, building has spread outward from city centers at a rate faster than the permit-reporting network has been broadened. These weaknesses have led to continual upward revisions of the more recent broadly based building-permit series. The permit-derived series for the nineteenth century, with their limited coverage, patently rest on insecure foundations.

The biases which run through construction-material-derived series are of a different character. First, amplitudes are dampened because of the substantial volume of construction materials used for maintenance and repair. Second, building and construction materials are used not only for building but also in other ways about which detailed information is known only for more recent years. Lumber is used for crates and boxes, as a fuel, in shipbuilding, and for manufacture of wooden products; bricks are used for sidewalks, street surfacing, and for underground construction.⁷ Third, annual interpolators for the building-material series are comparatively scant and not representative during most of the nineteenth century. Finally, the most important building materials, lumber and brick, were produced through most of that century typically in small establish-

⁶ For example, analysis of the results of the National Housing Inventory of 1956 disclosed that sizable undercoverage, which eluded the reporting permit network, was traceable to "failure to treat annexations correctly." At least during the period 1950-56, "surveys of non-permit housing starts seriously underestimated actual starts in non-permit areas." See *Progress Report on Improvements in Construction Statistics*, Census Bureau, Feb. 12, 1960, pp. 2 and 6.

⁷ In 1912 some 74 per cent of lumber was used in construction while 26 per cent was used to produce box crates, furniture, vehicles, and other wooden products (*Lumber and Timber Products*, Works Progress Administration, GPO, May 1938, p. 108). In the nineteenth century wood was still widely used for heating and industrial fuel. Ohio railroads in 1858 used 209,416 cords of wood and 816,675 tons of coal (*Ohio Executive Documents*, Part 2, 1858, p. 584). In 1892 it was noted that "the utilization of brick for street paving has opened a new market for brick and created a distinct industry. Within the past few years thousands of miles of streets have been paved with this material throughout the West" (*Mineral Resources of the United States*, Bureau of Mines, GPO, 1892, p. 723); V. S. Clark, *History of Manufacturers in the United States*, McGraw-Hill for Carnegie Institution of Washington, 1929 ed., Vol. II, p. 494.

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ments, many of which were operated only part time to meet local needs.⁸ The output of such establishments is in all countries difficult to evaluate statistically in reliable annual measurements.⁹ The fourteenfold growth recorded by Gallman in the production of construction materials between 1840 and 1900 thus reflects in part the drying up of local production facilities, not fully reflected in our records.¹⁰ Since the historic process of industrialization moved unevenly throughout the century, the patterns of movement of the census-recorded segment of the industry may give a deceptive account of total building activity.

At this juncture, new sources of information must be utilized. One helpful source may be found in the little-used "vintage" report of the *Housing Census of 1940*, which developed estimates of the decade in which 92 per cent of the enumerated dwelling units were erected.¹¹

⁸ "In the years preceding the Civil War the production process differed but little from the methods used since earliest historical times," with brick often being produced by hand methods and improvised kilns "at the building site" (A. J. Tassel, D. W. Bluestone, *Mechanization in the Brick Industry*, WPA, 1939, p. 4). The *1880 Census Weeks Report* commented (p. 27): "Brickmaking in many sections of the country is carried on upon a small scale and in a desultory way; the number of employees is small and the subdivisions of labor are of little importance." Even though William Haber reported that the brick industry between 1870 and 1890 had developed from "small scattered undertakings to a commercial enterprise of large proportions," still the Bureau of Mines in its 1895 report noted the difficulty of keeping a directory of producers up-to-date owing ". . . to the large number of plants, the constant establishment of new yards and the abandonment of old ones" (William Haber, *Industrial Relations in the Building Industry*, Cambridge, Mass., Harvard University Press, 1930, p. 25; *Mineral Resources*, 1895, p. 817).

⁹ Right up to the present time," notes a Swedish account in the late 1920's, "the brick-making industry, included in the Industrial Statistics since 1873, only represents part of the total output of the country, as bricks are still largely manufactured as a home industry subsidiary to agriculture." Data with regard to the sawmill industry and the allocation of sawmill products to building and other uses was found too imperfect, before 1896, to warrant making annual estimates of value of construction using a "materials-used" base (E. Lindahl, E. Dahlgren, K. Kock, *National Income of Sweden 1861-1930*, London, P. S. King & Son, 1937, Part I, p. 177; Part II, p. 186).

¹⁰ Gallman records a fourteenfold rise in construction materials used (millions of constant dollars) from 87 in 1839 to 1,224 in 1899. This contrasts with a sixfold rise in the recorded construction labor force from 269,000 gainful workers in 1839 to 1,640,000 in 1899. Gallman, "Commodity Output, 1839-1899," pp. 30, 63.

¹¹ See use of vintage returns by M. Reid, "Capital Formation in Residential Real Estate," *Journal of Political Economy*, Apr. 1958, pp. 135 ff.

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Another helpful source is the continuous census reporting of the decade increments of occupied dwelling units which, with appropriate adjustments for vacancy and shrinkage, should correspond in some fashion with estimated new residential production. The census decennial counts of incremental growth of urban population, occupied dwellings, and non-farm labor force will, for any one decade, correspond to residential building only with a substantial margin of error, but the growth over a stretch of decades should aid in judging the adequacy of any set of decade housing estimates.

Reliable decade totals of new residential production cannot, however, be derived from the census alone. We need to use independent measures as well, in permit-reporting urban areas. Another measure has recently become available owing to the discovery of a new stretch of hitherto unutilized building and real estate data for an entire north central state, Ohio, available without lapses and with full coverage from 1857 to 1914. Annual increments (smoothed by a moving average) in the assessed value of town and city real property were found to correlate closely with annual statewide building values, permitting a projection of building back to 1840. We also have available for ten years in the middle seventies and early eighties an annual count, by number and value, of buildings in Ohio lost or demolished. This information sheds light on building shrinkage rates and thus helps to reconcile total production estimates with realized increments in standing structures.

Originally, the intention was to use the Ohio and other available materials to extend backward by a half-century the BLS-NBER series, which begins in 1889. Those estimates were regarded as sufficiently well established, in spite of the well-known general weaknesses of permit-derived statistics. However, our first efforts to utilize the new materials for extrapolation disclosed an appreciable gap between the aggregate of "starts" for the decades between 1890 and 1910 as measured in the BLS-NBER series and as projected by our materials. The series seemed to seriously overestimate production in the 1890's and to underestimate production in the 1900's. Yet, quite clearly, the estimates for the two decades could not be adjusted on the desired scale without upsetting the whole pattern of decade levels and the secular trend running through the pattern. Nor could we build up an annual time series for the decades preceding 1890 and pin it to a level that involved a serious overestimate. A continuous long series was required. Since other information also indicated that the BLS-NBER series tended to underestimation, the task of a general revision of our nationwide residential building statistics was under-

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taken, beginning with the task of extending statistical coverage backward in time.

The work of revision and extension is limited in this study to preparation of annual nationwide estimates of the number of new housekeeping permanent dwelling units erected. Our work of statistical revision and extension is also limited to preparation of estimates that will yield valid knowledge about long-swing movements. We did not find it necessary to achieve the high degree of accuracy in year-to-year measures that would be important for analysis of the short business cycle. Hence we have utilized methods of statistical adjustment designed to achieve tolerable accuracies in measures of growth trend and long swings, but which may not do justice to short cyclical movements.