Hedonic Housing Indexes during the Great Depression

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Abstract

The Great Depression in the United States was a unique period in terms of the movement in real estate prices. To date, only Shiller (2005) has previously attempted to provide an annual national-level housing price index. Yet previous work has suggested that potential data issues stemming from combining data constructed from a housing survey intended to examine long-term trends rather than annual movements with the need to splice additional data from a small sample of cities beginning in 1934. This paper uses a newly constructed data set from 106 cities in the Home Owners' Loan Corporation City Survey to create a new national-level housing price index from 1929 through 1940. That data set is unique in that it has housing and neighborhood characteristics for over 6,000 neighborhoods with housing prices for three separate, non-consecutive years in each neighborhood. We construct constant-relative-value hedonic price indexes from this data that suggests that housing prices fell nearly 40 percent in nominal dollars between 1929 and 1932 with little recovery by 1940. These results contrast with Shiller which found that nominal housing values in 1940 nearly recovered to the levels found in 1929.

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1 Introduction

The housing boom in the early 2000s and the following bust during the Great Recession has led to renewed interest in two strains of research. The first is the role that housing plays into household and small firm balance sheets. Falling house prices can influence consumption through a reduction in borrowing capacity driven primarily through an increase in adverse selection of the borrowers (Bernanke and Gertler, 1995). As home values are a major portion of the assets in home owners' balance sheets, they figure prominently in consumption decisions by households (Bostic, Gabriel, and Painter, 2009).

The second has been a reassessment of the role of housing in the Great Depression of the 1930s. Recent studies have shown stronger relationships between downturns in housing and mortgages that had largely been ignored since the 1950s. The recent studies have also exposed a major problem in evaluating the role of housing during the 1930s. Until the early 2000s we had only two national series for housing values based on 22 cities between 1930 and 1934. Further, there was virtually no information about how national housing values changed between 1933-34 and 1940, a period when real GDP per capita recovered from its deep trough to 1929 levels but unemployment rates remained well above 10 percent of the labor force. Since roughly 40 percent of American households owned homes in this period, this presents a major gap in our understanding of the value of assets in household balance sheets during the New Deal and the recovery. The issue is particularly important because Frederic Mishkin (1978) found that changes in the value of household balance sheets played a significant role in the downturn between 1929 and 1933.

In the last few years, Shiller (2005) and Fishback and Kollmann (2014) have developed measures of the change in national housing values during the period 1930 through 1940. Their measures are roughly in agreement for the period 1930 to 1934. With a 1930 base year Shiller's index estimates suggest a drop in nominal housing values to a low of 79.1 in 1933, while Fishback and Kollmann developed several different measures that showed a drop to a low between 77 and 81.5 around 1933 and 1934. However, their 1940 range from 54.6 to 77.9 in sharp contrast with Shiller's estimate of 95.6 (Fishback and Kollmann, 2014, Tables 2 and 7).

It has become particularly important to develop a good estimate of housing values during the 1930s because the renewed attention on housing in the modern era has led to a number of studies that rely on housing price estimates to reassess the role of housing in the Great Depression. Recent examples include macroeconomic discussions by by Alexander Field (2014), Stephen Gjerstad and Vernon Smith (2014a; 2014b), and Eugene White (2014). Balcilar et al. (2014) used the Shiller housing value estimates to estimate Granger causality relationships for the period 1890 to 1952. The periods including the Great Depression are the only ones for which they find a Granger causal relationship using Shiller's data. However, those

relationships are likely be changed by the new data here and in Fishback and Kollmann (2014) because the alternative series do not find the strong recovery in nominal housing prices between 1934 and 1940 shown by Shiller's series.

One potential reason for the difference between the Shiller and the Fishback and Kollmann 1940 estimates is that none effectively control for differences in the quality of housing relative to 1930 and 1934 when making the comparisons.[1]

In this paper we develop a quality-adjusted national housing value index for the period 1929 through 1940 using data from the Home Owners' Loan Corporation's "City Survey," which we, along with Shawn Kantor, collected at the National Archives and then digitized. The HOLC asked real estate professionals who appraised, sold, or brokered housing in over 6,000 neighborhoods from 106 cities to describe housing prices, the condition and types of housing, and the characteristics of the neighborhood. Using this data, we construct constant-relative-value hedonic price indexes at the national and regional level for the years 1929 and 1932 through 1940.

Our results suggest that nominal quality-adjusted prices based on the HOLC data fell from 100 in 1929 to 57 in 1934, a drop that was nearly twice as large as the drop reported by Shiller and Fishback and Kollmann (2014, Tables 2 and 7). The price index rose to around 67 in 1937 and then fell back to 62 in 1940. Thus, the new price index in 1940 looks far more like quality-unadjusted measures reported by Fishback and Kollmann than the 95 value reported by Shiller. When adjusted for the large-scale deflation from 1929 to 1933 and the smaller rate of inflation that followed, the HOLC quality-adjusted prices fell from 100 in 1929 to a low of 73 in 1934, rose to around 83 in 1936 and 1937, and then fell back to 75 in 1940. The sharp drop in real housing values and the failure of the real housing values to recover much by 1940 is suggestive evidence that housing problems played a larger role in the Great Contraction from 1929 to 1933 than many had thought and that housing problems were a significant contributor to the high unemployment rates in the latter half of the 1930s.

2 The Recent Estimates of Housing Values in the 1930s

For the period 1930 to 1934 the estimates reported by Shiller (2005) and some of the estimates reported by Fishback and Kollmann (2014) are similar because they are based on the same source. Shiller's estimates for 1934 and earlier are the estimates unadjusted for depreciation that Grebler et al. (1956, pp. 342–356)

[1]There have been a number of single city indexes created. E.M. Fisher (1951) developed a series of median asking prices from newspaper advertisements in Washington, D.C. that are not quality adjusted. Nicholas and Scherbina (2013) develop a hedonic price index for Manhattan residential properties between 1920 and 1939 and find that the nominal price index fell from a value of 100 in 1929 to 66 in 1930 to 45.5 in in 1935 and remained at that level until 1939. Hoyt (1933) developed estimates of land values for Chicago between 1830 and 1932 and found that nominal land values fell 50 percent between 1928 and 1932.

(GBW) based on 22 cities from a survey performed by the Civil Works Administration in 1934. Homeowners reported their estimates of the market value of their home in 1934 as well as the price that they paid for it in the year they purchased the home. GBW used this information to create a national housing price index from 1890 to 1934. Shiller (2005) uses the GBW index for the period 1890 to 1934 for his national housing price index that runs from 1890 to the 2000s. He argues that since the index is based on the price of the same home it is similar to the Case-Shiller index of resale prices that runs from 1953 to the present. GBW recognized that there were problems with depreciation in the quality of the housing as the length of time between 1934 and the original year of purchase lengthened, an issue that Case and Shiller discuss extensively in their notes on the construction of their resale price index. GBW reported an alternative series that assumed an annual rate of depreciation that shows much more growth in nominal housing prices in the 1920s than their raw series. The differences are relatively small in the period 1929 to 1934 that is part of the focus of this paper.

For the period 1929 through 1934, Fishback and Kollmann (2014) found the original worksheets from the 1934 Civil Works Administration (CWA) study at the National Archives and were able to expand the GBW calculations to cover 53 cities. They also constructed estimates of average values of housing based on the homeowners' estimates of the market value of their homes in 1934, 1930, and 1929 that were also reported in the CWA studies. From homeowner's reports of the market values of their homes in the 1930 and 1940 census they calculated median home values from 978 cities and were able to match them up with the same calculations from mid-1930s surveys for 94 cities in 1934, 47 cities in 1935, and 40 cities in 1936. They also compiled indices from the average value of residential building permits for 257 cities and the rent CPI from 32 cities. As seen in Table 1, roughly the same story can be told for all of the series. Nominal housing values fell from an index value of 100 in 1930 to values ranging from 78.7 to 86.6 in 1934, depending on which measure is used.

For the period 1934 to 1940 there are sharp differences between the Shiller series and the variety of estimates developed by Fishback and Kollmann. Shiller interpolated between 1934 and 1953 by developing an index of asking prices based on newspaper advertisements for five cities: Chicago, Los Angeles, New Orleans, New York, and Washington, D.C. The Washington, D.C. series was collected by E.M. Fisher, Ernest M. (1951). For the remaining cities, the index is based on approximately thirty prices for each city and year. The asking price index shows that housing prices rose from 81.4 to 95.6, almost reaching the 1930 level. In contrast, the housing value evidence collected by Fishback and Kollmann and summarized in Table 1 shows housing values dropping between 1934 and 1940 in every case except the rent CPI. The highest 1940 index is 77.9 for the average value of one-family residential building permits. The lowest 1940 value of 54.6 is the median value of owner occupied homes for the five cities in the Shiller asking-price index that displayed

a value of 95.6 in 1940. One of the five cities is New York, and Nicolas and Scherbina (2013) developed a quality-adjusted hedonic index for Manhattan has a value of 44.7 in 1939, which is even lower than the 5-city value of 54.6 for the median value of owner-occupied homes.

It is generally agreed that a quality-adjusted index is preferred. Therefore, our goal in this paper is to use the HOLC surveys to develop an alternative national housing price index that will allow us to control for the quality of housing using hedonic methods. The indices in Table 1 that are most likely to control for the quality of housing are the top four because they are all based on the CWA survey of home owners that asked home owners to report home value in both 1934 and in the year of purchase. It is worthwhile noting, however, that the remaining index values of owner-occupied housing in 1933 were all between 82.2 and 82.6, within the interval of 79.1 to 84.8 from the expanded GBW indexes. In 1934 the remaining index values range from 79.2 to 81.4, very close to the unadjusted expanded GBW index of 81.4 but below the depreciation-adjusted index of 86.6. One reason may be that the thousands of observations in each city lead to means and medians for each city that average out the rise and fall in qualities of housing across the city.

3 Data

In April 1933, President Roosevelt urged Congress to pass the Home Owners' Loan Act of 1933 which would repeal the direct loan provision of the Home Loan Bank Act and replace it with the Home Owners' Loan Corporation (HOLC). The HOLC was under the supervision of the Federal Home Loan Bank Board (FHLBB) and was responsible for refinancing mortgages for people whose mortgage were in danger of foreclosure (Harriss, 1951, pp. 29–30). To accomplish its directives, the HOLC hired appraisers who were familiar with local economic conditions and met qualifications set by the American Institute of Real Estate Appraisers.[2] The appraisers were instructed to equally weight three factors for appraisals: Market value at the time of appraisal, the cost of a similar lot plus the cost of the building less depreciation, and the value of the premises by capitalizing the monthly reasonable rental value of the premises over the past ten years (Harriss, 1951, pp. 41–44).

As the program completed its refinancing program in 1935, the HOLC began the "City Survey" program which resulted in detailed area descriptions and maps for 239 cities with populations exceeding 40,000 people.[3] The area descriptions were collected from the National Archives II in College Park, MD (see Home Owners' Loan Corporation (1940)). This survey differed from its previous appraisal methods by incorporating neighborhood characteristics to analyze the risk of future investment by mortgage lenders

[2]Appraisers had to meet one of the following: (1) Five years experience in real estate brokerage; (2) Five years experience as an appraiser for a banking institution; (3) Experience assessing property for a municipal government; or (4) Qualification as an expert appraiser, membership in the AIREA, or professional qualification as a builder or architect.

[3]Several surveys in New Jersey incorporated the entire county. See Endnote 4 in Hillier (2005) for a list of cities surveyed.

in certain neighborhoods. Of the 239 cities surveyed, we have digitized surveys covering 106 [check this, thought it may be 103] of the largest cities which have been partitioned into 6,564 neighborhoods which were constructed to be as internally homogenous as possible. Figure 1 provides a reproduction of the form used to evaluate a neighborhood while Figure 2 provides the basic set of instructions provided to appraisers.

In many cases, forms evaluated several types of structures (ie. single-family or multi-family housing) separately. Therefore we split each structure type into a unique neighborhood. Due to the poor coverage of housing and contract rental data for many multi-family dwellings, we have restricted the sample to neighborhoods comprising primarily of detached and semi-detached one-family dwellings.[4]

The appraisers provided a range of housing values typically found in each neighborhood. To ease interpretation, we took the midpoint of the range of housing values to construct our price indexes. Each survey generally had estimates of prices for three points in time. Typically, there were 1929, the year of the survey, and one period inbetween these two. This resulted in an unbalanced panel data set comprising 20,495 observations.

In addition to estimated property values, the forms typically provide a range of demographic and structural characteristics of the neighborhood housing stock. Demographic information includes racial composition and share of foreign born. Forms typically included the state of repair, average age, occupancy, home ownership, and building materials of the housing stock. While Figure 1 suggests other survey questions were included, several had inconsistent coverage both within and across cities. Therefore, we have chosen a list of characteristics that are uniformly answered across the sampled cities.

Summary statistics are provided in Table 2. We do not have precise estimates for the population residing in each neighborhood, therefore we have weighted each observation in by an estimate of the city population in the survey year divided by the number of neighborhoods surveyed for the city.[5]

The survey indicates that the average nominal property values was \$7563. However, between the 1929 and 1940. This masks substantial annual variation in the data. The average neighborhood-level property values varied from a high of \$10,970 in 1929 to a low of \$5732 just three years later. These are suggestive of higher prices than the average property values suggested by Wickens. He found from 1930 Census data that the median housing price was under \$5,000 while the average value for owner-occupied dwellings was approximately \$5,800 (Wickens, 1941, p. 3). Even within a particular year, housing values ranged immensely. The average property value ranged between \$220 and \$392,500, the former being small, dilapidated shacks in the south while the latter were brownstones in Manhattan.

Demographic characteristics varied significantly across neighborhoods. The survey indicates that on

[4]Certain neighborhoods contain pooled estimates of housing values of one, two, and multi-family dwellings. Our results are robust to their exclusion from the analysis.

[5]The estimate of the population was calculated from the interpolated populations from the 1930 and 1940 U.S. Census.

average, 20.87 percent of a neighborhood population was foreign born with a standard deviation of 26.34. Moreover, while the average share of blacks was only 4.4 percent, the variable exhibited a standard deviation of 16.12 percent.

In regards to the structural characteristics, 50 percent of the neighborhoods contained brick building, 84 percent of neighborhoods had frame structures, while 21 percent consisted either of stucco or masonry structures. As suggested in the summary statistics, neighborhoods could comprise of buildings containing several different materials. When digitizing the data, it was not clear whether the first entry for building material was the predominant material. Therefore, it was not possible to separately code a primary and secondary building material.

The repair of structures in a neighborhood varied from good through terrible condition. The ratings correspond to the classification used in the period by the United States Census. Good condition housing was described as being in good to excellent physical condition, fair needing minor repairs, poor needing major repairs, while terrible were considered unfit for human habitation. At the national level, very few neighborhoods were considered entirely unfit for habitation. This contrasts with real property inventories which suggest a substantial presence of hazardous housing stock, even if few neighborhoods would be described as such.

The average neighborhood housing stock was 24 years old at the time of the survey with the average home ownership rate at 66.98 percent. It is important to note though that this rate is reflective of our selecting only single-family structures in our sample. The U.S. Census in 1930 found the national homeownership rate below 50 percent. Lastly, each neighborhood had a security grade that corresponded to the perceived risk of lending in a neighborhood. Eight percent of the neighborhoods received an "A" security grade, 23 percent a "B", 44 percent a "C", and 25 percent a "D". Receiving a ranking of "A" indicated the neighborhoods were of little risk for lenders, "B" were still good, "C" were considered in decline, while "D" were considered hazardous neighborhoods in which to lend (source one of Hillier's paper).

4 National Price Indexes

4.1 Hedonic Price Index Approach

In the simplest estimates of housing prices, one would estimate either mean or median housing prices in an individual or set of cities and track these over time. Yet housing stock is heterogeneous and available amenities often change over time. This reduces any particular inference on how to track prices when the quality is simultaneously shifting. The two main methodologies employed to control for quality is either a

repeat-sale or hedonic price index. The HOLC City Survey incorporates several aspects of both types of housing indexes. It is similar to a repeat-sales in that we observe several prices over time for neighborhoods. However, the data set does not have prices for each year in each city, leading to difficulties in creating a true repeat-sales index. As the data set does incorporate a variety of time-invariant structural and neighborhood characteristics of the neighborhood, it is straightforward to estimate the implicit prices of the characteristics and to estimate the price of a representative house.

To estimate hedonic price indexes, we rely on the direct time dummy variable method as described in Triplett (2006). However, as cities do not have annual coverage, we have pooled the sample and restricted the relative prices of the amenities to be constant over our sample period. While this may restrict the prices of amenities, the index changes are more reflective to the cities sampled in the rolling window rather than changes in national prices.

We thus estimate the following hedonic equation:

$$ln(p_{ict}) = \alpha + X_{ict}^{'}\beta + \gamma_c + \delta_t + \varepsilon_{ict} \tag{1}$$

where $ln(p_{ict})$ is an $n \times 1$ vector of logged housing values for neighborhood i, city c, and year t. X_{ict} is an $n \times k$ matrix of housing and neighborhood characteristics, γ_c is a vector of coefficients for city fixed effects and δ_t is a vector of coefficients for year fixed effects relative to the base year of 1934, and α is the coefficient for the y-intercept. We estimate the equation by weighted ordinary least squares. We generate the weights for each neighborhood i in year t by taking the population estimate of the city in year t that contains neighborhood i and dividing by the number of neighborhoods within the city. The population estimates are interpolated using the 1920, 1930 and 1940 population counts for the cities.[6] This weighting offsets the higher weighting that neighborhoods in small cities would account for in the national price indexes. The housing and neighborhood characteristics are those found in the summary statistics in Table 2.[7]

Using 1934 as the base year, we then construct constant quality hedonic price indexes by the ratio of predicted prices:

$$\hat{I}_{1932} = \frac{\hat{p}_{1932}\left(\overline{X}\right)}{\hat{p}_{1934}\left(\overline{X}\right)} = \frac{exp\left(\hat{\alpha} + \overline{X}_{ict}\hat{\beta} + \hat{\delta}_{1932}\right)}{exp\left(\hat{\alpha} + \overline{X}_{ict}\hat{\beta}\right)} \cdot 100 = exp\left(\hat{\delta}_{1932}\right) \cdot 100 \tag{2}$$

where $\hat{\alpha}$ is the coefficient estimate for the constant and $\hat{\delta}_{1932}$ is the coefficient estimate for the 1932 time

[6] This could result in an overestimate of the weight of the neighborhoods in Security Grades A and B relative to Grades C and D due to the likely relative higher population density of C and D.

[7] A subset of cities representing approximately half the neighborhoods have information on the number of rooms in a typical structure. The inclusion of this variable does not have an impact on the index estimates for the subset of cities which have the number of rooms available.

dummy variable.[8]

As a hedonic price index is constructed from a stochastic process, it is necessary to properly estimate the standard errors of the estimate of the price index and to bound the estimate with confidence intervals. Following the approach in Beer (2007) and Cameron and Trivedi (2005, p. 376), we estimate 95% confidence intervals for the hedonic price indexes using a wild bootstrap approach with 1000 replications. Details of the approach can be found in the Data Appendix. Due to the non-parametric aspect of the bootstrap estimator, the confidence interval is not symmetric across the point estimate of the index.

4.2 Regression Results

Estimates of the hedonic regressions of logged nominal housing values and contract rents can be found in Table 3. Models (1) and (3) do not include fixed effects, while (2) and (4) include them for housing values and contract rents respectively. All estimates are weighted by the estimated city-level population divided by the number of survey neighborhoods. To control for heteroskedasticity, we have clustered the standard errors by city.

Overall, the regression models with city-level fixed effects predicts 71.4% of the variation in log housing prices and 62.2% of the variation in log contract rents. Individual coefficient estimates are typically aligned with the predicted signs and relative magnitudes.

As an example, housing prices and rents are 0.4% and 0.3% lower respectively for a one percentage point increase in the share of blacks in a neighborhood. The sign is similar for the share of foreign born in a neighborhood, although the magnitude is smaller and statistically significant at the 10% level only for log housing values.

As discussed earlier, typical building materials at the neighborhood were classified into either brick, frame, stucco or masonry and cement. Neighborhoods could have several classifications, yet we see the coefficient estimates suggest that brick structures alongside stucco and masonry commanded larger prices and contract rents than frame housing. Interestingly, we see the magnitudes are weaker for contract rents than housing prices.

The quality of building upkeep is also another primary driver of maintaining property values and contract rents. Housing that is in generally good-to-fair condition is, on average, 13.1% below good housing stock with contract rents fetching 9.0% less. The relative return on housing values and contract rents falls as the average quality deteriorates with the exception of housing in terrible condition, yet this may indicate the small number of neighborhoods in terrible condition in the sample. We see in the results that contract

[8] Triplett (2006) notes that the estimates of $exp(\delta)$ will be biased and should be corrected by adding one-half the coefficient's squared standard error to the coefficient. As noted, this correction is quite small and does not have a marked difference in the non-adjusted results.

rents are more resistant to the decline in quality of housing stock, perhaps a reflection of a lack of mobility amongst renters.

Security grades are another driver of housing values and contract rents. Neighborhoods that were typically low-risk appear to have higher housing values and contract rents. Yet this is likely to be endogenous factor as assessors would likely rate a neighborhood higher in regions that have either unobserved quality differences or those that maintained above-average market value and contract rents.

The only coefficient estimate that did not have the correctly predicted sign is the age of housing. For both property values and contract rents, as the average housing stock aged by one year, it was predicted to command a 2.0% and 1.1% premium, respectively. The coefficient is likely biased by the fact that the existing older neighborhoods have been properly maintained with the remaining having been already replaced.

4.3 National Price Indexes

The hedonic price model estimates from Column (2) of Table 3 were used to construct the quality-adjusted nominal price index found in Table 4. In addition, we have included Shiller's housing price index as well as an index of the average value of owner-occupied, mortgaged one-family housing (AVOOM1F) and the average value of building permits of one-family households (BPermit). Details of the construction of these indexes can be found in Fishback and Kollmann (2014). The indexes have been plotted in a line graph in Figure 3. The figure includes the 95% confidence interval constructed using the wild bootstrap technique that is discussed in the Appendix.

We chose a base year of 1934 as that allows a consistent comparison across all four indexes. While we are aware that typically indexes focus on real prices, our results are focusing on nominal housing prices as that these results are more relevant to homeowners with mortgages taken prior to 1929. A housing index adjusted for inflation is more value to households who are interested in purchasing a home during our period.

Our results indicate that our quality-adjusted housing price index fell 42.6% between 1929 and 1934. While the index rose after 1934 and we can reject the null hypothesis at the 5% level of significance that nominal housing values remained at the 1934 level throughout the latter portion of the 1930s. The index shows that 1940 nominal housing values remained 62.0% of the value from 1929.

Shiller's nominal price index, which uses the unadjusted index found in Grebler et al. (1956) finds that housing prices reached a trough in 1933 before recovering to 91.5% of the 1929 value in 1940 and 17.4% higher than in 1934. Using the base year of 1934, the year in which Shiller spliced his five-city median asking-price index onto the GBW index, we can see that the price index largely follows the trend found in the HOLC price index. Therefore, the divergence in housing prices is almost entirely due to the difference in the price

movement from 1929 through 1934. Both Fishback and Kollmann (2014) as well as GBW themselves note that a more accurate depiction of housing values should incorporate a level of depreciation. Yet if Shiller's methodology had incorporated the depreciation-adjusted GBW's index, the results would actually widen the gap between our model and Shiller's housing index from 1929 through 1934. Thus it is clear from the results that there are fundamental differences in the housing stock used to create the index. As the GBW data relied on a 1934 survey of home owners of by the Civil Works Authority, it is entirely possible that it underestimated housing values prior to 1934 due to households who left homeownership prior to 1934 if the equity in their home fell substantially.

The indexes, AVOOM1F and BPermit behave relatively similar to the Shiller index, although there is a large drop in 1940 in the average value of building permits that is not reflected in the other data sets. In addition, while the drop is of similar magnitude for AVOOM1F, the price index from 1934 through 1940 suggests that nominal housing values fell slightly, which suggests a large gap between what is predicted in housing prices when adjusting for quality.

4.4 Regional Hedonic Price Indexes

A secondary benefit of having a data set as comprehensive as contained from the HOLC is that it allows us to estimate a housing price index at a regional level. We have followed the conventions of the United States Census and split the data into the four census regions. A map showing the regional distribution can be found in Figure 4. The plots of the real housing value indexes of the four regions, controlling for city-level fixed effects are found in Figure 5.

As the regions did not have as comprehensive cover for every year, there are no estimated housing index estimates for 1940 in the south as well as 1932 and 1940 in the west. While all four regions show a decline in housing values from 1929 to 1934, the largest declines were seen in the Midwest and Northeast. Our hedonic model suggests that nominal housing values fell 40.9% in the midwest and 44.4% in the northeast compared to a relatively small 33.8% in the south and west. It should be noted however that the average value of housing was smaller in the south and west than that in the midwest and northeast.

Like we saw at the national level, nominal housing values improved from 1934 through 1939/1940 in each of the regions, yet the 1939/1929 ratio of nominal housing values, at 60.01% was the lowest in the northeast and highest in the west (80.4%). While this estimate is above the level estimated by Nicholas and Scherbina for Manhattan, it reflects the state of the housing market in the Northeast relative to the rest of the United States failed to make a similar recovery. If one looks at the 1940/1929 ratio, housing values in the northeast look even worse in comparison. These results are consistent with the employment indexes created by Wallis

(1989). He found that employment during the Great Depression varied by region and that the southern economy fell less sharply than other regions before 1933 and had a stronger recovery.

Like the HOLC data, we split both the AVOOM1F data set by region and an index of average median city-level housing values. The latter data set was constructed from the median housing values indirectly or directly reported in the United States Census for 1930 and 1940 respectively. This data was combined with median prices from the 1934 Financial Survey of Housing.[9] It is difficult to explore the change in housing prices prior to 1934 as these indexes have data for 1930 and not 1929 as does the the HOLC, yet we do not see the same regional differences in the fall of housing prices by region for either AVOOM1F or the Median housing index. Indeed, they predict housing values fall further from 1934 through 1940 with the exception of the western region.

4.5 Hedonic Price Indexes by Security Grade

Appraiser used for the survey placed each neighborhood into one of four security grades based on the perceived risk to lending in these neighborhoods. These grades were A (Best), B (Still Desirable), C (Declining), and D (Hazardous). Hillier (2003) notes that while these neighborhood ratings suggest that lenders would be at high risk to lend in these neighborhoods, the HOLC did not discriminate on its refinancing mortgages based on the neighborhood ratings.

While we do not have quantitative evidence, similar to sub-prime mortgages in the Great Recession, the presumption is that higher risk neighborhoods would experience larger declines as these households would be the first to default on their mortgage in the face of economic stress. Therefore, we split our sample into the four security grades and re-estimated the housing price indexes.

Figure 6 shows the hedonic price indexes between 1929 and 1940 for each security grade. The point estimates from Security Grade A suggest that housing prices in the "Best" neighborhoods experienced severe declines, dropping nearly 50% from 1929 to 1934. These neighborhoods had recovered 40% of its losses over the next six years. However, the relatively small number of neighborhoods led to very imprecise estimates of the housing price index relative to the other security grades.

Security Grades B and C indicate that these neighborhoods experienced approximately a 40% fall, mounted a small recovery in the mid 1930s before falling back to the 1934 level by 1940. The most hazardous neighborhoods, according to the HOLC experienced similar falls to those in the top grade, falling approximately 45% between 1929 and 1934. However, the point estimates suggest that they did not experience the same level of recovery as did the housing in Security Grade A.

[9] Details on the construction methodology can be obtained from Appendix A of Fishback and Kollmann (2014)

These results do point to a situation in which higher-risk households leaving homeownership during the first part of the Great Depression led to a localized demand shock in their neighborhoods, forcing down housing prices. Yet, we see what should have been the safest neighborhoods also experienced large declines in housing prices.

5 Hedonic Rental Value Price Indexes

Contract rental rates are often highly correlated with property values. Yet in a period of declining homeownership rates coupled with low growth in new housing stock, it is not clear that demand for rental housing moved in step with property values. We estimated hedonic models of monthly contract rents for neighborhoods containing single-family housing. We focus on single-family housing as the majority of multi-family neighborhoods were missing contract rents or data on occupancy rates, etc. Thus the analysis will focus on the 17,649 neighborhoods from 1929 through 1940.

As we discussed in Section 4.2, we estimated a hedonic model of logged contract rents using neighborhood characteristics while controlling for city-level fixed effects and heteroskedasticity by clustering by city. The plots of the subsequent nominal rental index is found in Figures 7 and 8 as well as Table 9. For the national level, we have included the rental portion of the Consumer Price Index from U.S. Bureau of Labor Statistics (1941a). For both the national and regional levels, we have plotted median contract rents from the census and the 1934 Financial Survey of Housing.

At the national level, contract rents fell 38.8% from 1929 to 1934, slightly below housing prices in the same period. Contract rents then increased nearly 24% by 1937 before falling slightly through 1940. Unlike the housing price indexes, the rental price indexes are more closely aligned with our hedonic price indexes. For example, the Rent CPI index suggests rents fell 33.3% between 1929 and 1934. However, the CPI suggests that rents did not recover to the extent that is suggested with our sample of single-family units. The median contract rent index shows a similar result.

The regional results of our hedonic price indexes in Table 9 reflect similar findings to those of the regional housing prices indexes. The midwest and northeast experienced the largest falls as compared to the south and the west. In all cases, we can see that the magnitude of the falls in contract rents are less than the falls in property values. This suggests that contract rents were relatively sticky in the period, likely a reflection of the falling homeownership rate.

We also estimated hedonic indexes for contract rents for each security grade. The results, found in Figure 9, suggest that contract rents again reflected housing prices, yet the magnitude of the fall from 1929 to 1934 are more subdued with a stronger recovery after 1934. While it is not clear signal, these results coupled

do suggest that overall, neighborhoods with the lowest and highest security risk saw the largest relative fall in housing prices. If these neighborhoods were populated typically with the highest and lowest income households in the United States, it appears that the middle-class households were the least exposed to any housing price shocks.

6 Comparison with Alternate Indexes

The price indexes that we have used to compare our results use a different set of cities than used in our full sample. This could inevitably be driving our results, so as a robustness check, we have rerun our hedonic price indexes with a similar set of cities.

6.1 Shiller 4-City Index

From 1935 through 1953, Shiller computed his price index using a simple average of the the median asking price data for single-family housing for five cities: Chicago, Los Angeles, New Orleans, and Washington DC. The HOLC city survey contains four of the five cities, Washington DC was not included in the survey. As the median asking price for Washington, DC from Shiller's price index was obtained from Fisher, Ernest M. (1951), it is a simple task to recalculate Shiller's index for the four remaining cities. We have shown the price indexes in Table 14 along with a price index of Manhattan from Nicholas and Scherbina (2013) and Fisher's Washington, DC index. We have used a 1935 base year as the HOLC surveys did not have data from 1934 in our selected cities.

The nominal price index from Shiller varies only slightly without Washington, DC. As we see from the separate Washington, DC index, the median asking price index does not diverge with the possible exception of 1936. Yet it is interesting to see how these results compare to prices in Manhattan. The results suggest a 21% fall in prices in Manhattan between 1934 and 1935 with no sustained recovery. Shiller suggests housing prices are recovering during this period and as it includes New York City, it suggests that housing prices in Chicago, Los Angeles, New Orleans, and possibly the other boroughs of New York had a much different trajectory. Yet, Nicholas and Scherbina's index includes both commercial properties and multifamily dwellings in its sample. While their hedonic regression controls for these factors, it remains possible that these properties were falling while single-family housing improved.

6.2 GBW Index

The price series developed by Grebler, Blank and Winnick (GBW) used surveys from the Financial Housing Survey in 1934. They asked respondents the current value of their home in 1934 and their purchase cost.

They constructed the index by calculating the average of the survey respondent's ratio of purchase price to current value. The base index does not discount earlier purchases that would not adjust for quality changes over longer periods such as renovations and alterations of the structure. Therefore, they GBW recommend adjusting the index for depreciation of the quality of the housing stock over time. The GBW index was weighted by the number of households reporting the value of their home in the 1930 United States Census.

As discussed in Fishback and Kollmann (2014), we digitized additional summary data for another 31 cities to create a GBW-style index of 53 cities. Twenty-three of the 53 cities were also found in the HOLC city survey. Table 15 reports depreciation-adjusted indexes for the complete 53-city sample, the 23 city subset of cities that overlap with the HOLC survey and a hedonic price index of the 23 city subset.

Our GBW results suggest that housing prices fell 18.5% between 1929 and 1933 before recovering slightly by 1934. The 23 city sub-sample index shows a similar finding, housing fell 17.6% in the same period. Despite restricting our city survey to these 23 cities, our estimates of housing prices suggest prices fell 37.9% from 1929 to 1934.

6.3 GDP and Unemployment

As residential construction was and remains a major component of Gross Domestic Product (GDP), we have included Table 19 which displays an index of nominal GDP obtained from the US Bureau of Economic Analysis as well as an index of the national unemployment rate from the Historical Statistics of the United States Colonial Times to 1970, Part 1 (Bureau of Labor Statistics, 1975). We have copied our earlier nominal hedonic housing price index for comparison.

The BEA estimated that in nominal terms, the economy contracted 45.3% from 1929 to 1933. Unlike the other housing figures, this drop is aligned with our estimated 42.6% fall in housing prices between 1929 and 1934. It is hard to directly compare the unemployment rate, yet unemployment increased 587.3% over the same time frame.

Comparing GDP and housing prices after 1934 suggest that housing prices were recovering at nearly the same rate from 1934 through 1935, yet housing prices remained sluggish afterward, hitting only 20.79% above 1929 prices in 1937, while the GDP was 39.22% above that level. We do see that both GDP and housing prices do dip during from 1937 and 1938. However, by 1940, we can see that GDP recovered 54.0% of its value with housing prices only 7.5% above 1934.

6.4 CPI Rental Index

The Bureau of Labor Statistics reported the rent component of the Consumer Price for 32 cities individually during the 1930s, 20 of which were also surveyed in the HOLC city survey. Table 20 reports the weighted average of contract rent for these 20 cities as well as the hedonic contract index for these cities. We weighted the CPI by the number of households reporting rents in the 1930 United States Census.

Contract rents in the CPI fell an estimated 32.1% from 1929 through 1934. In the subsequent three years, rental prices rose over 8%, yet remained largely flat afterward. Our estimates of single-family housing indicates contract rents fell 39.7% from 1929 until 1934, although this is a slight recovery from the low in 1932. This contrasts with the CPI data that suggests a steady decline in the same period. Moreover, our estimates suggest contract rents recovered to around 24% above 1934 prices by the end of the decade. Above the CPI estimates, although they are consistent with the flat trajectory from 1937 onwards.

7 Adjusting for CPI Inflation

The Great Depression was associated with a decline of 25% in the CPI from 1929 to 1933. Throughout the remaining portion of the 1930s, the CPI rose 2.7% a year from 1933 to 1937. There was another bout of deflation from 1937 to 1940. The rapid decline in the CPI in the first part of the Great Depression resulted in the real price of housing to respond much differently than nominal prices. Figure 10 plots the CPI-adjusted hedonic property indexes found in Table 21 for the national housing market as well as the regional indexes.

The large deflation in the first few years of the Great Depression corresponded with the fall in nominal housing values. Thus while nominal prices fell 42.6%, real prices fell only 26.5%. The mild inflation subsequently dampened the nominal rise in prices, thus real prices peaked in 1936 at 13.2% above 1934 prices before falling mildly. The inflation-adjusted, regional indexes share an interesting results. In particular, the southern and western cities saw real declines in housing values of just over 15% between 1929 and 1934, real housing values were nearly back at the 1929 level by 1939. Real housing values in the West in 1936 were estimated to be higher than the level in 1929.

When earlier we compared nominal housing values and rents, we found in general that contract rents were more resilient than housing values in the large contraction of the Great Depression. As Figure 11 plots the indexes from Table 22, it should be no surprise that real rental values show only a relatively small decline in real contract rents of 21.9%. Yet by 1940, we estimate that real contract rents were 89.7% of their 1929 value. If we focus on the census regions, we see that outside of the Northeast which experienced the largest declines in its real rental index, real contract rents in 1939 ranged between 99.2 and 103.2% of the real

contract rents a decade prior.

8 State Income, Employment and Population

Gjerstad and Smith (2014a) argues that in the face of a recession, a deterioration in a household's balance sheet will result in a simultaneous reduction in banks' balance sheets. As loanable funds declines, we would see demand for housing fall as the number of consumers in the market fall. This has a negative feedback that would likely worsen and prolong any recession if the balance sheets for households are in a worse enough state. The 90 percent fall in housing starts from 1926 and 1933 is likely a symptom of the decline in demand. A comparable statistic notes that housing construction as a share of GDP falls from around 5.3 percent in 1925 to to 0.5 percent of GDP in 1933.

While we do not have data on household balance sheets from the period, we do have macroeconomic variables that rougly proxy for the economic health of a household. Thus, this paper is able to use our constructed data set to analyze how the decline in per capita state income, employment and population would feed into housing. These factors, previsouly identified by Reichert (1990), include state per-capita income, employment and population levels.

The relationship between housing prices and these factors are relatively intuitive. At the household level, we would expect that as income falls, a household with a mortgage would see their balance sheet deteriorate until the point that they would be unable to continue making mortgage payments. At this point, their house would fall under foreclosure proceedings. At the national level, we would see a fall in prices as a result of softening demand for housing services. The mechanism in which employment levels influence housing prices are similar to those of income. In regards to population, we would expect that any short-run population flows having spillover effects in housing prices as short-run housing supply remained relatively inelastic during the Great Depression as suggested by the number of new building permits issued.

Annual state per-capita income data were constructed via (how?) from (source)?

Wallis (1989) constructed an annual state-level index of employment similar to the methods used by Lebergott to gauge the strength of the workforce. He constructed the index using data from self-reported employment and payroll data from the Bureau of Labor Statistics, *Monthly Labor Review*. While he acknowledges that using this data can be a bit noisy, he attempts to benchmark to known levels from the decennial censuses in 1930 and 1940. Lastly, we obtained annual population estimates for each state from the United States Census Bureau. To control for neighborhood-characteristics, we employ a neighborhood-level fixed-effects model. As we are not interested in an unbiased estimate of the neighborhood intercepts, this allows us to better control for any time-invariant neighborhood characteristics, leaving our estimates for

state income, employment and population will be consistent and unbiased (find source). We thus have the following model:

$$log\, p_{jst} = \alpha_j + \beta_1 log\, y_{st} + \beta_2 log\, e_{st} + \beta_3 log\, pop_{st} + Year_t \cdot \beta_k + \varepsilon_{jst}$$

where j is the neighborhood, s is the state, and t is the year. $log\, p_{jst}$ is the log real housing prices in neighborhood j, state s, and time t; $log\, y_{st}$, $log\, e_{st}$, and $log\, pop_{st}$ is log real state income, log employment index (base year = 1929), and log population in state s and time t. We have also included a set of year dummies to control for any national macroeconomic shocks.

Yet it remains likely that the relationship between housing prices and state income is endogenous. The paucity of regional data leaves us vulnerable to omitted variable bias. To correct for this potential endogeneity in state income, we developed an instrument that measures the real value added in agriculture and manufacturing. This is a valid instrument as long as the value added in manufacturing and agriculture influences housing prices only through its effect on state income. The instrument will not be valid if changes in the real value added in manufacturing and agriculture may lead to substitution across industries such as residential construction. We test for the presence of underidentification through the Kleibergen-Paap rk LM statistic in which the null hypothesis is that the reduced form coefficients are underidentified. Likewise, we can use the statistic to test for weak instruments, the resulting test statistics indicate.

The results for the national housing market is presented in Table **??** with the regional estimates found in Table **??**. We controlled for heteroskedasticity with White's standard errors, clustering at the city-level or state-level yielded non-sensical results due to the lack of sub-state levels of income, employment and population.

Focusing first on the national results, we see that our Fixed-Effects elasticity estimates for per capita state income and housing prices range between 0.303 and 1.047 when first not controlling for and then controlling for time fixed-effects. The latter suggests that a 1 percent increase in real per capita state income is associated with a 1.047 percent increase in housing prices. Counter-intuitively, we see that that employment is associated with a 0.399 percent fall in housing prices for every 1 percent increase in the employment index. Yet we do see that a 1 percent increase in population is associated with a 1.054 percent increase in housing prices. All the coefficient estimates are statistically significant at the 1% level of significance.

As we believe that our model suffers from omitted variable bias, our IV estimates in Table **??** suggest that the coefficient estimate of per capita state income was biased downwards. In other words, our results suggest that a 1% increase in housing prices will yield a 4.624% increase in housing prices. As state per capita income was falling during the period, this suggests that a small fall in income will have large spillover

effects on households' willingness to purchase housing in the face of a worsening economy. It is difficult to uncover what may be the underlying cause of the downward bias in the FE results, yet one possibility is that there was a substantial speculative market during the Great Depression. If speculators believed that the market would return to pre-depression levels, we would expect speculative behavior to subside as housing prices increased. Yet the ability to speculate in housing was likely contingent on state income. As discussed earlier, (check to see if the correlation is right in Reichert) (Could interest rates also be driving these results? Interest rates may go up in the presence of higher state income, but are they negatively correlated with house prices? No, as prices go up, we would expect a restrictive money supply, yet that is not necessarily what happened in the Great Depression as the MS became more restrictive...)

The regional results do suggest a similar story to what was happening at the national level, yet interesting, the magnitudes for all four Census regions is less than the national estimate. As we can see, the magnitudes on the midwest and northeast are higher than those in the south and west. This suggests that housing prices were much more responsive in the latter regions. This is consistent with the price indexes which noted much larger falls in housing prices. Yet this may suggest that these regions had experienced a fallout from a bubble as compared to the west and south which may have been falling more as a result of falling state income. We also do not see a consistent response in the state population. In the midwest, housing prices were falling substantially in areas of growing population. Yet we see the opposite in the northeast and south, with the magnitude in the former nearly triple the level in the south. The estimates for the west are not precise, suggesting that again substantial variation existed.

9 Hedonic Housing Price Indexes for African American Neighborhoods

This section will add in information on the indexes for neighborhoods that have nonzero populations of African Americans. We reweight these observations by multiplying the original weights by the estimated Share Black for the neighborhood.

10 Expected Capital Gains

Here will talk about constructing a rent-to-price ratio index that under equilibrium conditions, will imply the direction of expected capital gains in the housing market. Is taken from McCarthy and Peach (2004) which based the ratio on a basic asset pricing model from Jorgenson (1963) and Poterba (1984). Trevor: I don't think this is still on the table of things we were going to do, but it is good to double check if that is

something we want to do.

11 Discussion

Overall, our estimates of property value indexes results stemming from hedonic regressions suggest that housing values in the United States during the Great Depression fell significantly in both nominal and real terms. The real price indexes suggest housing values remained at best 17% below their 1929 values. These estimates contrast with the estimates found in Shiller's Irrational Exuberance, yet we suspect the recovery found is likely due to the choice of cities used to estimate housing values after 1934. To a similar extent these estimates also contrast with the housing indexes constructed in Fishback and Kollmann (2014) which found real housing values between 1929 and 1934 to have risen, although there was not a recovery period when estimating the housing index for 1940.

In the end, this data set can likely do far more than just build a national housing index. With the depth of cities and number of neighborhoods within a city, we are able to construct housing indexes at both the city and regional levels. Ultimately this data can be used in fashion similar to Balcilar et al. (2014) to test various hypothesis of the role of housing as a causal factor in the Great Depression. In addition, this data could be used in a similar vein of Fishback, Lagunes, Horrace, Kantor, and Treber (2011) to explore whether any of the housing programs during the Great Depression had any influence on housing values.

In regards to the security grades, there are also several directions that this data could be utilized. There has been an ongoing debate on the role of redlining in cities. While the Federal Housing Administration has often been cited as the instigator of discriminatory lending practices against minorities, the HOLC City Survey Maps have been pointed to in the Urban History literature as an example of the practice. This data set can be used to first explore the importance of race in determining the "risk" of lending in neighborhoods as well as an exploration on whether these security grades had any long term impact on homeownership rates and housing values.

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AREA DESCRIPTION - SECURITY MAP OF _____

1. AREA CHARACTERISTICS:

b. Description of Terrain.

c. Detrimental Influences

d. Percentage of land improved ____% e. Trend of desirability next 10-15 yrs. _____

2. INHABITANTS:

a. Occupation _____ b. Estimated annual family income $_____

c. Foreign-born families ____%;_____predominating; d. Negro____;____%

e. Infiltration of _____; f. Relief families _____

g. Population is increasing _____; decreasing _____; static _____

3. BUILDINGS

	PREDOMINATING ___%	OTHER TYPE ___%	OTHER TYPE ___%
a. Type	_____	_____	_____
b. Construction	_____	_____	_____
c. Average Age	_____ Years	_____ Years	_____ Years
d. Repair	_____	_____	_____
e. Occupancy	_____%	_____%	_____%
f. Home ownership	_____%	_____%	_____%
g. Constructed past yr.	_____	_____	_____
h. ____ Price range	$ _____ ____%	$ _____ ____%	$ _____ ____%
i. ____ Price range	$ _____ ____%	$ _____ ____%	$ _____ ____%
j. ____ Price range	$ _____ ____%	$ _____ ____%	$ _____ ____%
k. Sales demand	$ _____	$ _____	$ _____
l. Activity	_____	_____	_____
m. ____ Rent range	$ _____ ____%	$ _____ ____%	$ _____ ____%
n. ____ Rent range	$ _____ ____%	$ _____ ____%	$ _____ ____%
o. ____ Rent range	$ _____ ____%	$ _____ ____%	$ _____ ____%
p. Rental demand	$ _____	$ _____	$ _____
q. Activity	_____	_____	_____

4. AVAILABILITY OF MORTGAGE FUNDS a. Home purchase _____; b. Home building _____

5. CLARIFYING REMARKS

6. NAME AND LOCATION _____ SECURITY GRADE _____ AREA NO. _____

Figure 1: HOLC City Survey Form (Reproduction)

INSTRUCTIONS FOR FILLING OUT

1. Name of city. Security Grade, i.e. A-B-C or D - Area No. - Example "C-10"

2. Describe or give word picture of "lay of land" i.e. level, rolling, hilly, mention physical features like slopes, bluffs, fills, gallies, streams.

3. Point out the major features which are advantageous and affect the area favorably from a residential standpoint; mention special or unusual things, such as parks, recreation centers, scenic features, good transportation and the type; zoning and restrictions; schools, churches, business centers (gas, water, electricity, sewer, telephone considered to be installed; when not, mention under item 4.

4. The reverse of item 3. Point out what the area lacks from a desirable residential standpoint, especially distances to schools or business centers, inadequate transportation, absence of zoning or restrictions for protection of neighborhoods, lack of public utilities. Mention such things as obnoxious odors, noises, traffic conditions, fire hazards from certain types of manufacturing plants such as cleaning plants, refineries, slaughter houses, disposal and reclaiming establishments. Mention eleemosynary institutions; danger of floods, etc.; in-filtration of lower grade population or different racial groups; encroachments of apartments, commercial or industrial properties. Point out heavily burdened tax districts, years special assessments have to run, areas of heavy delinquency, school tuitions, if any, etc.

5. (a) What is the general type of occupation, i.e. executives, business men, retired professional, clerical, skilled mechanics or factory workers, laborers, etc?
   (b) Estimate average annual income per family
   (c) Indicate predominating nationalities; estimate percentage of foreign-born families to total.
   (d) Estimate percentage of negro families to total number of families.
   (e) Any threat of infiltration of foreign born, negro or lower grade population? If so, indicate these by nationality and rate of infiltration like this: "Negro - rapid".
   (f) If a considerable number of families are on relief, indicate as "few" or "many".
   (g) Indicate rate as "rapidly" or "slowly". Strike out words inappropriate to answers.

6. (a) Predominant type or types, i.e. one, two, three, four or multiple family. Where applicable, state size of unit such as large singles, small 5-room cottages, 4-room apartments, etc.
   (b) Predominant material of construction i.e. brick, frame, stucco, other.
   (c) Average age. Self explanatory. Estimate.
   (d) Condition of repair, i.e. good, fair, poor, or dilapidated.

7. Consider 1929 level as 100

8. (a) Land - estimate percentage of plotted lots which are improved with buildings.
   (b) Dwelling units. A unit is place where one family normally resides. See Vacancy Surveys.
   (c) Home owners - estimate percentage of buildings (not dwelling units) occupied by owners.

9. (a) Express sales demand as good, fair, poor ornone.
   (b) State price and type of property in demand such as $6,500 single or $8,000 two-family.
   (c) Express as good, fair, poor or none. In some sections of the city it may be possible to get numbers and if so, include with statement.

10. a, b, and c same as 9a, b, and c, respectively.

11. (a) Types - include selling price, i.e. $7,500 singles.
   (b) Express as mediocre, fair, substantial - give number of new buildings, if possible.

12. Express a and b as none, limited, ample.

13. Express as up, down or static. In many cases it will be opssible to qualify by indicating rate of trend, i.e. rapidly or slowly downward.

14. Under CLARIFYING REMARKS add pertinent facts or information not covered in previous items with the following especially in mind: a. whenever the adjoining security areas are more than one grade apart, justify and explain. b. Be sure to explain gradations of security values within the area, i.e. "high" or "low" yellow. c. For neighborhoods which are mixed as to types of property and the typical case does not adequately present the picture, explain here. This pertains to items 6 & 7, especially. d. In case of wage-earner neighborhoods, it is helpful to know where they work, how fare they have to go, transportation time, methods, and cost.

15. Personal inspection: _____(name of)_____, Realtor: _____(name of)_____ Loan Service Field Representative; or whoever it is. Give date Form was completed.

Figure 2: HOLC City Survey - Basic Instructions (Reproduced)

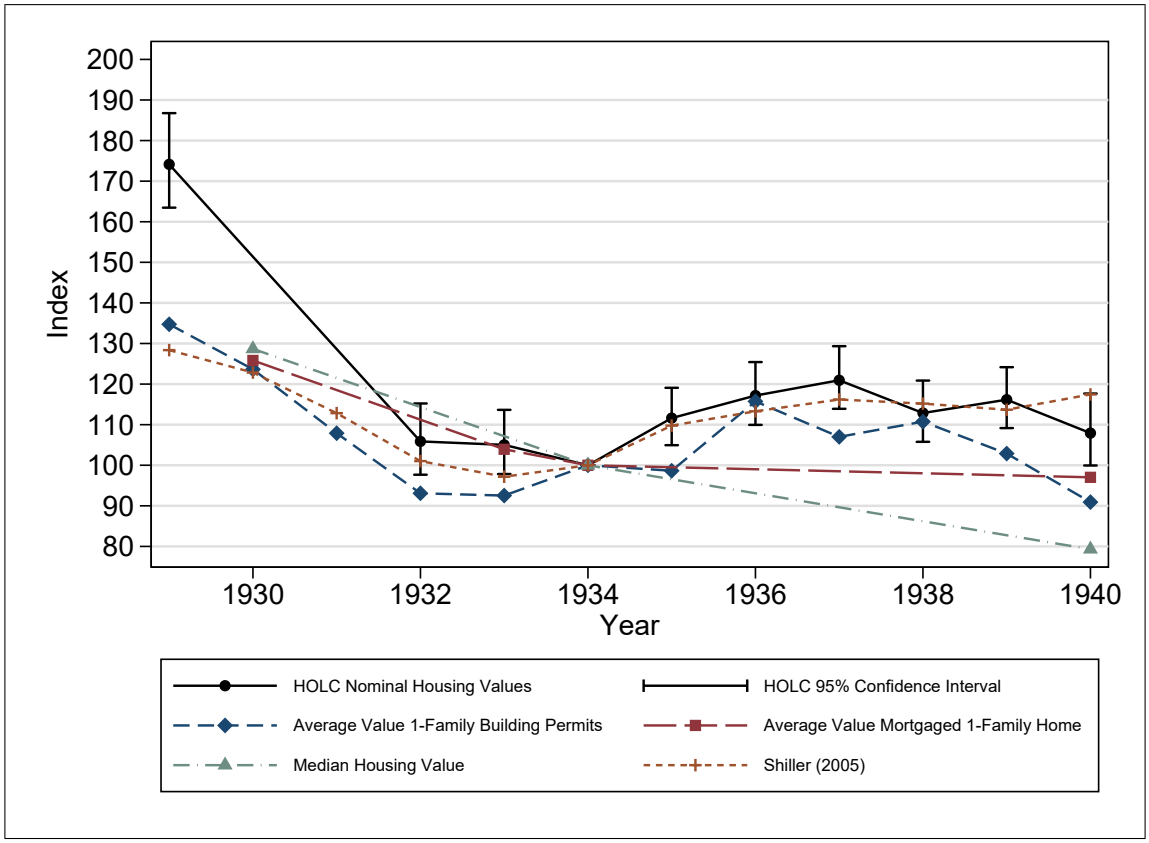

Figure 3: National Nominal Price Indexes (1929-1940)

Note. HOLC Nominal Housing Values is the national index generated from Model 2 in Table 3. 95% Confidence Intervals for the HOLC Nominal Housing Values Index constructed using wild bootstrapping technique described in the data appendix. Shiller (2005) is the nominal housing index which combines the unadjusted housing series in Grebler et al. (1956) with a time series of average asking prices in five major cities. Average Value Mortgaged 1-Family Home is the average value of mortgaged one-family homes, Average Value 1-Family Building Permits is the average value of one-family residential building permits, and Median is the median residential housing values as reported in the Census for 1930 and 1940. The 1934 is constructed from asdfasdf. Details of the construction of these variables are reported in Fishback and Kollmann (2014). Differences in index values from Table 1 are due to differences in the coverage of cities in Fishback and Kollmann (2014). Base Year = 1934.

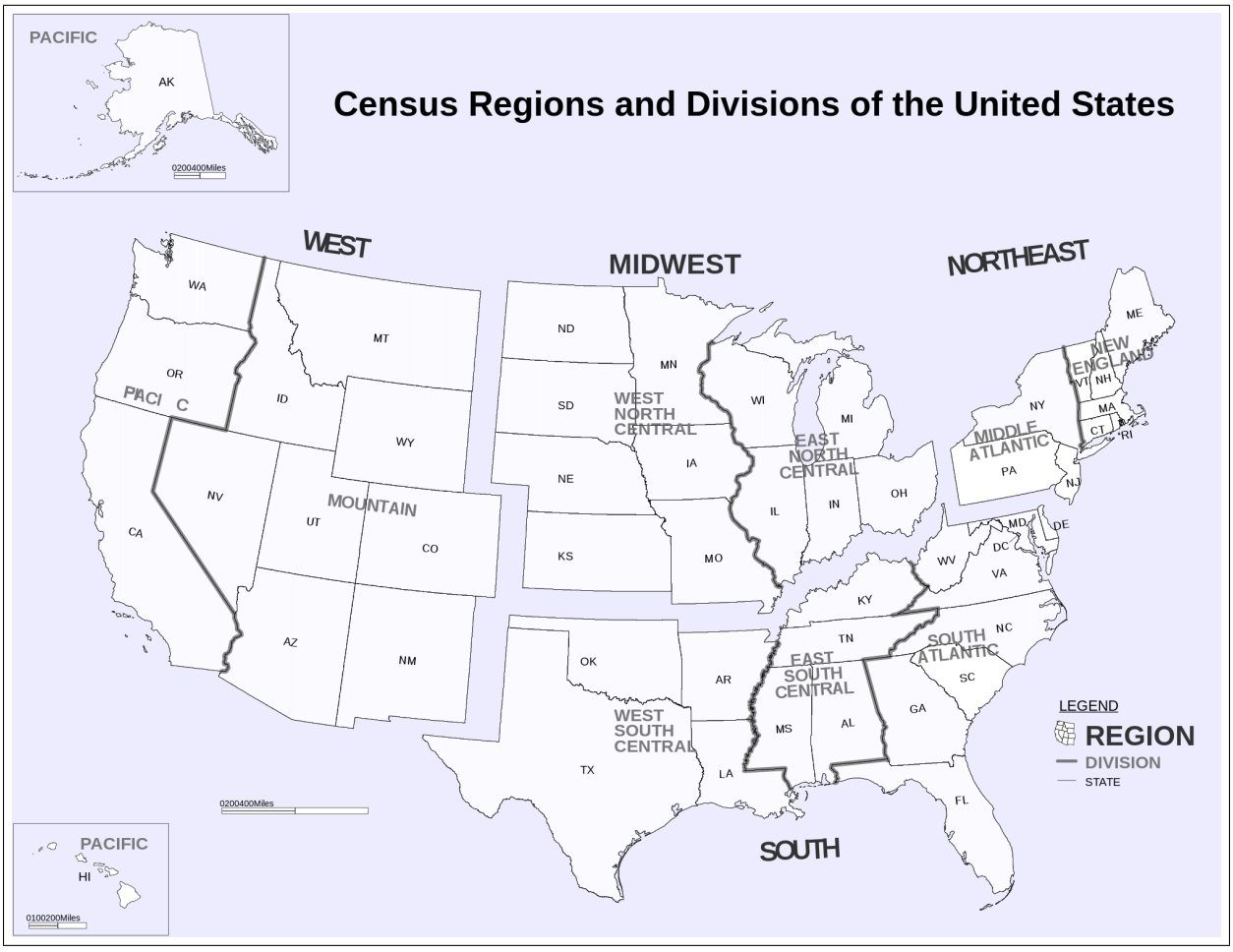

Figure 4: United States Census Regions

Source. United States Census Bureau

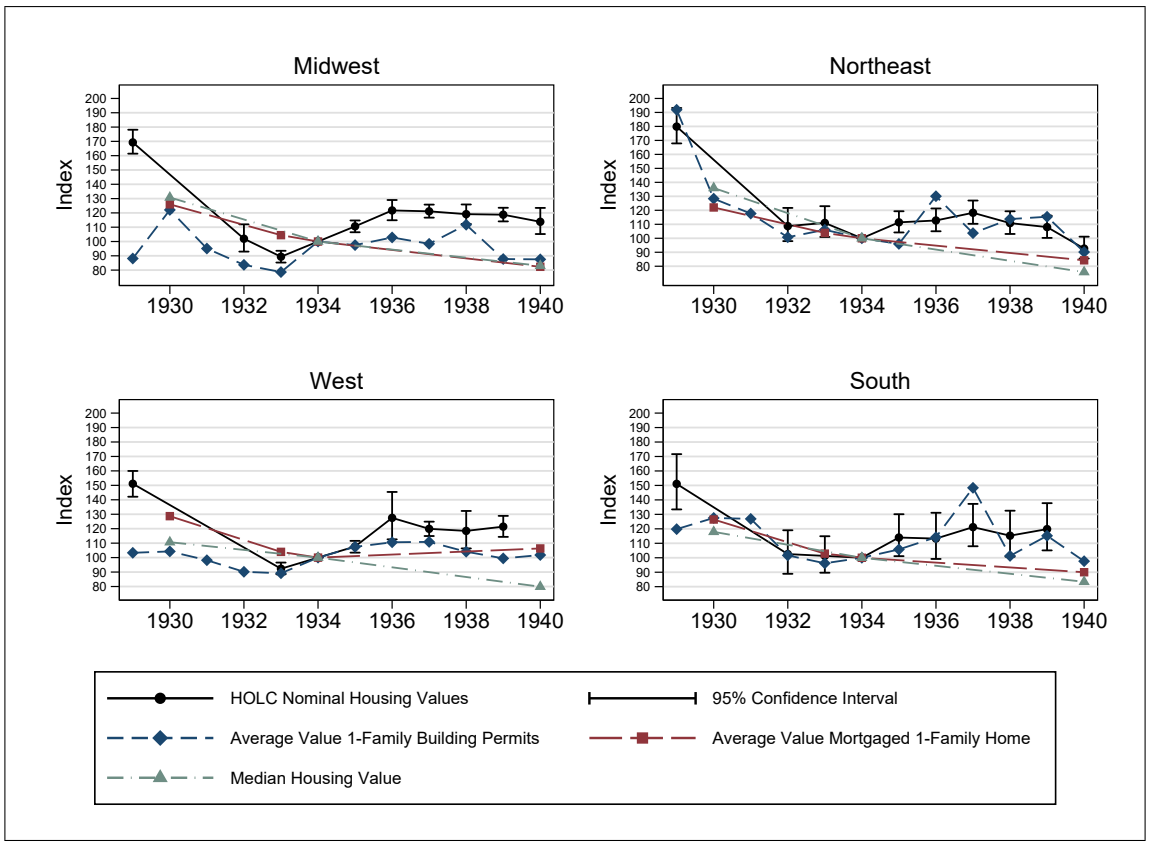

Figure 5: Nominal Price Indexes by United States Census Region

Note. The regions are based on the definitions by the US Census shown in Figure 4. Regional indexes are constructed by running hedonic regressions separately for each region. 95% Confidence Intervals for the HOLC Hedonic Index constructed using wild bootstrapping technique described in the data appendix. Base Year = 1934.

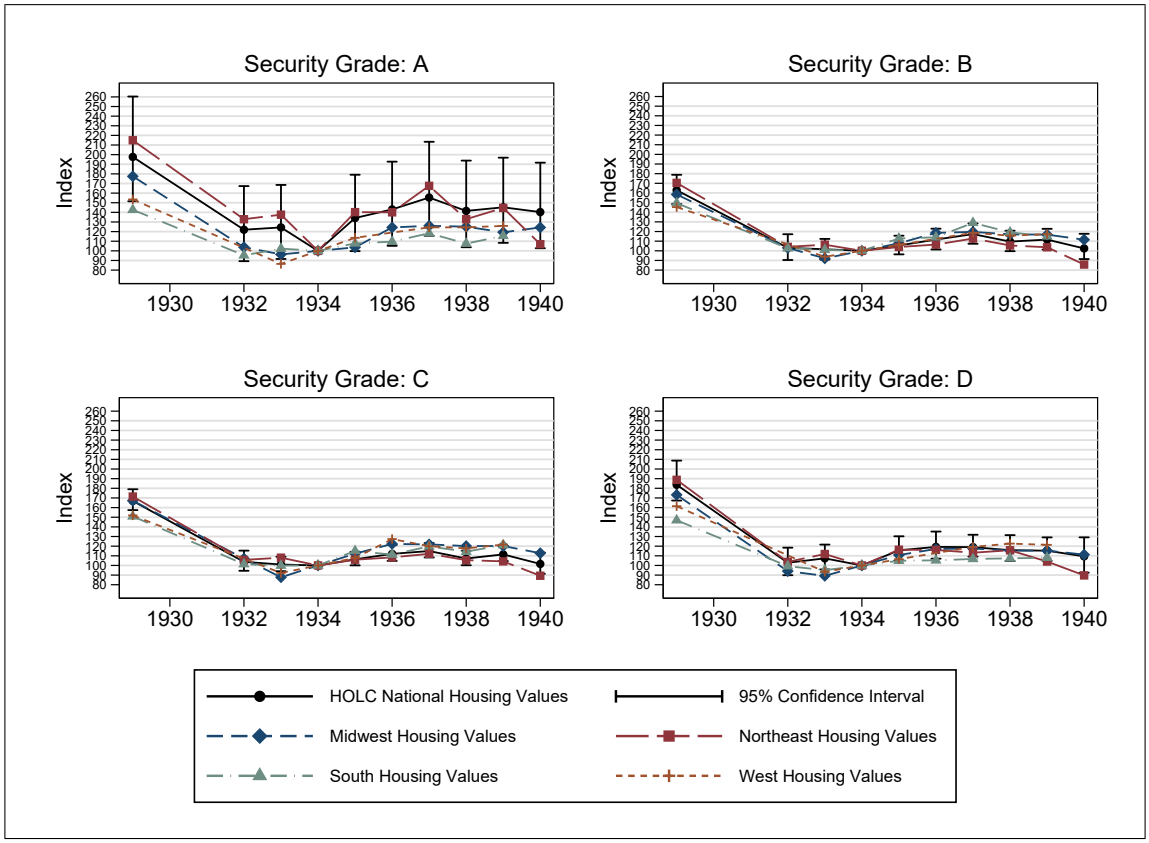

Figure 6: Nominal Hedonic Price Indexes by Security Grade Rating

Note. The hedonic indexes by security grade indexes are estimated by running hedonic regressions for each security grade separately. The indexes for regions are further disaggregated by running a hedonic regression for each combination of security grade and U.S. Census region. 95% Confidence Intervals for the HOLC Hedonic Index constructed using wild bootstrapping technique described in the data appendix. Base Year = 1934.

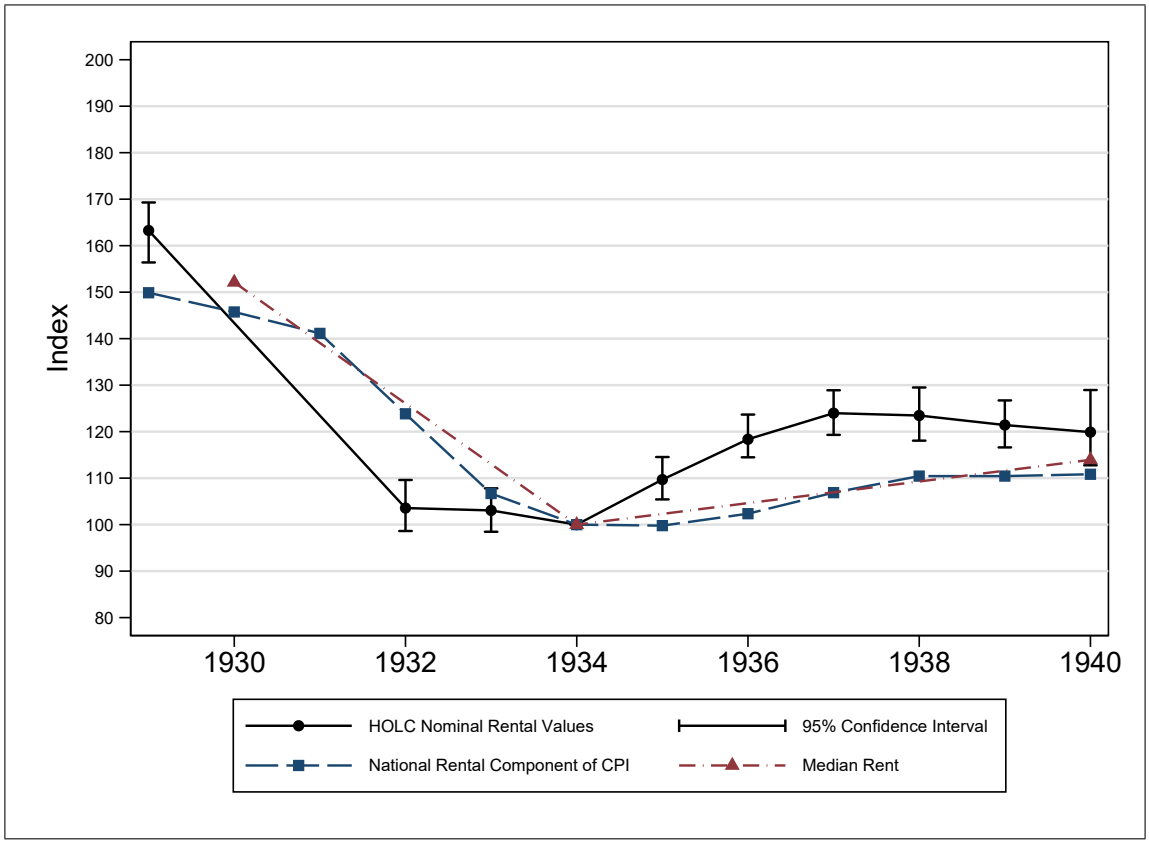

Figure 7: Nominal National Contract Rental Price Indexes

Note. HOLC Nominal Contract Rental Prices is the national rental index generated from Model 4 in Table 3. 95% Confidence Intervals for the HOLC Hedonic Rental Index constructed using wild bootstrapping technique described in the data appendix. Base Year = 1934.

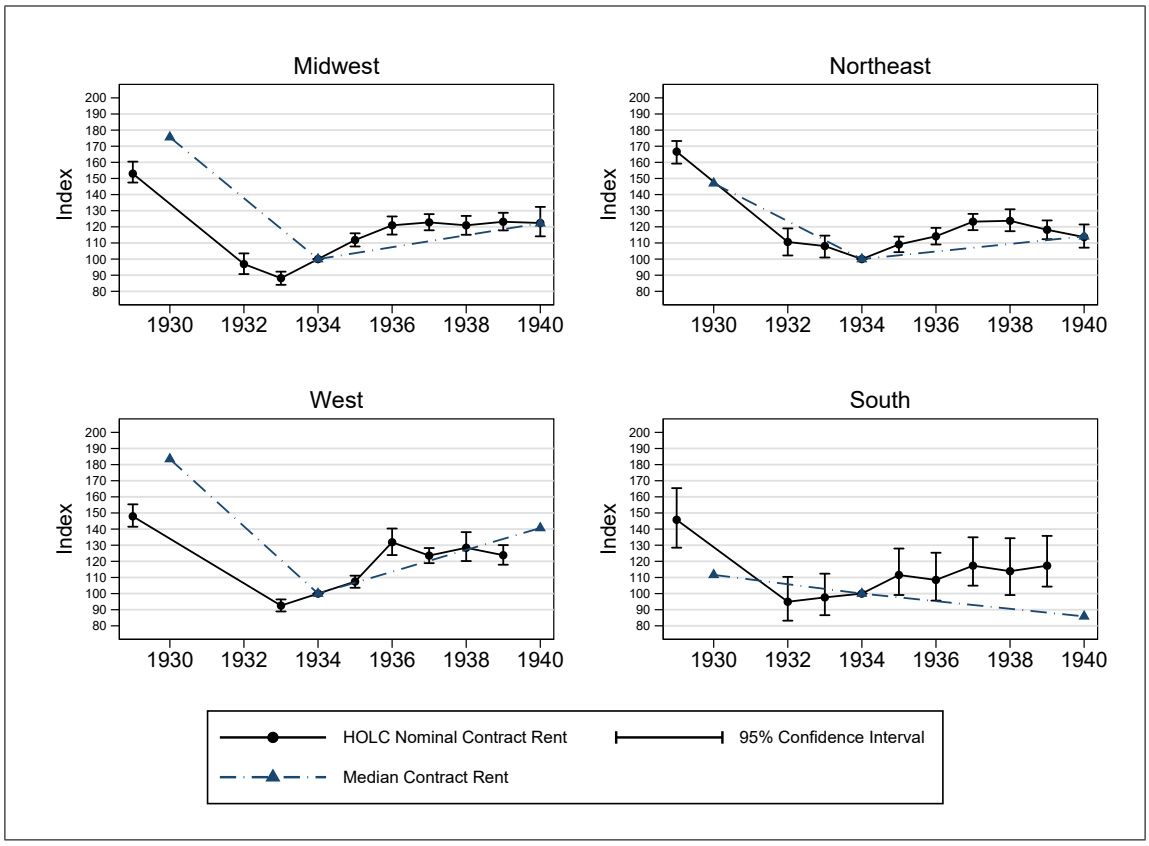

Figure 8: Nominal Contract Rental Price Indexes by United States Census Region

Note. The regions are based on the definitions by the US Census shown in Figure 4. Regional indexes are constructed by running hedonic regressions separately for each region. 95% Confidence Intervals for the HOLC Regional Contract Rentral Index constructed using wild bootstrapping technique described in the data appendix. Base Year = 1934.

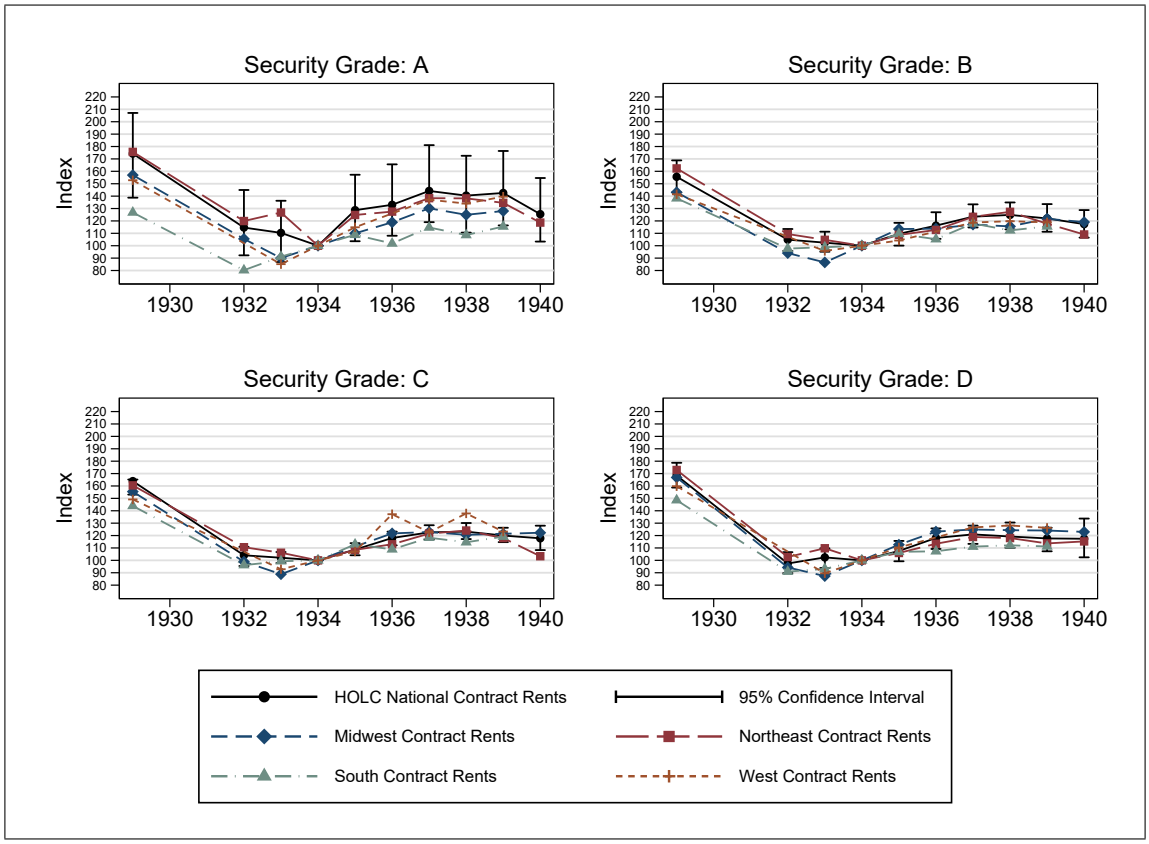

Figure 9: Nominal Hedonic Contract Rental Price Indexes by Security Grade Rating

Note. The hedonic contract rental price indexes by security grade indexes are estimated by running hedonic regressions for each security grade separately. The indexes for regions are further disaggregated by running a hedonic regression for each combination of security grade and U.S. Census region. 95% Confidence Intervals for the HOLC Hedonic Index constructed using wild bootstrapping technique described in the data appendix. Regional confidence intervals are omitted for legibility. Base Year = 1934.

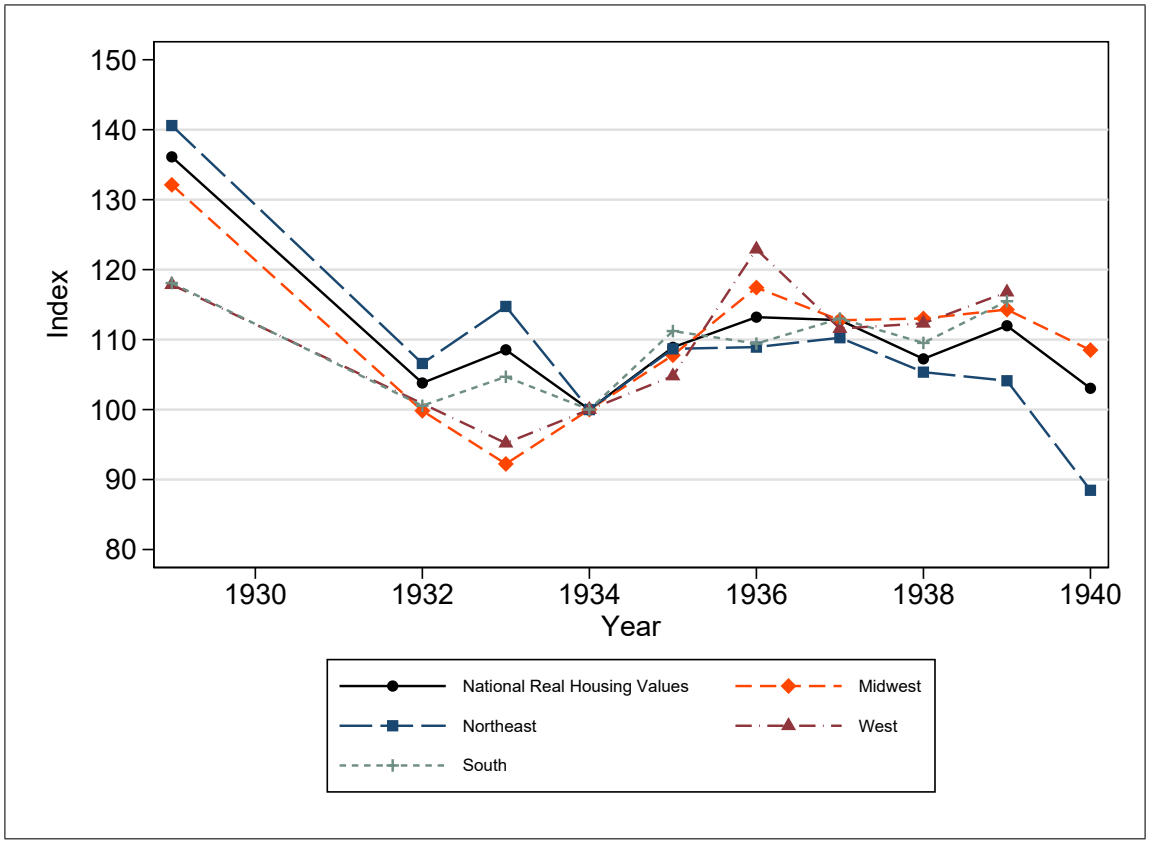

Figure 10: National and Regional Real Housing Value Price Indexes

Note. The hedonic indexes are estimated by the same specification as Equation 1, but the dependent variables is replaced by log real housing values. Housing values are adjusted for inflation with the national CPI. Confidence intervals are excluded from the figure for legibility. Base Year = 1934.

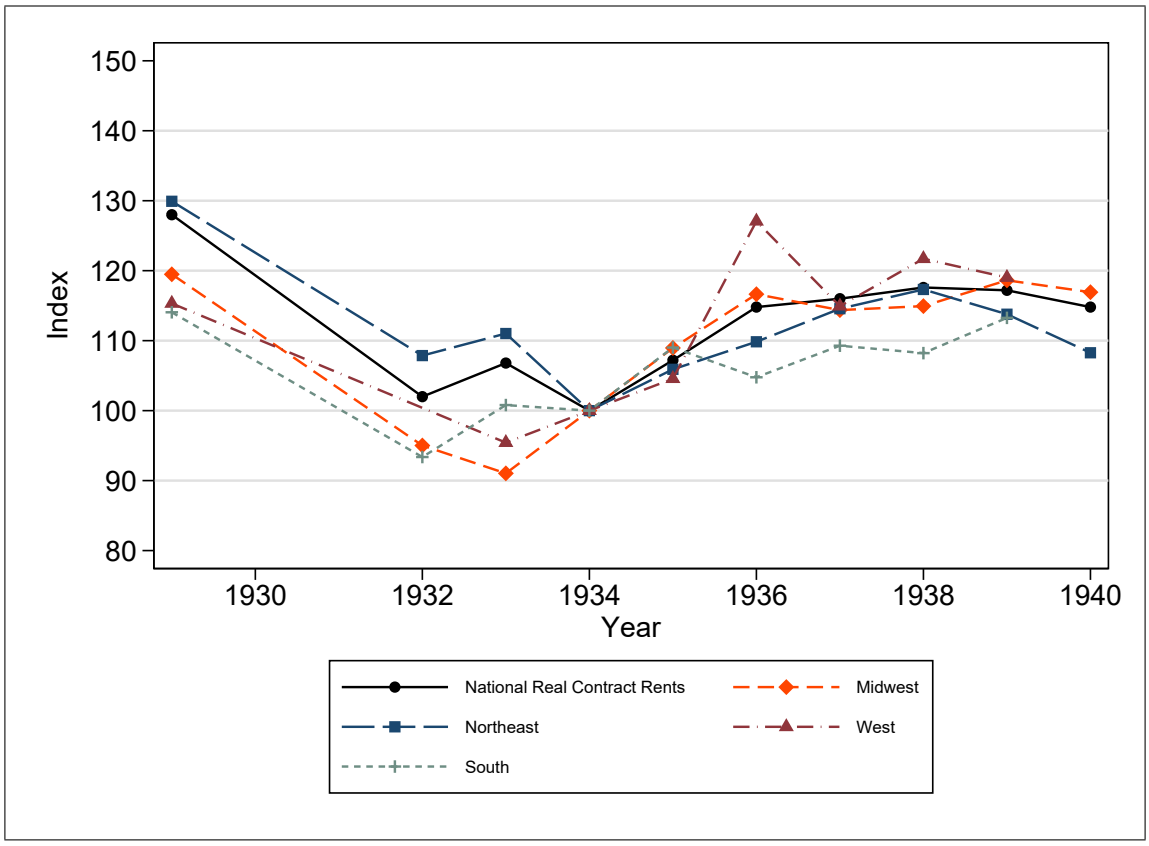

Figure 11: National and Regional Real Contract Rental Price Indexes

Note. The hedonic contract rental price indexes are estimated by the same specification as Equation 1, but the dependent variables replaced with log real contract rents. Contract rents are adjusted for inflation with the national CPI. The regions are based on the definitions by the US Census shown in Figure 4. Confidence intervals are excluded from the figure for legibility. Base Year = 1934.

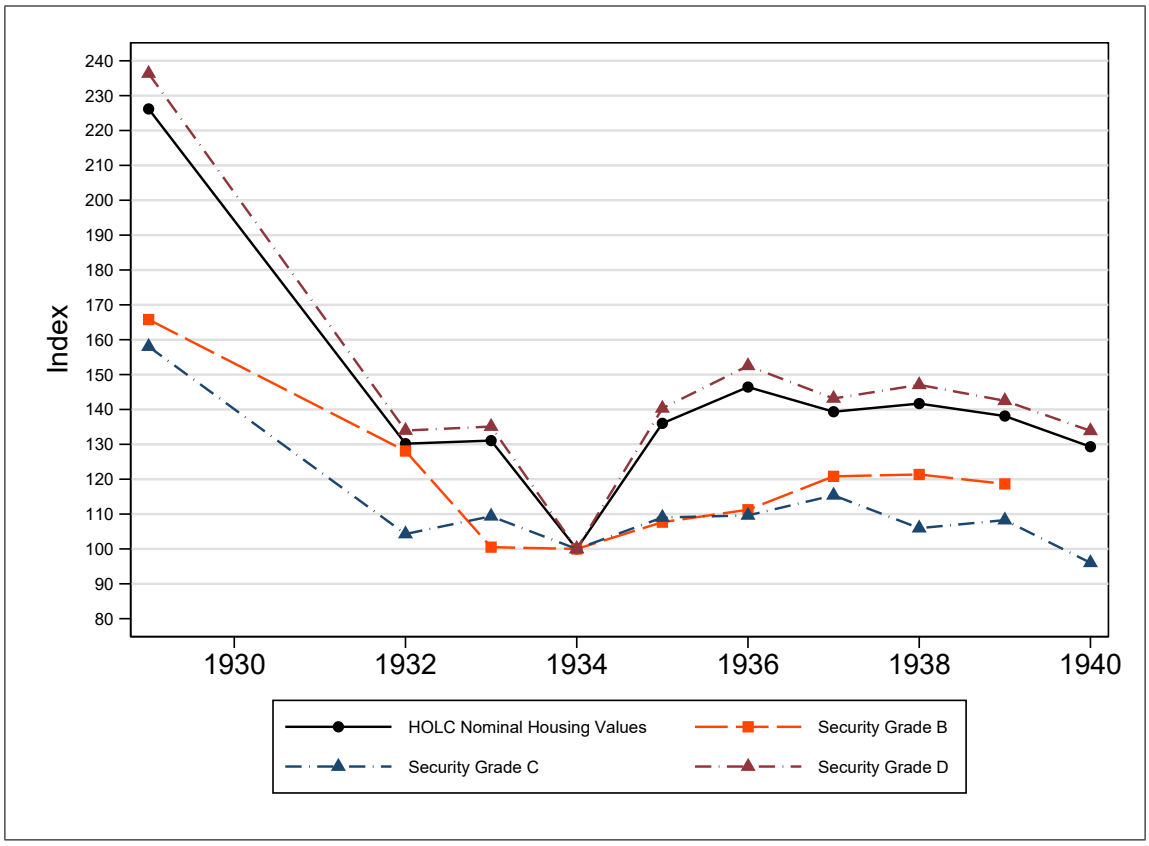

Figure 12: National Hedonic Price Indexes for African American Neighborhoods

Note. The hedonic price indexes are estimated by the same specification as Equation 1, but the weights are the estimated population in the neighborhood multiplied by the share black of the neighborhood. Security Grade A estimates are not available as no African Americans resided in these neighborhoods. Confidence intervals are excluded from the figure for legibility. Base Year = 1934.

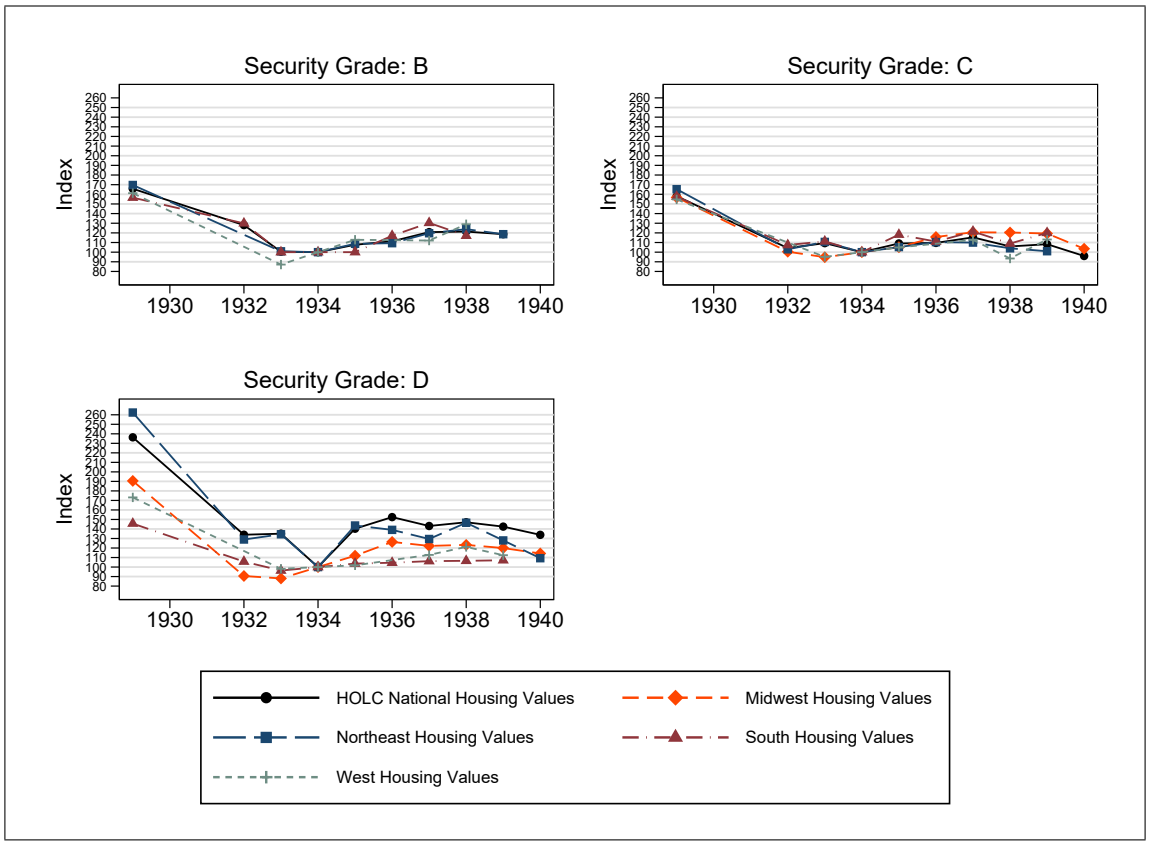

Figure 13: National Hedonic Price Indexes for African American Neighborhoods

Note. The hedonic price indexes are estimated for each security grade separately. The regional breakdowns are constructed by a further separate estimates for each combination of security grade and U.S. Census Region. Security Grade A estimates are not available as no African Americans resided in these neighborhoods. Confidence intervals are excluded from the figure for legibility. Base Year = 1934.

Table 1: Housing Value Index Comparisons

Housing Value Measure	1929	1930	1931	1932	1933	1934	1940	Number of cities
GBW Unadjusted used by Shiller	128.4	122.9	112.8	101.0	97.2	100.0		22
GBW Adjusted for Depreciation	127.8	124.1	115.5	104.7	102.2	100.0		22
Expanding GBW Unadjusted to 53 cities	128.8	122.1	112.8	101.3	99.4	100.0		53
Expanding GBW Depreciation-Adjusted to 53 cities	122.1	115.5	108.2	98.5	97.9	100.0		53
Average Value of Mortgaged Owner-Occupied Homes		126.3			104.3	100.0	92.9	40
Average Value of Mortgage Single Family Homes		126.1			104.0	100.0	92.8	40
Average Value of Mortgaged Owner-Occupied Homes, GBW cities		127.1			104.4	100.0	90.5	20
Average Value of Mortgage Single Family Homes, GBW Cities		126.9			104.3	100.0	88.8	22
Shiller Asking Price Index for 5 Cities Spliced to GBW		122.9				100.0	117.4	5
Median Values of Owner Occupied Homes for City Surveys Covering 1934		125.5				100.0	78.8	94
Rent Portion of Consumer Price Index	149.9	145.8	138.0	123.9	106.7	100.0	110.8	32
Average Value of One-Family Residential Building Permits	120.9	122.7	118.8	96.2	94.5	100.0	95.6	257

Note. Base Year 1934 = 100. Rescaled from 1930 base year in Fishback and Kollmann (2014). GBW refers to Grebler, Blank and Winnick (1956).
Source. Fishback and Kollmann (2014, Tables 2 and 7), Grebler et al. (1956, Appendix C)

Table 2: Weighted Summary Statistics

	mean	sd	min	max	count
Nominal Housing Values	7563.01	9409.39	220	392500	20495
1929	10970.72	14547.43	325	392500	3732
1932	5732.62	7198.83	350	58750	528
1933	6870.57	10537.61	400	112500	837
1934	6009.06	4200.56	850	28400	580
1935	6495.98	5961.47	300	225000	3624
1936	6532.70	6667.07	575	85000	1445
1937	7261.24	8985.39	220	162500	4914
1938	6859.75	6853.14	450	225000	1912
1939	6527.57	7227.26	300	162500	2641
1940	6318.26	6750.21	1000	62500	282
Share of Foreign Born	20.87	26.34	0	100	20495
Percent Black	4.46	16.15	0	100	20495
Brick Structures	0.50	0.50	0	1	20495
Frame Structures	0.85	0.36	0	1	20495
Stucco Structures	0.12	0.33	0	1	20495
Masonry Structures	0.09	0.28	0	1	20495
Structure Age	23.72	13.23	0	100	20495
Occupancy Rate	96.36	5.06	1	100	20495
Homeownership Rate	66.93	23.15	0	100	20495
Good Condition	0.34	0.47	0	1	20495
Good to Fair Condition	0.13	0.34	0	1	20495
Fair Condition	0.28	0.45	0	1	20495
Fair to Poor Condition	0.14	0.34	0	1	20495
Poor Condition	0.11	0.31	0	1	20495
Poor to Terrible Condition	0.00	0.05	0	1	20495
Terrible Condition	0.00	0.06	0	1	20495
Security Grade A	0.08	0.28	0	1	20495
Security Grade B	0.23	0.42	0	1	20495
Security Grade C	0.44	0.50	0	1	20495
Security Grade D	0.25	0.43	0	1	20495

Note. Observations are weighted by the estimated population of the city at the time of the survey year divided by the number of neighborhoods in the sample. See paper for details on the construction of weights.

Table 3: Hedonic Regression Estimates

	(1) Log Value	(2) Log Value	(3) Log Rent	(4) Log Rent
Share Foreign Born	0.00214**	-0.00110*	0.00138*	-0.00109
	(0.000955)	(0.000603)	(0.000749)	(0.000709)
Share Black	-0.00430***	-0.00397***	-0.00333***	-0.00340***
	(0.000729)	(0.000607)	(0.000759)	(0.000628)
Brick Structures	0.248***	0.209***	0.149***	0.108**
	(0.0356)	(0.0282)	(0.0395)	(0.0424)
Frame Structures	-0.241***	-0.211***	-0.0289	-0.0613*
	(0.0379)	(0.0300)	(0.0649)	(0.0367)
Stucco Structures	0.103*	0.159***	0.178***	0.160***
	(0.0564)	(0.0446)	(0.0439)	(0.0519)
Masonry and Cement Structures	0.177***	0.255***	0.0838**	0.137***
	(0.0503)	(0.0356)	(0.0323)	(0.0265)
Average Structure Age	0.0202***	0.0199***	0.00798**	0.0115***
	(0.00333)	(0.00300)	(0.00308)	(0.00251)
Average Structure Age Squared	-0.000199***	-0.000217***	-0.0000774**	-0.000113***
	(0.0000438)	(0.0000387)	(0.0000351)	(0.0000238)
Occupancy Rate	0.00420*	0.00133	0.00612**	0.00613*
	(0.00227)	(0.00206)	(0.00290)	(0.00359)
Share Homeownership	0.000119	-0.00107	0.00322**	0.000291
	(0.000807)	(0.000787)	(0.00151)	(0.00198)
Good to Fair Condition	-0.129***	-0.131***	-0.0506	-0.0900***
	(0.0257)	(0.0195)	(0.0322)	(0.0239)
Fair Condition	-0.206***	-0.223***	-0.139***	-0.165***
	(0.0372)	(0.0328)	(0.0430)	(0.0377)
Fair to Poor Condition	-0.343***	-0.333***	-0.151**	-0.204***
	(0.0622)	(0.0459)	(0.0728)	(0.0618)
Poor Condition	-0.526***	-0.504***	-0.224*	-0.290***
	(0.0816)	(0.0676)	(0.118)	(0.0918)
Poor to Terrible Condition	-0.516***	-0.581***	-0.142	-0.335***
	(0.159)	(0.130)	(0.136)	(0.0971)
Terrible Condition	-0.366*	-0.409***	-0.179	-0.298**
	(0.190)	(0.118)	(0.152)	(0.117)
Security Grade B	-0.488***	-0.499***	-0.320***	-0.375***
	(0.0385)	(0.0411)	(0.0508)	(0.0516)
Security Grade C	-0.813***	-0.814***	-0.580***	-0.650***
	(0.0568)	(0.0623)	(0.0726)	(0.104)
Security Grade D	-1.100***	-1.053***	-0.886***	-0.894***
	(0.0861)	(0.0812)	(0.127)	(0.170)
1929	0.635***	0.555***	0.507***	0.487***
	(0.0983)	(0.0491)	(0.0659)	(0.0448)
1932	-0.0719	0.0570	-0.181**	0.0383
	(0.130)	(0.0510)	(0.0723)	(0.0479)
1933	0.0468	0.0490	0.0165	0.0305
	(0.109)	(0.0423)	(0.0703)	(0.0340)
1935	0.230**	0.110**	0.165**	0.0942**
	(0.100)	(0.0512)	(0.0659)	(0.0447)
1936	0.178	0.158***	0.140**	0.172***
	(0.108)	(0.0537)	(0.0614)	(0.0539)
1937	0.211**	0.190***	0.200***	0.216***
	(0.0967)	(0.0510)	(0.0583)	(0.0421)
1938	0.287***	0.121**	0.295***	0.212***
	(0.102)	(0.0516)	(0.0799)	(0.0481)
1939	0.177	0.150***	0.213***	0.195***
	(0.109)	(0.0533)	(0.0718)	(0.0443)
1940	-0.0533	0.0762	0.0593	0.182***
	(0.0972)	(0.0567)	(0.0585)	(0.0455)
Constant	8.570***	8.603***	3.007***	2.974***
	(0.228)	(0.215)	(0.236)	(0.233)
City Fixed Effects	N	Y	N	Y
Observations	20495	20495	17649	17649
R^2	0.595	0.714	0.503	0.622
Adjusted R^2	0.595	0.712	0.502	0.620

Note. Coefficient estimates are weighted by the population of the city divided by the number of neighborhoods in the sample. Standard errors are in parenthesis and are adjusted for heteroskedasticity by clustering at the city-level. $*\ p < 0.1$, $**\ p < 0.05$, $***\ p < 0.01$. Housing in Good Condition, Security Grade A neighborhoods, and the year 1929 are the reference category for the regression. No structure type is a reference category as a neighborhood may contain multiple types of structures.

Table 4: National Nominal Housing Indexes

	HOLC	SecA	SecB	SecC	SecD	Shiller	Median	AVal1F	BPermit
1929	174.14	197.59	162.85	166.88	183.72	128.37			134.74
1930						122.85	128.68	125.83	123.65
1931						112.84			107.9
1932	105.87	122	103.12	103.77	102.79	101.03			93.09
1933	105.03	124.38	101.63	100.97	107.38	97.18		103.94	92.53
1934	100	100	100	100	100	100	100	100	100
1935	111.62	134.16	105.54	106.38	115.67	109.77			98.64
1936	117.17	143.1	111.66	112.06	119.27	113.3			115.74
1937	120.95	155.37	117.33	114.96	119.01	116.2			107
1938	112.87	141.51	109.59	107.2	115.82	115.19			110.75
1939	116.16	145.27	111.61	111.45	115.32	113.69			102.88
1940	107.92	140.3	102.49	101.58	109.46	117.45	79.32	97.03	90.92

Note. HOLC is the national index generated from Model 2 in Table 3. The security grade indexes are estimated by running hedonic regressions for each security grade separately. Shiller is the nominal housing index as reported in Shiller (2005) which combines the unadjusted housing series in Grebler et al. (1956) with a time series of average asking prices in five major cities. Median for 1930 and 1940 is median housing values as constructed from 1930 and 1940 Census. Median housing values in 1934 are constructed by ... AVal1F is the average value of mortgaged one-family homes and BPermit is the average value of one-family residential building permits. Details of the construction of these variables are reported in Fishback and Kollmann (2014). Differences in index values from Table 1 are due to differences in the coverage of cities in Fishback and Kollmann (2014).

Table 5: Regional Nominal Housing Price Indexes in Midwest

	HOLC	SecA	SecB	SecC	SecD	Med	AVal1F	BPermit
1929	169.28	177.46	158.48	167.19	173.23			88.11
1930						130.78	126.01	122.09
1931								95.1
1932	101.98	103.82	103.04	107.14	94.12			83.71
1933	89.38	96.33	92.18	87.76	89.2		104.44	78.66
1934	100	100	100	100	100	100	100	100
1935	110.62	103.67	107.82	112.24	110.8			97.51
1936	121.73	124.37	118.65	122.3	117.11			102.85
1937	121.11	126.04	119.63	121.86	117.56			98.38
1938	119.12	125.14	117.04	120.13	115.44			111.74
1939	118.75	119.3	116.79	120.16	115.43			87.75
1940	113.81	124.33	111.53	112.73	111.25	83.04	82.34	87.54

Note. HOLC is the regional housing price index generated from Equation 1, but restricted to states in the Midwest. Census regions are defined by the U.S. Census as seen in Figure 4. The security grade indexes are estimated by running hedonic regressions for each security grade separately for neighborhoods in the Midwest. Median for 1930 and 1940 is median housing values as constructed from 1930 and 1940 Census. Median housing values in 1934 are constructed by ... AVal1F is the average value of mortgaged one-family homes and BPermit is the average value of one-family residential building permits.

Table 6: Regional Nominal Housing Price Indexes in Northeast

	HOLC	SecA	SecB	SecC	SecD	Med	AVal1F	BPermit
1929	179.86	214.93	170.45	171.48	188.82			191.91
1930						135.96	122.07	128.33
1931								117.68
1932	108.72	132.91	104.12	105.79	103.7			100.77
1933	111.02	137.61	106.34	108.07	111.85		103.87	106.08
1934	100	100	100	100	100	100	100	100
1935	111.41	140.22	103.95	105.97	116.31			95.98
1936	112.74	140.05	106.51	108.38	116.12			130.1
1937	118.25	167.58	112.77	112.07	113.23			103.71
1938	110.87	132.94	105.55	105.51	115.71			113.73
1939	108.02	144.63	103.69	104.25	104.06			115.39
1940	92.66	106.9	85.78	89.36	89.7	75.86	84.27	90.16

Note. HOLC is the regional housing price index generated from Equation 1, but restricted to states in the Northeast. Census regions are defined by the U.S. Census as seen in Figure 4. The security grade indexes are estimated by running hedonic regressions for each security grade separately for neighborhoods in the Northeast. Median for 1930 and 1940 is median housing values as constructed from 1930 and 1940 Census. Median housing values in 1934 are constructed by ... AVal1F is the average value of mortgaged one-family homes and BPermit is the average value of one-family residential building permits.

Table 7: Regional Nominal Housing Price Indexes in South

	HOLC	SecA	SecB	SecC	SecD	Med	AVal1F	BPermit
1929	151.08	142.7	149.45	150.89	146.89			119.79
1930						117.93	126.44	127.54
1931								126.88
1932	102.56	95.39	102.63	101.36	99.28			101.65
1933	101.29	102.32	101.02	99.89	95.12		102.84	96.2
1934	100	100	100	100	100	100	100	100
1935	113.99	107.74	112.8	115.08	104.88			105.76
1936	113.25	109.55	114.03	111.27	105.3			114.17
1937	121.17	118.33	129.04	119.77	106.78			148.36
1938	115.27	107.55	119.16	114.32	107.4			101.28
1939	119.81	115.61	115.03	121.06	108.05			115.2
1940						83.4	89.99	97.62

Note. HOLC is the regional housing price index generated from Equation 1, but restricted to states in the South. Census regions are defined by the U.S. Census as seen in Figure 4. The security grade indexes are estimated by running hedonic regressions for each security grade separately for neighborhoods in the South. Median for 1930 and 1940 is median housing values as constructed from 1930 and 1940 Census. Median housing values in 1934 are constructed by ... AVal1F is the average value of mortgaged one-family homes and BPermit is the average value of one-family residential building permits.

Table 8: Regional Nominal Housing Price Indexes in West

	HOLC	SecA	SecB	SecC	SecD	Med	AVal1F	BPermit
1929	151.13	153.46	145.33	151.93	161.47			103.32
1930						110.66	128.71	104.29
1931								98.19
1932								90.19
1933	92.33	86.43	93.87	92.23	93.48		103.98	89.19
1934	100	100	100	100	100	100	100	100
1935	107.67	113.57	106.13	107.77	106.52			107.44
1936	127.51			127.37				110.62
1937	119.93	124.45	118.7	119.98	119.26			110.9
1938	118.49	124.42	115.71	117.7	122.67			104.1
1939	121.44	125.93	117.3	121.7	121.39			99.48
1940						79.88	106.34	101.81

Note. HOLC is the regional housing price index generated from Equation 1, but restricted to states in the West. Census regions are defined by the U.S. Census as seen in Figure 4. The security grade indexes are estimated by running hedonic regressions for each security grade separately for neighborhoods in the West. Median for 1930 and 1940 is median housing values as constructed from 1930 and 1940 Census. Median housing values in 1934 are constructed by ... AVal1F is the average value of mortgaged one-family homes and BPermit is the average value of one-family residential building permits.

Table 9: National Nominal Contract Rental Indexes

	HOLC	secA	secB	secC	secD	Median	RentCPI
1929	163.27	174.28	155.61	163.93	168.47		149.88
1930						152.12	145.74
1931							141.14
1932	103.57	114.64	104.9	104.1	97.47		123.85
1933	103.06	110.38	102.47	102.11	102.41		106.7
1934	100	100	100	100	100	100	100
1935	109.69	128.66	109.57	108.67	107.58		99.79
1936	118.37	133	116.2	118.03	118.05		102.35
1937	123.98	144.19	123.43	122.6	120.94		106.88
1938	123.47	140.43	124.85	123.19	119.25		110.45
1939	121.43	142.56	122.01	120.02	117.69		110.45
1940	119.9	125.48	117.44	117.8	117.45	113.94	110.84

Table 10: Regional Nominal Contract Rental Indexes in Midwest

	HOLC	SecA	SecB	SecC	SecD	Med
1929	153.01	156.97	143.13	155.44	166.9	
1930						175.6
1931						
1932	96.9	105.54	94.07	98.96	94.3	
1933	88.16	90.03	86.57	88.86	87.34	
1934	100	100	100	100	100	100
1935	111.84	109.97	113.43	111.14	112.66	
1936	120.95	118.93	113.78	121.76	123.23	
1937	122.77	130.19	117.05	122.86	124.9	
1938	120.95	124.93	115.6	120.6	124.34	
1939	123.13	127.98	121.74	121.44	124.06	
1940	122.4		119.08	122.28	122.95	122.19

Table 11: Regional Nominal Contract Rental Indexes in Northeast

	HOLC	SecA	SecB	SecC	SecD	Med
1929	166.67	175.68	162.35	160.49	172.89	
1930						147
1931						
1932	110.61	119.93	109.44	110.62	102.73	
1933	108.08	126.77	104.77	106.17	109.76	
1934	100	100	100	100	100	100
1935	109.09	124.78	108.73	108.52	105.97	
1936	114.14	127.51	112.73	112.96	113.39	
1937	123.23	138.37	123.29	121.6	118.85	
1938	123.74	138.19	127.35	124.07	118.01	
1939	118.18	134.58	117.81	118.02	113.66	
1940	113.64	118.68	109.08	103.33	115.28	114.11

Table 12: Regional Nominal Contract Rental Indexes in South

	HOLC	SecA	SecB	SecC	SecD	Med
1929	145.76	126.8	138.25	143.92	148.53	
1930						111.62
1931						
1932	94.92	80.25	97.7	96.16	90.9	
1933	97.63	91.17	98.82	99.31	93.13	
1934	100	100	100	100	100	100
1935	111.53	108.83	109.52	112.9	106.87	
1936	108.47	101.8	105.27	108.9	107.32	
1937	117.29	114.7	117.97	118.28	111.1	
1938	113.9	108.61	112.39	114.61	112.14	
1939	117.29	115.51	115.57	119.14	111.25	
1940						85.86

Table 13: Regional Nominal Contract Rental Indexes in West

	HOLC	SecA	SecB	SecC	SecD	Med
1929	147.92	152.84	141.51	149.15	159.82	
1930						183.46
1931						
1932						
1933	92.55	85.13	95.8	92.85	89.57	
1934	100	100	100	100	100	100
1935	107.45	114.87	104.2	107.15	110.43	
1936	131.84			137.23		
1937	123.58	137.11	118.7	122.65	126.59	
1938	128.44	134	119.78	137.85	128.16	
1939	123.81	139.61	118.86	123.22	126.22	
1940						140.67

Table 14: Comparison of Shiller Nominal Housing Index 1934-1940

Year	Shiller (5-City)	Shiller (4-City)	HOLC (4-City)	N&S (Manhattan)	Washington, DC
1934	91.10	90.17		126.67	94.85
1935	100.00	100.00	100.00	100.00	100.00
1936	103.22	104.62		105.00	97.60
1937	105.86	106.04	109.05	96.67	105.18
1938	104.94	105.68	101.62	100.00	101.97
1939	103.57	103.99	109.17	98.33	101.91
1940	107.00	107.71			104.16

Note. Cities in 4-City index of Shiller includes Chicago, Los Angeles, New York and New Orleans. Washington, DC is excluded as the HOLC had not conducted a city survey of the neighborhoods.

Table 15: Comparison of GBW Nominal Housing Index 1929-1934

Year	GBW	GBW23	HOLC23
1929	120.18	122.49	161.03
1930	115.49	115.20	
1931	108.19	110.02	
1932	98.54	99.22	98.20
1933	97.96	100.96	104.86
1934	100.00	100.00	100.00
1935			111.06
1936			111.42
1937			113.72
1938			114.25
1939			115.04
1940			92.96
Cities:	53	23	23

Note. GBW and GBW23 are adjusted for depreciation and weighted by the number of owner-occupier families reporting home values in 1930.

Table 16: Comparison of Nominal Building Permit Index 1929-1940

Year	BPermit	BPermit48	HOLC48
1929	134.74	101.40	176.60
1930	123.65	104.73	
1931	107.90	104.75	
1932	93.09	86.06	102.98
1933	92.53	80.72	107.37
1934	100.00	100.00	100.00
1935	98.64	92.61	111.85
1936	115.74	108.32	117.14
1937	107.00	94.55	120.55
1938	110.75	114.85	113.28
1939	102.88	103.28	116.17
1940	90.92	81.34	107.95
Cities:	89	48	48

Note. Nominal Building Permit Index is based on the average value of building permits in 89 cities for the full sample and 48 cities that align with cities in the HOLC City Survey.

Table 17: Comparison of Nominal Average Value of One-Family Mortgaged Properties Index 1929-1940

Year	AVal	AVal22	HOLC22
1929			160.92
1930	125.83	124.75	
1931			
1932			98.17
1933	103.94	103.74	104.82
1934	100.00	100.00	100.00
1935			111.05
1936			111.41
1937			113.77
1938			114.23
1939			115.06
1940	97.03	96.99	93.28
Cities:	53	22	22

Note.

Table 18: Comparison of Nominal Median One-Family Housing Values Index 1929-1940

Year	Med	Med33	HOLC33
1929			184.08
1930	128.68	132.29	
1931			
1932			109.73
1933			120.53
1934	100.00	100.00	100.00
1935			128.74
1936			126.20
1937			129.74
1938			128.07
1939			123.16
1940	79.32	77.99	100.24
Cities:	94	33	33

Note.

Table 19: Comparison of Nominal HOLC Hedonic Housing Values Index to GDP and Unemployment (1929-1940)

Year	GDP	Unemployment	HOLC
1929	156.59	14.55	174.31
1930	138.02	40.45	
1931	115.87	74.09	
1932	89.07	109.55	104.65
1933	85.63	114.55	105.04
1934	100.00	100.00	100.00
1935	111.23	92.27	111.68
1936	127.10	77.27	117.81
1937	139.22	65.00	120.79
1938	130.84	86.82	112.79
1939	139.97	78.18	115.86
1940	154.04	66.36	107.46

Source. GDP: http://www.bea.gov/national/index.htm#gdp Unemployment: Bureau of Labor Statistics, Historical Statistics of the United States Colonial Times to the 1970, Part I (U.S. Government Printing Office, 1975), Series D 1-10

Table 20: Comparison of Nominal CPI Rental Index 1929-1940

Year	CPI Rent 20	HOLC20
1929	147.29	165.72
1930	142.98	
1931	134.46	
1932	117.23	92.44
1933	102.83	108.41
1934	100.00	100.00
1935	100.13	109.94
1936	102.62	115.60
1937	108.30	124.70
1938	109.25	124.94
1939	109.38	123.65
1940	109.91	120.17

Note. Comparison of Rental Portion of CPI for 20 cities between 1929 and 1940 to Nominal Hedonic Rental Price Index for same 20 cities.

Table 21: Real Housing Value Indexes

	National	Midwest	Northeast	South	West
1929	136.12	132.12	140.59	118.09	117.85
1930					
1931					
1932	103.8	99.83	106.59	100.55	
1933	108.54	92.23	114.74	104.69	95.2
1934	100	100	100	100	100
1935	108.9	107.77	108.69	111.22	104.8
1936	113.21	117.44	108.93	109.43	122.92
1937	112.79	112.77	110.27	113	111.58
1938	107.25	113.02	105.35	109.53	112.33
1939	111.98	114.3	104.12	115.49	116.79
1940	103.04	108.5	88.47		

Table 22: Real Contract Rent Indexes

	HOLC	Midwest	Northeast	South	West
1929	128	119.49	129.92	114.06	115.32
1930					
1931					
1932	102	95.02	107.87	93.37	
1933	106.8	91.04	111.02	100.8	95.43
1934	100	100	100	100	100
1935	107.2	108.96	105.91	109.02	104.57
1936	114.8	116.64	109.84	104.77	127.07
1937	116	114.37	114.57	109.28	114.93
1938	117.6	114.94	117.32	108.22	121.71
1939	117.2	118.63	113.78	113.26	119.02
1940	114.8	116.93	108.27		

A Data Appendix

A.1 City list and years

Table 23: Cities and Years Surveyed

City	Region	29	32	33	34	35	36	37	38	39	40	Med	AVal	Bper	GBW	Shiller4	CPI
Akron, OH	MW					X		X		X				X			
Albany, NY	NE	X				X			X					X			
Altoona, PA	NE	X	X	X	X			X									
Asheville, NC	S	X		X				X				X	X		X		
Atlanta, GA	S	X					X		X			X	X	X	X		X
Atlantic City, NJ	NE	X				X		X				X					
Augusta, GA	S	X		X				X									
Aurora, IL	MW	X						X	X								
Baltimore, MD	S	X		X	X	X		X						X			X
Battle Creek, MI	MW	X		X				X									
Bay City, MI	MW	X		X				X									
Bergen County, NJ	NE					X		X		X							
Binghamton, NY	NE	X	X					X				X	X		X		
Birmingham, AL	S	X					X		X			X	X	X	X		X
Boston, MA	NE	X		X	X	X	X	X						X			X
Bridgeport, CT	NE	X	X					X						X			
Brockton, MA	NE	X	X					X									
Buffalo, NY	NE	X		X				X						X			X
Lake County, IN	MW	X				X		X						X			
Charleston, WV	S	X					X		X			X	X		X		
Charlotte, NC	S	X		X				X						X			
Chattanooga, TN	S					X		X		X				X			
Chicago, IL	MW					X		X		X				X		X	X
Cleveland, OH	MW							X	X	X		X	X	X	X		X
Columbia, SC	S	X				X		X				X	X		X		
Dallas, TX	S	X					X		X			X	X	X	X		
Dayton, OH	MW	X		X				X						X			
Decatur, IL	MW	X	X					X				X					
Durham, NC	S	X		X				X									
Elmira, NY	NE	X					X		X								
Erie, PA	NE	X			X	X	X	X				X	X	X	X		
Essex County, NJ	NE					X		X		X		X		X			
Evansville, IN	MW	X	X					X									
Fort Wayne, IN	MW	X				X		X						X			
Greensboro, NC	S	X	X					X				X	X		X		
Hartford, CT	NE	X				X		X						X			
Haverhill, MA	NE	X			X			X									
Hudson, NJ	NE					X		X		X		X		X			
Huntington, WV	S	X					X		X								
Indianapolis, IN	MW	X	X					X				X	X	X	X		X
Jamestown, NY	NE	X			X			X									

Table 23 – continued from previous page

City	Region	29	32	33	34	35	36	37	38	39	40	Med	AVal	Bper	GBW	Shiller4	CPI
Johnstown, MI	MW	X		X				X									
Joliet, IL	MW	X	X					X									
Kalamazoo, MI	MW	X				X		X									
Kansas City, KS	MW					X		X		X				X			X
Kenosha, WI	MW	X					X	X				X			X		
Knoxville, TN	S					X		X		X		X		X			
Lawrence, MA	NE	X	X					X									
Lexington, KY	S	X					X	X									
Los Angeles, CA	W					X		X		X				X		X	X
Louisville, KY	S	X				X		X						X			
Lynchburg, VA	S	X	X					X									
Macon, GA	S	X	X	X				X									
Madison, WI	MW	X	X					X									
Manchester, NH	NE	X					X	X									
McKeesport, PA	NE	X		X	X	X		X									
Miami, FL	S	X				X			X					X			
Milwaukee, WI	MW	X					X	X	X					X			
Mobile, AL	S	X	X	X				X									X
Montgomery, AL	S			X				X									
Muncie, IN	MW	X				X		X									
New Britain, CT	NE	X	X					X									
New Haven, CT	NE	X				X		X						X			
New Orleans, LA	S					X		X		X				X		X	X
Bronx, NY	NE	X				X			X					X		X	X
Manhattan, NY	NE	X				X			X					X		X	X
Brooklyn, NY	NE	X				X			X					X		X	X
Queens, NY	NE	X				X			X					X		X	X
Staten Island, NY	NE	X				X			X					X		X	X
Newport News, VA	S	X						X									
Greater Norfolk, VA	S					X		X		X				X			X
Norfolk, VA	S	X		X				X						X			X
North Haven, CT	NE	X				X		X									
Oakland, CA	W	X		X				X						X			
Oshkosh, WI	MW	X					X	X									
Passaic County, NJ	NE					X		X		X		X		X			
Peoria, IL	MW	X	X						X			X	X	X	X		
Perth Amboy, NJ	NE	X				X		X				X					
Philadelphia, PA	NE	X			X			X				X		X			X
Pittsburgh, PA	NE	X			X			X				X		X			X
Portland, OR	W	X						X	X			X	X	X	X		X
Poughkeepsie, NY	NE	X				X			X								
Racine, WI	MW	X					X	X				X	X		X		
Richmond, VA	S	X		X				X				X	X	X	X		X
Roanoke, VA	S	X	X					X									
Rochester, NY	NE					X	X	X	X					X			
Rockford, IL	MW	X	X						X								

Table 23 – continued from previous page

City	Region	29	32	33	34	35	36	37	38	39	40	Med	AVal	Bper	GBW	Shiller4	CPI
Sacramento, CA	W	X				X			X			X	X	X	X		
San Jose, CA	W	X		X				X									
Schenectady, NY	NE	X				X			X								
South Bend, IN	MW	X		X				X									
Spokane, WA	W	X				X			X					X			
Springfield, IL	MW	X	X					X									
Springfield, OH	MW	X					X	X									
St. Joseph, MO	MW	X	X					X				X	X		X		
St Louis, MO	MW						X			X	X			X			X
Stockton, CA	W	X					X		X								
St Petersburg, FL	S	X	X	X				X									
Syracuse, NY	NE				X			X			X	X	X	X	X		
Tacoma, WA	W	X		X				X						X			
Terre Haute, IN	MW	X				X		X									
Toledo, OH	MW	X					X		X					X			
Trenton, NJ	NE	X					X	X				X	X	X	X		
Troy, NY	NE	X	X						X								
Union County, NJ	NE					X		X		X		X		X			
Warren, OH	MW	X	X					X									
Waterbury, CT	NE	X			X			X				X	X		X		
Wheeling, WV	S	X					X		X			X	X		X		
Wichita, KS	MW	X		X				X				X	X	X	X		
Winston-Salem, NC	S	X		X				X									
Number of Cities		92	23	25	11	41	21	86	28	15	2	33	22	49	23	4	20

A.2 Bootstrapping Confidence Intervals

Suppose the estimation error of the hedonic price index in 1932 is defined as:

$$\zeta_{1932} = \hat{I}_{1932} - I_{1932} = \frac{exp\left(\hat{\delta}_{1932}\right)}{exp\left(\hat{\delta}_{1934}\right)} \cdot 100 - \frac{exp\left(\delta_{1932}\right)}{exp\left(\delta_{1934}\right)} \cdot 100 = \left(exp\left(\hat{\delta}_{1932}\right) - exp\left(\delta_{1932}\right)\right) \cdot 100 \qquad (3)$$

we could thus construct 95% confidence intervals for I_{1932} by:

$$\left[\hat{I}_{1932} - \zeta_{0.025}, \hat{I}_{1932} - \zeta_{0.975}\right]$$

where $\zeta_{0.025}$ and $\zeta_{0.975}$ are the 2.5 and 97.5 percentiles of ζ respectively. We estimate the distribution of ζ using a wild bootstrapping approach where:

$$\zeta^*_{1932} = \left(exp\left(\hat{\delta}^*_{1932}\right) - exp\left(\hat{\delta}_{1932}\right)\right) \cdot 100 \tag{4}$$

We generate R replications to create the estimated distribution of ζ, using the following steps:

For $r = 1, ..., R$:

1. Estimate $\hat{\varepsilon}$ from Equation 1.
2. Create $\hat{\varepsilon}^*_{r,i} = a_{r,i}\hat{\varepsilon}$, where $a_{r,i} = (1-\sqrt{5})/2$ with probability $(1+\sqrt{5})/2\sqrt{5}$ and $a_{r,i} = 1-(1-\sqrt{5})/2$ with probability $1-(1+\sqrt{5})/2\sqrt{5}$
3. Form $V^*_r = \hat{\alpha} + X\hat{\beta} + T\hat{\delta} + \hat{\varepsilon}^*_r$
4. Regress V^*_ron the same set of regressors to create estimates of $\hat{\delta}^*_r$
5. Estimate $\zeta^*_{r,1932} = \left(exp\left(\hat{\delta}^*_{r,1932}\right) - exp\left(\hat{\delta}_{1932}\right)\right) \cdot 100$

Sorting the set of ζ^*_{1932} from smallest to largest, we then construct our confidence interval for I_{1932} by

$$[\hat{I}_{1932} + \zeta^*_{(R+1)\cdot 0.025}, \hat{I}_{1932} + \zeta^*_{(R+1)\cdot 0.975}] \tag{5}$$

B Filler

Add some stuff later for what needs to go here.

Table 24: National Housing Indexes

	Cities	Neigh	1929	1932	1933	1934	1935	1936	1937	1938	1939	1940
Hedonic	102	5043	100	60.8	60.31	57.43	64.1	67.28	69.46	64.82	66.71	61.97
29-32-37	16	415	100	59.01					68.13			
29-32-38	3	125	100	74.63						72.67		
29-33-37	20	639	100		59.08				70.41			
29-34-37	8	634	100			60.17			84.82			
29-35-37	12	524	100				57.78		59.74			
29-35-38	7	834	100				60.65			61.5		
29-36-37	7	255	100					64.02	64.56			
29-36-38	10	675	100					65.43		64.78		
29-37-38	2	74	100						75.98	74.05		

Table 25: National Housing Indexes

	Cities	Neigh	1929	1932	1933	1934	1935	1936	1937	1938	1939	1940
Hedonic	102	5043	143.97	87.53	86.83	82.68	92.29	96.87	100	93.32	96.04	89.23
29-32-37	16	414	146.79	86.62					100			
29-33-37	20	612	142.03		83.92				100			
29-34-37	8	654	117.9			70.93			100			
29-35-37	12	524	167.38				96.72		100			
29-36-37	7	258	154.88					99.16	100			
29-37-38	2	74	131.62						100	97.47		
34-37-40	1	101				91.49			100			73.17
35-37-38	1	75					115.38		100	94.45		
35-37-39	13	2426					92.52		100		97.98	
37-38-39	1	261							100	98.71	104.72	