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Residential Security Maps and Neighborhood Appraisals

The Home Owners' Loan Corporation and the Case of Philadelphia

At the request of the Home Loan Bank Board, the Home Owners' Loan Corporation (HOLC) created color-coded maps for cities across the country between 1935 and 1940 that indicated risk levels for long-term real estate investment. Involvement in this City Survey Program marked a departure from the original mission of HOLC to provide new mortgages on an emergency basis to homeowners at risk of losing their homes during the Depression. This article considers why HOLC made these maps, how HOLC created them, and what the basis was for the grades on the maps. Geographic information systems and spatial regression models are used to show that racial composition was a significant predictor of map grades, controlling for housing characteristics.

The Home Owners' Loan Corporation (HOLC), created during the Great Depression to help reduce the number of residential foreclosures, made more than one million loans between 1933 and 1936 to homeowners who were in default on their mortgages. Toward the end of this period, HOLC embarked on the ambitious and secretive City Survey Program to investigate real estate conditions in cities across the country. This program resulted in a series of residential security maps for 239 cities that were designed to "graphically reflect the trend of desirability of neighborhoods from a residential viewpoint" (FHLBB 1937: 1). The maps assigned residential areas a grade from

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one to four, coloring fourth-grade areas red and deeming them hazardous. Historians rediscovered the maps in the late 1970s and connected them to what had become known as redlining—the practice of not lending to certain areas based on their neighborhood characteristics, particularly their racial and ethnic composition (Jackson 1985; Mohl and Betten 1986).

Recent research has challenged the idea that HOLC's maps caused redlining by private lenders, arguing that the maps were not widely distributed, lenders had access to other information about neighborhood ratings, and lenders did make mortgages in the red areas after the maps were made (Hillier 2003a). But many questions remain about HOLC's mapmaking activities. First, why did HOLC—an agency created to make new loans to homeowners at risk of foreclosure—create maps of neighborhoods that disparaged the same areas to which it made most of its loans? Second, how did HOLC make the maps? Finally, what was the basis for the HOLC grades? Previous research on HOLC has argued that race—particularly the presence of African Americans—was the primary determinant of the HOLC grade. But was race a significant factor, controlling for the condition and age of housing? How important was it relative to housing characteristics? These issues are critical to a more complete assessment of HOLC's role in housing during the Depression as well as an understanding of the role of the federal government in neighborhood appraisals and redlining during the decades following the Depression.

To address these questions, this research relies on materials from HOLC's archives, real estate and appraisal journals from the 1930s, and census tract-level housing and demographic data from Philadelphia, along with the literature on appraisals and federal involvement in real estate. The quantitative data are analyzed using spatial statistics and geographic information systems (GIS), providing a means for testing the relationship between race and HOLC grade. Robert Beauregard (2001) has been critical of urban history that promotes a theory of the federal government's complicity in the decline of cities during the twentieth century without empirical evidence to support such a connection. By testing the relationship between race and the appraisal of neighborhood risk, controlling for housing characteristics, this approach allows for more confident results and provides a method for testing other commonly held arguments about race, real estate, and urban decline.

This essay first considers why HOLC made the residential security maps, shifting attention away from HOLC and on to its parent organization,

the Federal Home Loan Bank Board (FHLBB). It then considers the process by which the maps were made, including the people who helped to create them and the data sources they used, and compares three different versions of the maps made for Philadelphia. Finally, it uses spatial statistical analysis to determine the neighborhood housing and demographic factors that were the bases for the residential security grades and the relative influence they had.

Why Did HOLC Make the Maps?

The Home Owners' Loan Act of 1933 authorized HOLC to exchange government bonds for delinquent mortgages with lenders and provide homeowners with new low-interest, 15-year fully amortized mortgages and the chance to save their homes (Marvell 1969; Harriss 1951; Colean 1944). Because HOLC made most of its loans before creating the residential security maps, staff did not use the maps to decide where to make loans (Hillier 2003a). In fact, HOLC made a disproportionate number of loans to fourth-grade areas. Loan summaries created by HOLC staff for Newark, New Jersey; Memphis; and Chicago show that HOLC made a majority of its loans to areas later given third or fourth grades (Jackson 1985; Cohen 1990; Metzger 1999). Analysis of a sample of loans HOLC made in Philadelphia similarly reveals that HOLC made most of its loans in areas it later colored red. Many of the recipients of these loans were recent immigrants, Jews, and African Americans (Hillier 2003b).

The residential security maps directed attention to the neighborhood in which a property was located. Through its lending program, HOLC helped to systematize real estate appraisal standards, but this appraisal process focused almost exclusively on the borrower and property rather than the neighborhood. When making loans, HOLC considered the "moral risk" of loan applicants by analyzing the borrower's credit history and present value of the property without much consideration of its location or the future of property values in the area (Harriss 1951: 47). HOLC conducted a second appraisal when it acquired a property through foreclosure in order to determine its fair market rent and sale value (ibid: 103). The structured appraisal form HOLC used to appraise properties requested information about the neighborhood including land use; quality of the residential district ("best," "good," or "poor"); neighborhood trend ("up," "down," or "static"); age of housing; proximity to schools, stores, and transportation; racial composition; and new

public improvements (FHLBB 1935a). But nothing in materials describing HOLC's appraisal process indicates that these were important factors in its appraisals or lending decisions.

If HOLC did not make the security maps in order to decide where to make its own loans, what was their purpose? Part of the answer relates to its concern for the long-term real estate investments it made through its lending program. A memo about the City Survey Program in the FHLBB archives states that the program aimed, in part, to help the FHLBB "successfully establish policies with respect to the collection of HOLC loans" and "the management and ultimate sale of acquired real estate" (Holdcamper 1965). While this seems to have been one of the motivations for initiating the City Survey Program, there is no evidence that HOLC serviced its loans differently according to the type of neighborhood in which it was located.

The limited amount of work HOLC did relating to neighborhood rehabilitation bears a relationship as well. HOLC conducted an experiment in the Baltimore neighborhood of Waverly to show how, through careful intervention, residents and community leaders could preserve neighborhood stability with private capital and support from government agencies. "The HOLC's interest in the protection and rehabilitation of essentially sound residential districts is obvious," the report explained, "since it is the largest single investor in urban real estate and home mortgages" (FHLBB 1940: 16). HOLC conducted similar work in the "blighted" southwest section of Washington, D.C., as part of the defense housing program (FHLBA 1942).

HOLC's rehabilitation work demonstrated a belief that the blight process could be reversed before real estate values collapsed. This optimism went against theories of property valuation that considered neighborhood decline natural and inevitable. A history of the FHLBB explained HOLC's philosophy:

> [HOLC] experts believe that since its interest is duplicated by that of all home-financing and mortgage institutions, a program can be evolved which will reclaim large residential areas which are doomed unless some concerted action is taken. Those experts believe that a joint program of Government agencies and private capital can save millions of dollars in property values now being wasted each year. If such efforts are undertaken in the future, the HOLC will be able to contribute surveys made of more than 300 cities throughout the United States—an accumulation of real estate and mortgage data never before available. (ibid.: 15)

This mention of the City Survey Program in a government publication about the Waverly experiment is among the few published references to the program. It links the surveys to efforts to stabilize real estate property values, although this rehabilitation program accounted for just a tiny fraction of HOLC's resources relative to its lending program.

To more fully understand the motivation for the City Survey Program, one must look beyond HOLC's work to the broader agenda of the FHLBB. It was the FHLBB, HOLC's parent organization, that initiated the program, not HOLC, according to the FHLBB memo about the City Survey Program (Holdcamper 1965):

> The origin of this program early in 1935 was centered in the [FHLBB] Chairman's Office and stemmed from the realization by him and other Board members that to successfully establish policies with respect to the collection of HOLC loans, the management and ultimate sale of acquired real estate as well as to the rehabilitation of the savings and loan industry, there was a great need for information on real estate and mortgage conditions on a local basis.[1]

The board may have initiated the survey in part to facilitate collection of HOLC loans, but it also was intended to inform the board's non-HOLC activities. The FHLBB and its agencies were established to stabilize the entire real estate industry to prevent the failure of lending institutions and the loss of homes by homeowners. By establishing the 15-year fully amortized loan as the standard and increasing the loan-to-value ratio (the amount of the mortgage relative to the appraised value of the property) on first mortgages in order to reduce the need for second mortgages, the federal government hoped to avoid the type of "social disaster" threatened by the Depression (Fahey 1934: 1). The FHLBB believed that this new approach to residential mortgages required a more systematic appraisal process that included careful attention to the neighborhoods in which these long-term investments were made (Bartelt 1993). The board's Savings and Loan Division was responsible for chartering and supervising federal savings and loan associations. The Federal Savings and Loan Insurance Corporation that also fell under its jurisdiction insured deposits in those institutions (Marvell 1969; Bloch 1963). The board considered minimizing the risks involved in mortgage lending by these local associations and "helping to protect them against adverse trends" to be its responsibility (FHLBA 1942: 1).

In 1934, the FHLBB started publishing the *Federal Home Loan Bank Review*, a journal that was sent free to all FHLBB member savings and loan institutions. The *Review* was intended to create a permanent record of FHLBB agency activities, build a sense of unity among member savings and loan institutions, report statistics about the nation's home-financing and construction industries, and "provide a channel for the dissemination of sound principles and sound technic [*sic*] for home-financing and related activities" (FHLBB 1934a: 18). Consistent with this last goal, the *Review*, starting in August 1935, ran a 12-part series entitled "Neighborhood Standards as They Affect Investment Risk" to encourage lenders to consider neighborhood conditions before making loans. The articles highlighted the need for lending institutions to use "exhaustive and scientific analysis" rather than "general impressions or prejudice" (FHLBB 1935c: 404).[2] The *Review* also included an article outlining the process of creating security maps, encouraging all lending institutions to make their own maps of their lending areas. The criteria for appraising neighborhoods and the coloring scheme suggested were identical to those used for the HOLC maps (FHLBB 1936). The *Review* also ran a 10-part series on "Appraisal Methods and Policies," starting in November 1936, which described sound appraisal practices, including the "importance of the neighborhood in appraising" (FHLBB 1937: 111). These articles all demonstrate the FHLBB's interest in promoting neighborhood appraisals and mapmaking among its member institutions as a way of strengthening their investments and, ultimately, the savings and loan industry.

The FHLBB's interest in neighborhood appraisals was not unique among federal agencies or within the real estate industry. The Federal Housing Administration's (FHA) *Underwriting Manual*, first published in 1935, established clear standards for lending institutions seeking federal insurance on their mortgages. The FHA expected lenders to rate the neighborhood as well as the property, taking into consideration the stability of an area, its protection from "adverse influences," and access to transportation, utilities and services, and commercial institutions, among other factors (FHA 1935, pt. 2, sec. 3, par. 312; see also FHA 1936, 1938, 1947). The FHA also published Homer Hoyt's *The Structure and Growth of Residential Neighborhoods in American Cities* (1939), which outlined a method for using map overlays of housing and demographic factors to identify high-risk areas for real estate investment. Like the FHLBB, the FHA shared its ideas about sound investment practices through its own journal, *Insured Mortgage Portfolio*.

Hoyt and Frederick Babcock, who served as the FHA's deputy administrator and head of the Underwriting Division, brought their ideas about property values and neighborhood change to their posts at the FHA. In *The Valuation of Real Estate* (1932: 49), Babcock argued that the "future history of a property is conditioned by the trend of development of the district and city within which the property lies." Along with Robert Park and Ernest Burgess from the Chicago School of Sociology, Hoyt popularized ecological theory before assuming his post at the FHA, positing that cities undergo constant transformation and that neighborhood decline is natural and inevitable. People with the necessary means push outward toward the edges and suburbs of cities, filtering down the older and less desirable housing to African Americans and other racial and ethnic minorities in the final stage of neighborhood decline. Hoyt argued in his dissertation (published in 1933 as *One Hundred Years of Land Value in Chicago*) and in his *The Structure and Growth of Residential Neighborhoods in American Cities* (1939) that property values increased temporarily when African Americans moved in and then dropped precipitously. The concentric zone model that Robert Park and Ernest Burgess, Hoyt's mentors at the University of Chicago, presented in 1925 served as a graphic representation of this kind of urban growth and change (Mohl 1997; Hoyt 1939; Park et al. 1925).

By the time HOLC created the residential security maps, the real estate and appraisal industries had thus joined in the chorus calling for attention to neighborhood factors. Articles in the *Review of the Society of Residential Appraisers*, the *Journal of the American Institute of Real Estate Appraisers*, and the *National Real Estate Journal* all described the neighborhood risk-rating system developed by the FHA.[3] In 1937, the president of the National Association of Real Estate Boards (NAREB) celebrated the attention that the real estate industry had started giving to neighborhoods in the association's *National Real Estate Journal*. The "realization of the importance of neighborhood factors as affecting the value of the individual piece of real estate" was among the "greatest advances" in real estate and he hoped that "it will penetrate far enough and fast enough to be the foundation for judgment in the buying and selling, the building and rebuilding that is ahead of us" (Stark 1937: 25).

The FHLBB, not the HOLC, was the impetus behind the creation of the City Survey Program. The residential security maps served the FHLBB's larger purpose of strengthening the savings and loan industry and promoting

new appraisal standards it believed long-term amortized loans required. The FHLBB's mapping program also must be understood in the context of growing interest in neighborhood appraisals within the FHA and the real estate and appraisal industries. Although the scale of the City Survey Program was unprecedented, the concern for the relationship between neighborhood conditions and real estate investment risks was not. As the next section will describe in more detail, HOLC's major contribution to this effort was in the form of staff members and contacts in the communities where the surveys were conducted.

How Did HOLC Make the Maps?

The FHLBB decided to survey all cities with populations of at least 40,000; 239 met this criterion.[4] In September 1935, the board assigned responsibility for the surveys to the Mortgagee Rehabilitation Committee, which it consolidated into the Division of Research and Statistics in September 1936. The Mortgagee Rehabilitation Committee assigned field agents to collect data about local real estate conditions and create a security map for each city or metropolitan area with the assistance of local realtors and lenders. These field agents were to report their findings, including "the general attitude of the public toward the policies and activities of the Board" (Holdcamper 1965). The FHLBB initiated another round of surveys at the end of 1938 to update the earlier ones. Most of this work was completed in 1940.[5]

The board looked to HOLC staff to serve as and recruit field agents because they were already located in, or near, the 239 cities; they were familiar with local real estate conditions; and they knew many of the local realtors and lenders. Field agents in Philadelphia (including at least one field agent and two junior field agents) completed two different surveys, in the summer of 1936 and in the spring of 1937. Both of these involved interviews and consultations with local realtors, lenders, and housing experts that resulted in residential security maps and written reports. The FHLBB's Division of Research and Statistics also created a summary based on the local report that the field agents submitted, as it did for the other surveyed cities.

To complete their work, the field agents depended upon assistance from map consultants. Many of them were brokers and appraisers hired on a fee-for-service basis to support the agency's lending activities rather than as full-time HOLC staff. The map consultants appear to have all been men, only a

few of whom were listed as map consultants in both 1936 and 1937. In 1936, 14 of the 21 consultants already worked for HOLC as real estate brokers or appraisers. More than half of the 19 consultants in 1937 were realtors, but the list also included two lenders (FHLBB Division of Research and Statistics 1936a, 1937). Many of these consultants completed the detailed area description forms that were the basis for the map grades. It is less clear what role they played in the creation of the maps. The Philadelphia area description for 1937 simply states, "The following local persons collaborated with the field agent in the preparation of this map and area descriptions" (FHLBB Division of Research and Statistics 1937). In his *History and Policies of the Home Owners' Loan Corporation* (1951), C. Lowell Harriss describes in detail how HOLC staff were recruited, trained, paid, and utilized, but Harriss never mentions the City Survey Program or creation of the maps in his book.[6] According to Raymond Mohl (1987: 16), these map consultants made the maps, although Kenneth Jackson (1985: 199) has said that they assisted the process. A report submitted by field agents in Los Angeles included an annotated list of map consultants that provides some insight. The former state HOLC appraiser and president of the California Association of Real Estate Boards "was the leader in organizing 26 brokers in different sections of the city" for HOLC (FHLBB Division of Research and Statistics 1936b). The chief FHA underwriter "spent one entire evening in a reviewing conference" and the chief appraiser for a national bank "went over the map very carefully" (ibid.). Mohl (1987: 18) has argued that "the HOLC appraisals of Miami neighborhoods reflected the bias of the local appraisers," noting that they lived in the neighborhoods given the best rating. Most of the map consultants were not listed in *Polk's-Boyd's Philadelphia Directory* for 1935–36. Many of them worked in the suburbs and likely lived there as well. Of the four who could be matched, all of them lived in second-grade ("still desirable") areas.[7] None of them was responsible for surveying the area in which he lived.

The fact that their reports included detailed information about the housing and demographic characteristics of each area in the city indicates that HOLC relied on quantitative data as well as the more qualitative observations of the consultants (Bartelt 1979: 13). HOLC field staff likely relied on the census tract-level data from the 1934 Real Property Survey conducted by the Works Progress Administration (WPA).[8] Adolph Siegrist, the project superintendent for the survey, served as a map consultant to HOLC in 1936. The WPA and Commerce Department conducted surveys of housing condi-

tions in cities across the country, gathering enormous amounts of information that precipitated the inclusion of new housing variables in the 1940 U.S. census. The FHLBB announced the availability of these data in the *Federal Home Loan Bank Review*, first in a brief article in October 1934 and then in a more lengthy article in 1935 that included a number of tables and charts that the Division of Research and Statistics created based on the survey data (FHLBB 1934b, 1935b). A footnote in the 1936 article about security maps in the *Review* pointed lenders to these surveys, indicating that lenders "would undoubtedly find the results a great aid in making security maps" (FHLBB 1936: 390).

The survey sheets completed by HOLC field agents and map consultants in Philadelphia contained statistical information not included in the real property survey. The block-level map of real estate, race, and commercial activity in Philadelphia created by J. M. Brewer in 1934 likely served as an additional source that was even more detailed than the WPA survey. Before heading up Property Service, Inc., a clearinghouse for real estate data, Brewer was the chief appraiser for Metropolitan Life Insurance Company for the Philadelphia district. Like Siegrist, he served as a map consultant in 1936 (FHLBB Division of Research and Statistics 1936a). Brewer's 1934 map of Philadelphia described where Jews and Italians resided, information not included in the WPA survey but frequently mentioned in HOLC's survey.[9]

Just as there was more than one HOLC survey of Philadelphia, there was more than one security map. The first map, marked "obsolete," was created in November 1935 and has no corresponding survey.[10] The second and third versions correspond in date and content with the 1936 and 1937 field reports. The graded areas on the second and third maps extended to some of the suburban communities immediately outside the city, including Narberth, Cheltenham, and Glenside. Field agents also created a separate map for the Main Line and eastern Delaware County in 1937. Detailed area descriptions accompanied the last two Philadelphia maps, describing the racial, ethnic, and socioeconomic makeup; sales and rental values; new construction; availability of mortgage funds; and "trends of desirability" for each area.

The same criteria were used for grading neighborhoods in all of the cities. First-grade areas, also referred to as "A" and colored green, were the "hot spots." These were areas that still had room for new residential growth, were "homogeneous," and were in demand during "good times or bad." Second-

grade or "B" areas were colored blue and had been completely developed. "They are like a 1935 automobile—still good, but not what the people are buying today who can afford a new one." Third-grade or "C" areas, colored yellow, were older, becoming obsolete, and had "expiring restrictions or lack of them" and "infiltration of a lower grade population." These areas had poorly maintained homes, had "jerry built" areas, and often lacked homogeneity. Fourth-grade or "D" areas, colored red, "represent those neighborhoods in which the things that are now taking place in the C neighborhoods, have already happened." They had lower homeownership rates, poor housing conditions, "detrimental influences in a pronounced degree," and "undesirable population or an infiltration of it" (FHLBB Division of Research and Statistics 1937).

The maps did not rely on any existing set of boundaries, such as census tracts or wards, in defining areas because the areas they defined were intended to incorporate homogeneous groups and types of housing rather than coincide with political or administrative units. These boundaries changed on each version of the Philadelphia security map. The first map defined 29 areas that constituted the entire city except for Fairmount Park along the Schuylkill River and the Navy Yard, at the southern tip of the city (see figure 1). The second map divided the 12 districts used in the WPA's 1934 Real Property Survey into more than 60 areas, carefully leaving out parks, industrial and commercial areas (including all of Center City), and even major streets and railroad corridors (see figure 2). The final version of the map dropped the use of districts and divided the city into 70 new areas, grading essentially the same parts of the city as the second map (see figure 3). These last two maps defined all of Roxborough, in the northwestern section of the city, and much of the lower northeast as undeveloped but still assigned them grades. The far northeast, on the other hand, did not have sufficient population or prospects for future development to warrant grading, with a few small exceptions.[11]

There were similarities among the three maps. The "best" areas were consistently located away from the central part of the city, near Fairmount Park, in the neighborhoods of Wynnefield, Chestnut Hill, Mount Airy, and East Falls as well as Olney in north Philadelphia. Areas of the city with African Americans were consistently given a fourth-grade rating, but some areas with no African American residents also received fourth-grade ratings, including the neighborhoods of Kensington, Fishtown, and Port Richmond

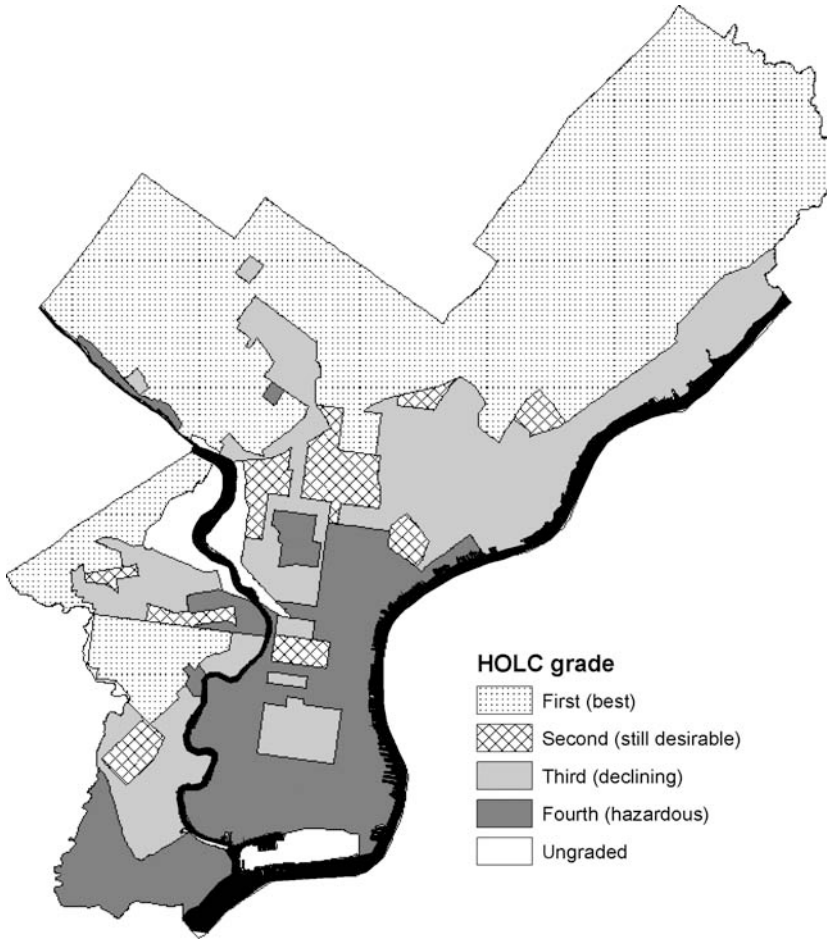

Figure 1 First residential security map plan for Philadelphia, 1935

Note: The first residential security map HOLC agents created for Philadelphia offered the most generous appraisal of real estate conditions: 54 percent of the graded area on the map was assigned first grade; 5 percent, second grade; 23 percent, third grade; 18 percent, fourth grade.

along the Delaware River. Red areas were never adjacent to green areas and only rarely adjacent to blue, with yellow areas generally serving as a buffer.

Despite these general patterns, there were important differences among the three maps. More than half (54 percent) of the first map was colored green and less than one-fifth (18 percent) of it was colored red. On the second map, the green areas dropped to 13 percent and the red areas accounted for 31 percent of the graded area in the city. Red covered more than 34 percent

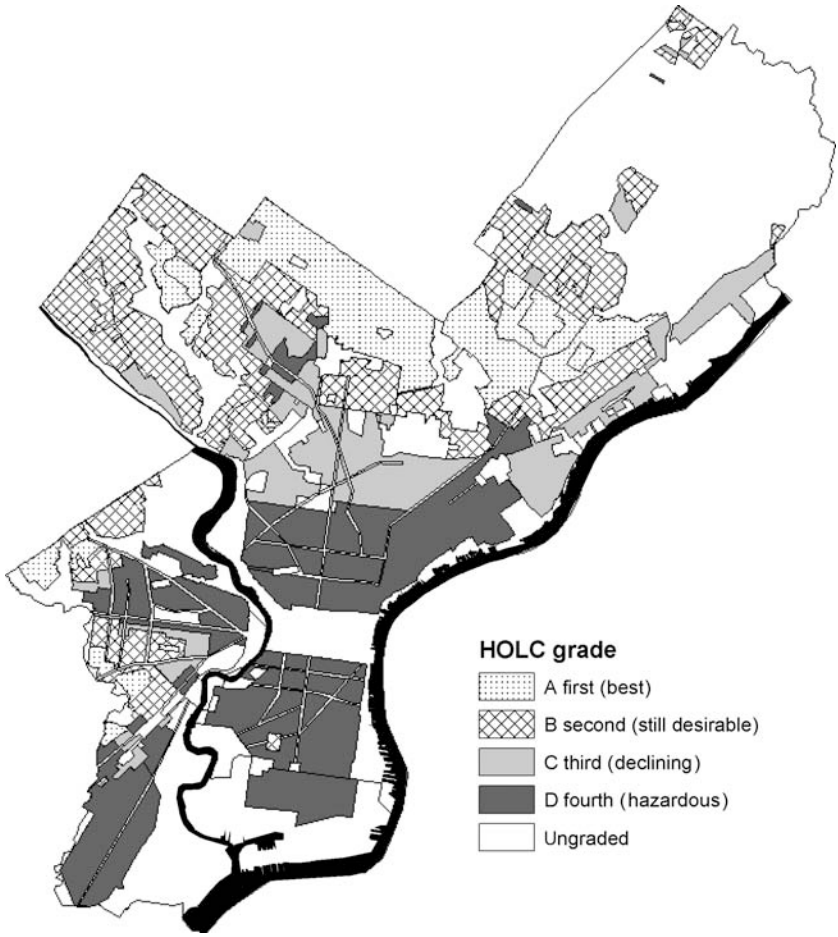

Figure 2 Second residential security map for Philadelphia, 1936

Note: The second residential security map reflected less optimism about real estate conditions in Philadelphia and left much more of the city ungraded: 19 percent of the graded area on the map was assigned first grade; 32 percent, second grade; 17 percent, third grade; 32 percent, fourth grade.

of the final map, while only 8 percent was colored green. One area colored green in the first map, in the far northeast, was left ungraded in the subsequent versions, while other green areas earned second-grade ratings. The part of west Philadelphia south of Market Street turned from green to mostly blue to mostly yellow over the course of the three maps. The first map also provided the most generous appraisal of the western half of north Philadelphia, coloring much of it yellow and even blue, while the later versions

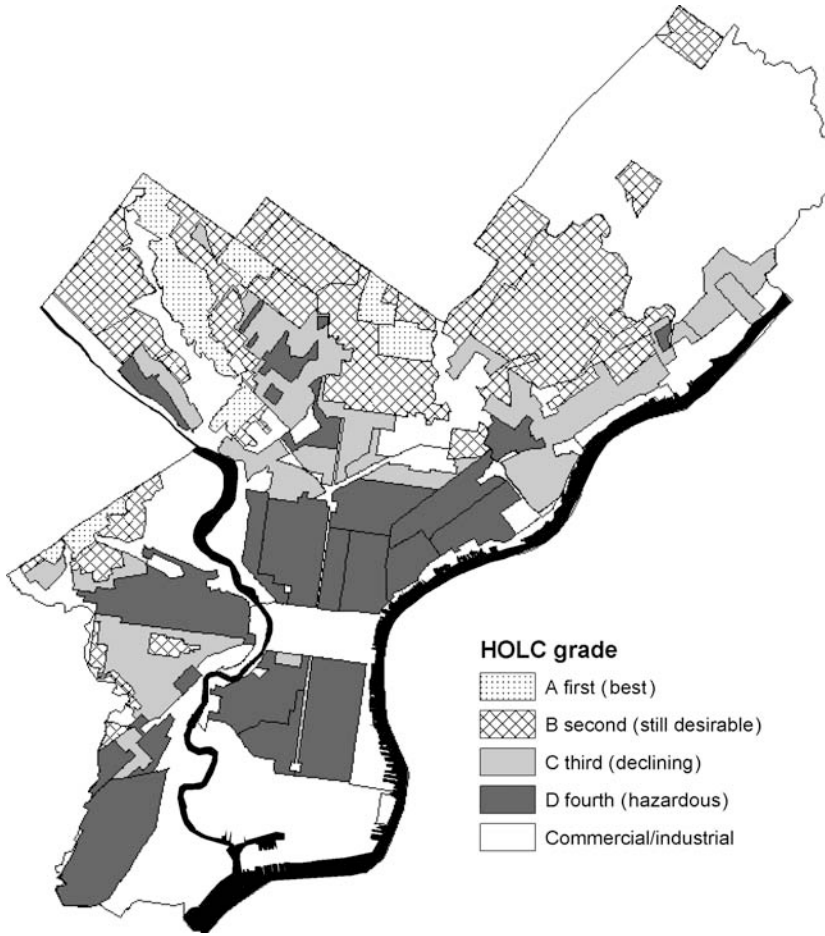

Figure 3 Final residential security map for Philadelphia, 1937

Note: The third and final security map reflected the harshest assessment of real estate conditions in Philadelphia: 8 percent of the graded area on the map was assigned first grade; 36 percent, second grade; 22 percent, third grade; 34 percent, fourth grade.

colored all of it red. Most of south Philadelphia was red on all three maps, with the exception of the central area (bounded by Wharton, Shunk, Fifth, and Twenty-third streets), which was colored yellow on the first version, and Girard Estates in the southwestern part, which was colored blue on the second version. Rittenhouse Square was the only area south of Market Street and east of the Schuylkill River not colored red in the final version.

This increasingly dreary picture of real estate conditions in Philadelphia

contradicts the actual economic trends. HOLC's own reports indicate that Philadelphia's real estate market improved considerably between 1935 and the end of 1936, as the volume of new construction increased, the number of foreclosures decreased, and several banks started making a large number of FHA loans (FHLBB Division of Research and Statistics 1936a). Other economic indicators—employment rates, payrolls, and the numbers on work relief—also showed improvement. Rather than worsening, as suggested by changes in the security maps, housing and economic conditions were improving during the second half of the 1930s.

More likely, the differences reflect a change in personnel, at either the national or the local level, and differences in the local interpretation of the national appraisal criteria. This shift toward harsher appraisals may have coincided with the consolidation of FHLBB's Mortgage Rehabilitation and Research and Statistics divisions in September 1936, which brought new leadership into the City Survey Program (ibid.). HOLC used some different consultants for the 1936 and 1937 surveys of Philadelphia, but these local personnel changes do not necessarily account for the different assessments. For example, Manayunk, a working-class Catholic neighborhood located along the Schuylkill River, went from third grade on the 1936 map to fourth grade on the 1937 map, despite the fact that Francis McGill, a realtor operating in Roxborough and Manayunk, served as a map consultant in both years. The description of Manayunk is quite similar for both years, giving no indication of why the area was considered declining one year and hazardous the next.

What Was the Basis for the Grades?

FHLBB and HOLC materials instructed field agents to collect a large amount of very detailed data, but they do not explain how field agents were to integrate all the different characteristics into a single grade. The variations across the three versions of Philadelphia's residential security map indicate that they applied different standards or applied the standards differently each time. Researchers have consistently argued that HOLC colored areas with African Americans red, as well as those with other undesirable characteristics such as older housing, relying on their readings of the area descriptions and visual analysis of the security maps to support their conclusions (Hanchett 1998; Sugrue 1996; Mohl and Betten 1986; Jackson 1985).

The area descriptions are quite explicit, and looking at a series of maps

showing tract-level demographic and housing characteristics can indicate some general patterns and relationships. But visual analysis does not provide a way to simultaneously evaluate the effect of different area characteristics on the HOLC grades or the statistical significance of those relationships. Multiple regression, on the other hand, is capable of assessing the unique contribution of several explanatory variables. David Bartelt (1979) found that a census tract's location relative to the central city, housing values, and racial composition were all significant predictors of HOLC grade. Building on Bartelt's work, George Leon (1985) determined that a census tract's location relative to the central city, number of industrial jobs, and age of housing had significant effects but that race did not have a significant independent effect. Both used a set of 248 common tracted areas that allowed for comparisons between 1930 and 1970 that reduced the amount of variance in the explanatory variables, as well as conventional statistical models that fail to account for spatial autocorrelation. Adherence to the original census tract boundaries, use of spatial regression models that consider the influence of spatial autocorrelation, and standardized coefficients that allow for comparisons of the influence of the different neighborhood factors all distinguish the statistical research presented here.

Dependent Variables

The grades on each of the three versions of Philadelphia's residential security map served as the dependent variables for the statistical analyses. In order to analyze them, GIS software was used to digitize the three security maps and the 1930 and 1940 census tracts, as well as assign a security grade to every census tract. Census tracts were chosen as the unit of analysis because housing and demographic data were available at this level from the 1934 WPA Real Property Survey and 1940 U.S. census. In most places, whole tracts had the same HOLC grade. In cases where two or more grades covered the same tract, the grade was determined based on the proportionate area for each grade down to two decimal places (so a tract that was one-third yellow and two-thirds red was given the grade 3.66). Only tracts that had at least half of their area graded were included, so predominantly commercial and industrial areas were left out of the analysis.

HOLC grade was treated as a continuous variable, even though ideally it would have been defined as an ordered categorical variable. Technically, one

can only rank order the four grades: second-grade neighborhoods were less risky than third and third-grade neighborhoods were less risky than fourth. An ordered categorical variable implies this ordering without guaranteeing equal distance between each category. Treating HOLC grade as a continuous variable, on the other hand, assumes that a fourth-grade neighborhood was twice as risky as a second-grade neighborhood. This made it possible to have fractional grades for a census tract, such as 3.5, and to use a spatial lag model. Ordered categorical variables require much more complicated statistical modeling that generates much less interpretable output.[12]

Independent Variables

To the extent possible, the characteristics identified as factors in the neighborhood ratings in the materials that accompanied the maps were included as independent variables. Most of these variables were taken from the 1934 WPA Real Property Survey because it was the source most concurrent with the maps and was most likely used by field agents themselves. The percentage of dwelling units with Colored families (which included all nonwhites) was used as an approximate measure of the African American population, something that field agents noted for all areas.[13] The area descriptions also referred to different types of ethnic groups as threats to neighborhood stability, particularly poorer and more recent immigrants. The Real Property Survey did not include information about ethnic composition, but the 1940 U.S. census reported the percentage "native white," so the remaining population that was not defined as Negro in 1940 was used as a measure of percentage white immigrants. Although this catchall category does not reflect the differences in ethnicity and nationality that HOLC field agents noted, it does incorporate their general bias against the presence or encroachment of newer immigrant groups.

The other independent variables relate to housing. Median age of residential structures, median value of single family homes as reported by owners, and percentage of residential structures converted to apartments were all included because they were specifically mentioned in HOLC materials and the area descriptions.[14] The percentages of crowded units, residential structures needing major repairs, and residential structures without inside flush toilets were included as general indicators of housing conditions. The percentage of residential structures occupied by owners and owned free and

clear as well as the median duration of residence were included as measures of neighborhood stability. The location of industries relative to residences was also of interest to field agents, so the number of firms listed in the 1928 *Industrial Directory of Pennsylvania* was included.[15] Finally, the distance between each tract and Center City was included as an indicator of the location because of the importance of ecological theory and the concentric zone model at the time.[16]

Statistical Model

Spatial Autocorrelation. It is often inappropriate to use linear regression and ordinary least squares (OLS) to analyze spatial data because they assume that residuals—the variance in the dependent variable not explained by the independent variables as well as the error in the model—are independent. When this assumption is violated, standard errors become unreliable and the significance of effects may be overestimated. Social, temporal, and spatial relationships can all create this situation. Almost by definition, an analysis of neighborhood risk involves spatial autocorrelation because whole parts of the city received the same grade. Field agents' explanation for grading red all of the eastern part of south Philadelphia, including the "somewhat better" area between Wolf, Bigler, Twelfth, and Eighteenth streets, spoke directly to the relationship between nearby observations: "If this section were more favorably located it would deserve a better rating, but South Philadelphia is generally held in such poor esteem and the surrounding territory is so poor that it must be classed with the rest of the area" (FHLBB Division of Research and Statistics 1936a). In the context of this analysis, spatial autocorrelation represents a challenge that, while complicating statistical analysis, provides important information about the distribution of values on the dependent variable—HOLC grade.

Spatial Lag Model. HOLC grades were analyzed first using OLS, in order to generate residuals that could be tested for spatial autocorrelation. Moran's I tests indicated the presence of spatial autocorrelation, so weight matrixes were constructed to be used with a spatial lag model (Cressie 1993; Bailey and Gatrell 1995). A weight matrix identifies observations considered "neighbors" based upon some spatial criteria and incorporates the influence of values on the dependent variable of these neighbor observations. Rather than

assuming independence among observations such as the OLS model, the spatial lag model hypothesizes that there is spatial dependence and incorporates this directly into the model through the weight matrix. The spatial lag model is defined as

$$y = \lambda Wy + \chi\beta + \varepsilon, \qquad \text{[spatial lag model]}^{17}$$

where y is the dependent variable, λ is a coefficient for the spatial influence (similar to β), W is the weight matrix (incorporating values of the dependent variable for nearby observations), χ is a vector of independent and control variables, β is the coefficient for the independent and control variables, and ε represents a general error term. This differs from the more common spatial autoregression model that incorporates the spatial dependence into the error term and is defined as

$$y = \chi\beta + u, \text{ where } u = \varrho Wu + \varepsilon \qquad \text{[spatial autoregression model]}$$

Four different weight matrixes were constructed: a nearest neighbor matrix and three distance-based weight matrixes that defined tracts as neighbors when their centroids were within approximately 0.5 miles, 1 mile, and 2 miles of each other.[18]

Statistical Results

Results indicated that each of the weight matrixes adequately incorporated the spatial autocorrelation into the spatial lag models for all three maps.[19] Results reported here are based on the half-mile weight matrix because it represents a more sophisticated (and realistic) model of the spatial autocorrelation than the nearest neighbor weight matrix, and it generated better goodness-of-fit statistics than the other distance-based weight matrixes (table 1). The three maps generated similar results, although several variables that were significant in the last two equations were not significant in the first. All three models had high pseudo R-square values, indicating that the variables included in the model explain much of the choice of grade, something that became increasingly true with each new map.[20]

Race was significant for all three, with higher percentages of Colored families predicting higher (worse) HOLC grades. This relationship was strongest for the 1935 map. Race had less influence in the 1936 and 1937 versions. The distance a tract was from Center City showed a similar rela-

Table 1 Spatial lag standardized coefficients for security map grades

Variables	1935 map	1936 map	1937 map
Housing age	0.0336	0.0479*	0.0875***
	(0.1525)	(0.1484)	(0.1261)
Percentage immigrant	0.0542***	0.0116	0.0560***
	(0.3291)	(0.2980)	(0.2385)
Housing value	−0.0713***	−0.0592***	−0.1235***
	(0.0004)	(0.0376)	(0.0327)
Converted housing	−0.0287	0.0092	−0.0248
	(0.2916)	(0.2416)	(0.2078)
No flush toilet	0.0779***	0.0245	0.0287
	(0.1650)	(0.1645)	(0.1315)
Residence duration	−0.0213	0.0423*	0.0061
	(1.1740)	(1.0653)	(0.8648)
Mortgage free and clear	0.0538**	0.1140***	0.0645***
	(0.1367)	(0.1403)	(0.1190)
Owner-occupied housing	−0.0094	−0.0617***	−0.0718***
	(0.1493)	(0.1541)	(0.1253)
Over-crowded housing	0.0229	0.0899***	0.0828***
	(0.2278)	(0.2259)	(0.1880)
Major housing repairs	0.0140	−0.0613**	−0.0694***
	(0.2290)	(0.2279)	(0.2096)
"Colored" families	0.1106***	0.0546**	0.0615***
	(0.1557)	(0.1356)	(0.1153)
Distance to Center City	−0.1349***	−0.0941***	−0.0734***
	(1.0411)	(1.0641)	(0.9137)
Industrial firms	0.0045	0.0270	0.0139
	(0.0855)	(0.1264)	(0.1151)
N	370	322	315
Pseudo-R^2	0.455	0.548	0.589

Note: Standard errors are in parentheses.
*$p < 0.1$ **$p < 0.05$ ***$p < 0.01$

tionship, continuing to be a statistically significant factor but becoming less influential in 1937. Tracts with higher percentages of immigrants also had higher grades, although this relationship was significant only for the first and third maps. Unlike race, the magnitude of this relationship persisted. Housing variables had more influence on the grades in the later maps, with poorer housing conditions predicting higher HOLC grades. Housing values had the greatest impact in the last map. The age of housing and amount of

overcrowding also had greater influence than race on the 1937 map. These statistical results confirm what a less systematic assessment of HOLC neighborhood appraisals could not, that even when controlling for the value and condition of housing, race and immigrant status influenced the neighborhood appraisals. They also show that as HOLC refined its mapmaking process, race became somewhat less important—but still significant—and housing conditions became more important.

The City Survey Program was typical of appraisal efforts from that time in its concern for location as a predictor of mortgage risk and the unabashed ethnic and racial prejudice that influenced its ratings. The standards that FHLBB devised and HOLC field agents implemented in the maps and area descriptions reflected broad acceptance of ecological and infiltration theories. It was exceptional in that it constituted federal endorsement of racially based appraisal standards. HOLC's maps are not the only example of the federal government's acceptance and promotion of such standards, but they are among the most explicit. The program was also exceptional in its scale, covering medium-sized and large cities across the country. It represented one of the most ambitious neighborhood appraisal projects conducted in a period when—with the encouragement of the National Association of Real Estate Boards, the American Institute of Real Estate Appraisers, the Society of Residential Appraisers, and the FHA as well as FHLBB—the real estate and appraisal industries were making the transition to more systematic appraisals of properties and their neighborhoods. Finally, the maps are exceptional because they have been so well preserved. Security maps for most of the cities included in the City Survey Program have been preserved in the records of the FHLBB. The maps are large—approximately 36 inches by 48 inches—and retain much of the original color, making them dramatic representations of the larger neighborhood appraisal movement.

The story of the Home Owners' Loan Corporation is composed of multiple stories that are to some extent in conflict. On the one hand, HOLC provided assistance to a million homeowners, across race and ethnicity, who were desperate to save their homes. On the other hand, HOLC created security maps in which race was used to signify risk levels. Rather than setting HOLC apart from other public and private institutions, this conflict in values and purpose—putting at odds a desire to serve individuals and communities in need, protect financial investments, and follow industry standards and expectations—likely characterized the work of others in federal agencies.

Arnold Hirsch (2000: 209) describes how Secretary of the Interior Harold Ickes included a nondiscrimination clause in all Public Works Administration contracts and guaranteed blacks access to jobs through a quota system, but for political purposes felt compelled to comply with the "neighborhood composition" rule so that new housing developments would not alter the racial composition of communities.

Even more, this episode in HOLC's history also demonstrates that the residential security maps can be understood only in the context of HOLC's relationship to the FHLBB. HOLC was only intended as an emergency measure; the FHLBB's influence on the home mortgage industry was intended to be much more profound and long term. Through its policies, investments, and journal, the FHLBB exercised great influence on the savings and loan industry, pushing member and nonmember institutions toward long-term amortized loans and thorough neighborhood appraisals that the board considered essential to sound lending. Although acceptance of the dominant ecological theory that supported the link between racial composition, neighborhood stability, and housing values predated any federal involvement in the mortgage market, the FHLBB and FHA were in a stronger position than any private institutions to standardize appraisal methods. The FHLBB's City Survey Program integrated the firsthand experience of local realtors and appraisers with extensive survey data into maps, encouraging others to follow its example.

Notes

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1 This barely readable, photocopied document is included in the Civilian Records finding aid that Forrest R. Holdcamper created in March 1965. The document described the process of reproducing and distributing the maps in a level of detail that only someone within the FHLBB could have provided.

2 A note below the title indicates that this was the second in the series, but there is no article in the previous issue that appears to be part of the series, which ended in August 1936.

3 See, for example, DuBois 1935; Babcock 1935; and NAREB 1935. Later articles that came out after the City Survey Program was under way included Keefer 1938; Pratt 1937; and Babcock et al. 1938.

4 Surveyed cities include in Alabama, Birmingham, Mobile, and Montgomery; in

Arizona, Phoenix; in California, Fresno, Los Angeles, Oakland-Berkeley, Sacramento, San Diego, San Francisco, San Jose, and Stockton; in Colorado, Denver and Pueblo; in Connecticut, Bridgeport, Hartford, New Britain, New Haven, New London, Stamford, and Waterbury; in Florida, Jacksonville, Miami, St. Petersburg, and Tampa; in Georgia, Atlanta, Augusta, Columbus, Mason, and Savannah; in Illinois, Aurora, metropolitan Chicago, Decatur, East St. Louis, Jolie, and metropolitan St. Louis; in Indiana, Evansville, Ft. Wayne, Indianapolis, Lake County (E. Chicago, Gary, and Hammond), Muncie, Mushanaka, Peoria, Rockford, Southbend, Springfield, and Terre Haute; in Iowa, Cedar Rapids, Council Bluffs, Davenport, Des Moines, Dubuque-Waterloo, and Sioux City; in Kentucky, Covington, Lexington, and Louisville; in Louisiana, New Orleans and Shreveport; in Maine, Portland; in Maryland, Baltimore; in Massachusetts, Boston, Brockton, Cambridge, Fall River, Fitchburg, Haverill, Holyoke-Chicopee, Lawrence, Lowell, Lynn, New Bedford, Pittsfield, Salem, Springfield, and Worcester; in Michigan, Battle Creek, Bay City, greater Detroit, Flint, Grand Rapids, Jackson, Kalamazoo, Lansing, Muskegon, Pontino, and Saginaw; in Minnesota, Duluth, Minneapolis, and St. Paul; in Mississippi, Jackson; in Missouri, Kansas City, St. Joseph, and St. Louis; in Nebraska, Springfield, Lincoln, and Omaha; in New Jersey, Atlantic City, Bayonne, Bergen County, Camden, Essex County, Hoboken, Hudson County, Jersey City, Kearney, Newark, northern New Jersey, Passaic County, Perth Amboy, Trenton, and Union County; in New York, Albany, Binghamton, Brooklyn, Bronx, Buffalo, Elmira, greater Rochester, greater Troy, Jamestown, lower Westchester, Manhattan, Mt. Vernon, New Rochelle, Niagara Falls, Poughkeepsie, Queens, Queens County, Rochester, Schenectady, Staten Island, Syracuse, Troy, Utica, and Yonkers; in North Carolina, Asheville, Charlotte, Durham, Greensboro, and Winston-Salem; in Ohio, Akron, Canton, Cincinnati, greater Cleveland, Columbus, Dayton, Hamilton, Lima, Lorain, Portsmouth, Springfield, Toledo, Warren, and Youngstown; in Oklahoma, Oklahoma City and Tulsa; in Oregon, Portland; in Pennsylvania, Allentown, Altoona, Bethlehem, Chester, Erie, Harrisburg, Johnstown, Lancaster, McKeesport, New Castle, Philadelphia, Pittsburgh, Reading, Scranton, Wilkes-Barre, Williamsport, and York; in Rhode Island, Providence; in South Carolina, Columbia; in Tennessee, Chattanooga, Knoxville, Memphis, and Nashville; in Texas, Amarillo, Austin, Beaumont, Dallas, El Paso, Ft. Worth, Galveston, Houston, Port Arthur, San Antonio, Waco, and Wichita Falls; in Utah, Ogden and Salt Lake City; in Virginia, Lynchburg, Norfolk, greater Norfolk, Portsmouth, Richmond, and Roanoke; in Washington, Seattle, Spokane, and Tacoma; in West Virginia, Charleston, Huntington, and Wheeling; in Wisconsin, Kenosha, Madison, Milwaukee, Oshkosh, and Racine. This is the most complete list available. Conspicuously absent is a survey of Washington, DC. It is not clear if HOLC chose not to survey Washington or if the survey results and maps simply were not preserved. See Holdcamper 1965.

5 It is not clear what criteria the FHLBB used in deciding which cities to resurvey. It seemed to favor large cities, but Philadelphia was not resurveyed. FHLBB materials state that 23 cities were resurveyed, but the City Survey files indicate that 25 were, including Birmingham, Los Angeles, Denver, Miami, Atlanta, Chicago,

New Orleans, Boston, Detroit, Kansas City, St. Louis, Atlantic City, Westchester, Manhattan, Rochester, Troy, Akron, Cleveland, Toledo, Youngstown, Chattanooga, Knoxville, Memphis, Dallas, and Norfolk.

6 There are very few published references to the City Survey Program before the rediscovery of the security maps in the 1970s. The two known references only vaguely describe what HOLC and FHLBB were doing. See FHLBB 1940 and 1936: 389. Harriss was dependent upon the cooperation of HOLC staff to conduct his research, and HOLC's cooperation may have been contingent on Harriss's willingness to leave the City Survey Program out of his HOLC history.

7 Home addresses could be found for Henry J. Tunstall, Joseph G. Barth, James H. Livezly, and W. R. Hutzel.

8 The 1939 Real Property Survey produced block-level data.

9 Brewer's 1934 map is part of the map collection at the Free Library of Philadelphia.

10 Handwritten on the front of the map is "(app.) Nov. 1935," suggesting that the map was dated sometime after it was created, perhaps when an inventory was completed of the City Survey files.

11 The maps assigned grades to the neighborhoods of Bustleton and Somerton.

12 Rescaling the continuous values (using square, square root, and positive and negative numbers) confirmed that the statistical results (direction and significance of relationships, R^2) were impervious to the scale.

13 It is not clear how "white" was defined, but presumably it included immigrants and native-born Americans of European descent. Philadelphia had almost no Asians or Hispanics at this time, so "Colored" probably referred almost exclusively to people of African descent.

14 The WPA Real Property Survey had missing data on median age and value of buildings for several tracts along the Delaware River. Median value was imputed using median values for those tracts reported in the 1940 U.S. census correcting for the average change in values between the 1934 WPA survey and the 1940 census values (1934 values were 1.2 times larger). Median age was imputed based on the average age (68 years) of adjacent tracts reported in the WPA survey.

15 The type and number of industrial jobs and firms was included in a large historical data set compiled by William Yancey and Eugene Ericksen of Temple University. To analyze changes over time, they used common tracted areas between the 1930 and the 1970 U.S. census as the basis for the data set. The number of firms and jobs correlated too highly (0.8) to include both in the same statistical model.

16 Distance from Center City was operationalized as the distance (rounded to the nearest mile) from the centroid of each census tract to City Hall, located at the intersection of Philadelphia's major streets, Broad and Market. For a similar approach, see Bartelt 1979 and Leon 1985.

17 The spatial lag model used in this study is based on the program sp_lag.m, written for MATLAB by Tony E. Smith on April 11, 1998, and modified June 14, 1999. It uses maximum likelihood estimation to determine the model parameters.

18 This was done using a program called dist_wts.m, written for MATLAB by Tony E.

Smith on March 3, 1998. The distance chosen was intended to incorporate most adjacent tracts as neighbors.

19 The Moran's I statistic was significant at the 0.001 level for all three maps using all four weight matrixes with one exception (the first map using the nearest neighbor matrix). The significance of the autocorrelation using the weight matrixes with the spatial lag models was above 0.2 for each of the models.

20 The traditional R^2 generated by OLS becomes meaningless in the presence of autocorrelation, so various pseudo R^2 measures are used to judge the goodness of fit for SAR and spatial lag models. The simplest of these is used in this analysis and is based on the fact that spatial lag models have reduced forms under which R^2 can be interpreted.

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