Regional Effects and Convergence in Dallas Neighborhood Housing Markets

by

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ABSTRACT

The paper investigates two key questions relating to the dynamics of neighborhood change: the extent to which change in housing prices at the neighborhood level is driven by change in the region, and the extent to which neighborhoods tend to converge over time. The analysis, based on real estate transaction data in four cities and their counties (Dallas, Chicago, Cleveland, and Seattle) over a period of 15 years, reveals that, overall, 35% of neighborhood variation in housing appreciation is explained by regional trends. However, there are significant differences across regions, as this figure ranges from 3% in Cleveland to over 80% in Seattle. The study also finds that, at least over the study period, neighborhoods overall do tend to converge, as neighborhoods that start off with lower housing values tend to "catch up" over time, with the notable exception of Dallas. These findings have important implications for community economic development practice, concerning both the appropriate level of intervention and the ability to target investments to the areas that need them most.

Keywords

real estate markets, convergence, regional effects, neighborhood change, community development, economic development

Acknowledgements

This paper presents selected findings from the first phase of the Dynamic Neighborhood Taxonomy, a project sponsored by Living Cities and conducted by RW Ventures, LLC.[1] The project aims to gain a more systematic understanding of how neighborhoods change over time, and what factors drive change in different types of neighborhoods. Ultimately, the goal of the project is to develop a new set of diagnostic tools for community economic development in order to enable funders, businesses, practitioners, and government agencies to better target investments and interventions to the various types of communities. The project is organized in three components: Neighborhood Evolution (descriptive analysis

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[1] Living Cities (www.livingcities.org) is a partnership of financial institutions, national foundations, and federal government agencies that invest capital, time, and organizational leadership to advance America's urban neighborhoods. RW Ventures, LLC (www.rw-ventures.com) is an economic development firm specializing in market-based strategies to enable investment and economic growth in underserved people and places.

of patterns of neighborhood change based on local housing markets), Drivers of Change (explanatory analysis of the factors driving neighborhood change), and Neighborhood Typology (identification of distinct neighborhood types and related patterns and drivers of change). The project has recently completed its first phase, Neighborhood Evolution, which analyzed trends in urban housing markets to shed light on how neighborhoods change over time.

This phase of the project focused on a set of analytical questions related to neighborhood change, including how much and how fast neighborhoods change over time, the relationship between change in the neighborhood and change at the regional level, the existence of convergence among neighborhoods, and the existence of distinct patterns of neighborhood change. This paper focuses on the issues of regional effects and neighborhood convergence in particular, as they have specific implications for community development practice in Dallas.

The author and project team would like to thank the Foundation for Community Empowerment and the Williams Institute for their participation in the project and for giving us the opportunity to present some of our initial results in this publication. We are very grateful to Living Cities for its generous support of this project and for its continued commitment to the development of new knowledge and tools for the economic development field. The project itself owes its existence to the vision, leadership, and expertise of Robert Weissbourd of RW Ventures, LLC, who designed and guided the work from its conception.

The findings presented in this paper are the result of the work of an outstanding team of researchers, including primarily Christopher Berry, Assistant Professor at the Harris School of Public Policy Studies of the University of Chicago, Richard Voith and Graeme Blair of Econsult Corporation, and Michael He of RW Ventures, LLC.

Introduction

For all the research that has been conducted on neighborhoods over the past few decades, we still know remarkably little about the basic dynamics of neighborhood change. This is due to a combination of factors, including the difficulty of acquiring reliable and detailed data at a small level of geography and, of course, the fact that neighborhoods themselves are complex entities.

This study used parcel-level real estate transaction data over a period of 15 years from Dallas and three other counties[2] to address two basic questions related to neighborhood change: the extent to which neighborhood change is determined by regional trends rather than local shifts, and the extent to which neighborhoods tend to converge over time. Both questions have important implications for community economic development practice and reveal insights that might be useful for Dallas in particular.

The paper is articulated in five sections. The first section introduces the analytical questions and frames them in the context of community and economic development practice. The second section describes the datasets and metrics that were used for the analysis. The third section describes the methodology that was adopted to investigate each question. The fourth section presents the findings of the work. Finally, the fifth section examines the implications of these findings for community development practice.

Regional Effects and Convergence in Neighborhood Trends

The practice of community economic development typically focuses on the neighborhood as the primary unit of intervention. Whether the goal is the creation of affordable housing, retail development, or crime prevention, the design and implementation of development strategies are usually carried out at the neighborhood level. In recent years, however, increasing attention has been paid to the region as a key unit of economic activity—the advent of globalization has reconfigured the geography of the world economy around

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[2] The Dynamic Neighborhood Taxonomy project collected data on real estate and other neighborhood characteristics across four cities and their counties: Dallas, Chicago, Cleveland, and Seattle. These four cities were selected based on three criteria: diversity of regional economies and neighborhood types, availability of good local data, and presence of Living Cities partners. The first criterion in particular was adopted to make sure that the results of the analysis were highly generalizable and could be applied to other cities across the country.

regional centers of production, as regions are large enough to compete on a global scale and small enough to benefit from the agglomeration economies that arise from the concentration of shared economic assets and activities. At the same time, as the field of economic development has moved toward more market-based approaches, it has become apparent that many of the markets whose activity determines neighborhood-level outcomes (such as new housing units built and sold, new stores opening, creation of new jobs, and so forth) actually operate on a regional scale.

These observations have raised the issue of the relationship between regional- and neighborhood-level interventions. By focusing on economic rather than political boundaries, regional approaches might more effectively tackle development issues and devise more comprehensive strategies for economic growth. Still, the success of the region arguably depends on the wellbeing of its cities and neighborhoods, and investing in the neighborhood could be critical to strengthening both the neighborhood and its region.[3]

A threshold question in assessing this issue is the degree to which neighborhood-level outcomes are tied to regional trends. To the extent that neighborhoods move in virtual lockstep with their region, interventions that improve the regional economy would translate to improvements at the neighborhood level. By the same token, neighborhood-level interventions would be more effective if they took into account the linkages that tie the neighborhood to the region. However, if neighborhoods displayed predominantly localized trends, regional and neighborhood-level economic development could proceed as two largely unrelated sets of work and interventions.

The literature on regionalism has focused primarily on the interdependence of cities and suburbs (Pastor, Dreier, Grisby, & Lopez-Garza, 2000; Voith, 1998; Haughwout & Inman, 2002; Ihlanfeldt, 1995), and less on the relationship between regional trends and neighborhood outcomes. Jargowski (1997), however, noted that neighborhood poverty "rises and falls in response to local labor market conditions," and used census data to show that the increase and decline in the number of high-poverty neighborhoods can be linked to the economic trends of their metropolitan areas (for instance, the way a decline in oil prices affected regions in the South, or how the economic recovery of the 1980s lifted metropolitan areas and their neighborhoods in the Northeast). In this study, we looked at housing values as a basic indicator of

[3] For a discussion of the importance of neighborhood wellbeing to regional economic growth, see Weissbourd (2006).

performance (as explained in more detail below) and investigated the degree to which changes in neighborhood housing values were accounted for by regional trends.

An additional question is whether market forces cause neighborhoods to converge over time, or whether neighborhoods that do well continue to do well while poorer neighborhoods consistently fall behind. Economic theory has suggested that, over time, places that are less developed will grow faster as investments move to these underdeveloped markets because entrepreneurs value inexpensive factors of production. This theory has been extensively tested in the context of national economies (Barro & Sala-I-Martin, 2003) and, to a lesser extent, in metropolitan areas (Pack, 2002; Drennan, Tobier, & Lewis, 1996; Weissbourd & Berry, 2004).

There are reasons to believe similar principles would apply to neighborhoods as well; as neighborhoods decline, real estate should become cheaper, to the point where the low cost of land would make them once again attractive to development. This should be particularly true in highly centralized cities or in places with greater constraints on the supply of land. Due to transportation and land costs, in both cases it would be economically more viable to redevelop old neighborhoods in the central city than to build new housing units at the outskirts of the region.

If convergence across neighborhoods were in fact occurring, we would expect poorer neighborhoods to appreciate faster than wealthier neighborhoods, and the difference in real estate prices between neighborhoods to diminish over time. The ability to differentiate between places where convergence is occurring and places where it is not would have important implications for development—it would enable targeting interventions to the places that need them the most (i.e., ones that are not converging), and, to the extent that we can explain why convergence is not occurring, it would inform what kinds of interventions are most likely to be effective.[4]

Metrics and Data Sources

For the purposes of the Dynamic Neighborhood Taxonomy project, neighborhood and regional performance were measured primarily in terms of changes in housing values, which should reflect changes in the demand for

[4] This question is at the heart of the second phase of the Dynamic Neighborhood Taxonomy project, which is seeking to identify the drivers of neighborhood change.

housing, and thus in the desirability of a given geography.[5] In the long run, of course, changes in neighborhood desirability will also result in a change in the quantity of the housing stock (and not just its price), as more units will be built to meet the increased demand.[6] This study is focused primarily on price because it is more easily measured and because it captures most of the neighborhood dynamics with which the study is concerned.

However, there are two components of neighborhood housing stock that affect its price: the quality of the housing and the quality of the amenities associated with its location. When we talk about changes in price as an indicator of change in demand for the neighborhood, we are mostly interested in the latter. The project thus used a repeat sales model to separate the appreciation due to changes in the housing stock (e.g., prices going up because larger or higher quality houses are being sold) from the appreciation due to a change in demand for the neighborhood.[7]

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[5] This approach will necessarily focus on some aspects of neighborhood performance and not others. In particular, the focus on housing markets means that the study measures improvement and deterioration in the neighborhood as a place, and not necessarily changes in the wellbeing of its residents. Moreover, the focus on appreciation as a measure of how a neighborhood is doing does not directly address the issue of affordability or the social consequences of increases in housing values. These are, of course, important issues that need to be addressed and are worth investigating further.

[6] In fact, changes in price reflect changes in the supply of housing as well as changes in demand, and a change in demand for a neighborhood will result in changes in the price, quantity, and quality of the housing stock. While all three dimensions need to be taken into account for a complete understanding of neighborhood dynamics, change in housing values is the most relevant for the topics discussed in this paper, and the one for which more granular data is available. In its investigation of the drivers of neighborhood change, the Dynamic Neighborhood Taxonomy project is conducting analysis on change in quantity as well as change in price.

[7] The two most common methodologies to estimate quality-adjusted change in housing prices are hedonic models, which estimate change in price by looking at all sales and controlling for the attributes of the units that are being sold, and repeat sales models, which only look at the appreciation from the sales of the same unit over time, assuming the characteristics of the unit remain constant. Repeat sales models might be biased if some of the units in the sample have been remodeled between sales. Hedonic models, on the other hand, are vulnerable to omitted variable bias since it is very difficult to account for all relevant characteristics of a housing unit. Given the type of research and the quality of the available data (which often did not include full details on property characteristics), a repeat sales index was deemed the most appropriate metric for this project. The data cleaning procedure and the specific methodology adopted (quantile regression instead of OLS) were designed to account for possible bias introduced by unobserved remodeling activity. For a discussion of repeat sales and hedonic methods, see, for example, McMillen and Dombrow (2001) and Crone and Voith (1992).

Repeat sales indices are a good way to control for changes in housing stock because they only measure appreciation from the sales of the same properties over time. However, as they typically require a large volume of sales in order to have sufficient sample size to be estimated, they are difficult to use for small geographies. In order to address this problem, we adopted McMillen and Dombrow's (2001) Fourier expansion methodology, which has a number of advantages over standard linear repeat-sales indices. Using the Fourier expansion, sales price varies smoothly but non-linearly with time, and the model can be estimated by linear regression after appropriate transformation of the time variables. By imposing the attractive restriction of a smooth index, the Fourier model can estimate price changes over any time span, and is less sensitive to periods with small samples than the standard linear repeat-sales model.

The basic equation used to estimate the repeat sales index is as follows:

$$\begin{aligned} y_{i,t} - y_{i,t-s} = {} & \alpha_1\left(z_i - z_i^s\right) + \alpha_2\left(z_i^2 - \left(z_i^s\right)^2\right) \\ & + \sum_{q=1}^{Q}\left[\lambda_q\left(\sin\left(qz_i\right) - \sin\left(qz_i^s\right)\right) + \gamma_q\left(\cos\left(qz_i\right) - \cos\left(qz_i^s\right)\right)\right] \\ & + u_{i,t} - u_{i,t-s} \end{aligned} \quad (1)$$

Where:

$y_{i,t}$ is the natural logarithm of the sales price of house *i* at time *t*

$y_{i,t-s}$ is the natural logarithm of the previous sales price, *s* period ago

z_i is equal to $2\pi T_i / \max\{T_i\}$ and T_i is the linear transformation of the time variable t_i to the interval $[0,2\pi]$

z_i^s is equal to $2\pi T_i^s / \max\{T_i^s\}$ and T_i^s is the linear transformation of the time variable $(t-s)_i$ to the interval $[0,2\pi]$

Q is the length of the Fourier expansion[8]

$\alpha_1, \alpha_2, \{\lambda_q\}, \{\gamma_q\}$ are estimated coefficients

$u_{i,t}, u_{i,t-s}$ are error terms accounting for the effects of unobserved factors on housing prices

The equation is estimated using quantile regression, as this method is more robust to outliers (including unobserved remodeling of some of the units) and has the added benefit of making the index directly comparable to other measures of housing values, which are typically based on the median rather than the mean (McMillen & Thorsnes, 2006).

While the index is estimated at the census-tract level, from a conceptual standpoint neighborhood housing markets do not change discretely across census tract boundaries. Rather, the appreciation of each property is partly a function of the appreciation of the surrounding properties, regardless of whether these are located in the same census tract. At the same time, though, in estimating appreciation for a tract, observations located outside that tract should be given less importance than observations located within the tract.[9]

To address these considerations, Equation (1) can be easily embedded within a locally weighted regression (LWR), as shown by McMillen (2004): rather than defining preexisting neighborhood boundaries a priori, we allow

[8] For any given case, the optimal length of the Fourier expansion can be determined by the Schwarz information criterion (McMillen & Dombrow, 2001). However, this case-specific approach could not be adopted in our case due to the high number of observations in our sample. Therefore, the project considered values of Q from one to six, and compared its effects on index estimation for the entire county as well as a small subset of census tracts with different sample sizes. At the county level and for tracts with larger sample size there was very little difference in the paths and final values of the index for all values of Q greater than 1. Tracts with small sample size, however, produced different results depending on Q. Overall, using $Q - 3$ produced final index values that seemed to be more consistent with other available measures of change in housing values, though it is possible that in some cases a different number of expansions would have produced a more accurate result. Given these observations, the project chose $Q = 3$ as the length of the Fourier expansion in Equation (1).

[9] Moreover, taking into account observations of neighboring tracts has the added benefit of helping bolster sample size in areas with few repeat sales.

any site to have a unique "neighborhood" in which closer properties carry greater weight than more distant properties. The distance from the target census tract defines each observation's weight in the LWR. Simply put, this is a regression in which more weight is placed on nearby home sales. Therefore, the equation in (1) is weighted spatially by assigning to all properties in the tract a weight of one, while properties in adjacent tracts have a declining weight of $[1 - d_i / \max\{d_i\}]^2$, where d_i is the distance between property i and the tract centroid.[10]

In addition to this repeat sales index, the project also analyzed change in median housing values, computed as the median sales price of all the residential properties sold in the tract over a given time period.

All of these metrics were constructed based on historical, parcel-level real estate transaction data derived primarily from public records maintained by county assessors and recorders of deeds offices in the four counties of Cook (Illinois), Cuyahoga (Ohio), Dallas (Texas), and King (Washington).[11] Because the study acquired data from different sources in each county, a set of standard procedures was generated to clean and make the data comparable across cities. These procedures included appending spatial information to individual properties, calculating distances from every property to every census tract, tracking the sales history of the same property over time, identifying and excluding nonmarket transactions, and developing a universal land use code to compare parcels across cities.[12] The analysis then focused on change in housing values at the census-tract level over a period of 15 years, between 1990 and 2004.

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[10] In order to finalize the regression method (chosen among a set including OLS, quantile regression, and robust regression with Huber weights) and weighting scheme, the project implemented a five-fold cross-validation procedure, and selected the option that minimized the overall error (i.e., produced the best estimates of out-of-sample data) and could, thus, be considered the most reliable.

[11] In particular, the data was provided by the following individuals and organizations, whose contributions were critical to the success of the project: Chris Cunningham, Atlanta Federal Reserve Bank; the Cook County Assessor's Office; James Murdoch and the Dallas County Department of Assessments; the King County Assessor; and NEOCANDO at the Center on Urban Poverty and Community Development at Case Western Reserve University.

[12] Detailed documentation on the database and data cleaning procedures is available on the RW Ventures website, by registering at www.rw-ventures.com/rwteam.

Methodology

Regional Effects

There are several ways to address the question of the influence of regional trends on neighborhood change, and none of them are perfect. To the extent that neighborhood and regional trends are correlated, it is difficult to distinguish correlation due to genuine regional shifts from correlation due to the region being, in fact, the sum of its neighborhoods.

In order to elaborate a statistical estimate of the impact of regional trends on neighborhood change, the project estimated the proportion of variability (the R-squared statistic) in the monthly differenced tract-level repeat sales indices accounted for by ordinary least squares (OLS) regression on the monthly differenced countywide price indices.[13] In specifying the model, a full set of fixed and interaction terms were included to allow each region to have its own idiosyncratic growth patterns. The model that was estimated is as follows:

$$\begin{aligned} d_{i,t} &= \beta_0 + \beta_1 D_{c(i),t} + \beta_2 \mathrm{I}_{\{c(i)=2\}} + \beta_3 \mathrm{I}_{\{c(i)=3\}} + \beta_4 \mathrm{I}_{\{c(i)=4\}} \\ &\quad + \beta_5 \mathrm{I}_{\{c(i)=2\}} * D_{c(i),t} + \beta_6 \mathrm{I}_{\{c(i)=3\}} * D_{c(i),t} + \beta_7 \mathrm{I}_{\{c(i)=4\}} * D_{c(r),t} + \varepsilon_{i,t} \end{aligned} \tag{2}$$

Where:

$d_{i,t}$ is the differenced index of tract *i* between times t and $t-1$, i.e.,

$$d_{i,t} = \frac{RSI_{i,t} - RSI_{i,t-1}}{RSI_{i,t-1}}$$

$c(i)$ is a function which maps the tract *i* to its county, identified as either $\{1,2,3,4\}$

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[13] The study used the countywide repeat sales index as an indicator of regional trends since detailed real estate data were not available beyond the county. However, this metric is found to be highly correlated with the repeat sales index released at the metropolitan area level by the Office of Federal Housing Enterprise Oversight (OFHEO, n.d.) In particular, the correlation between the Dallas County repeat sales index developed by the Dynamic Neighborhood Taxonomy project and the Dallas MSA repeat sales index released by OFHEO was 0.961.

$D_{c(i),t}$ is the differenced index of the county $c(i)$ between times t and $t-1$, i.e.,

$$D_{c(i),t} = \frac{RSI_{c(i),t} - RSI_{c(i),t-1}}{RSI_{c(i),t-1}}$$

$\beta_0, \ldots, \beta_7$ are estimated coefficients

$\varepsilon_{i,t}$ are error terms

The model above estimates an R-squared statistic for the four regions combined. To assess the importance of each region on its neighborhoods separately, four models, one for each region, were estimated as well. Using the same notation as in Equation (2), the estimated equation for each of these models is as follows:

$$d_{i,t} = \beta_0 + \beta_1 D_{c(i),t} \tag{3}$$

In each region, there is a small subset of tracts that display extreme values in the repeat sales index, which are due not to real appreciation but to instability in the estimates because of small sample size. These outliers were removed from the sample used to run the regional effect regressions. In particular, the 1st and 99th percentiles of index values were adopted as a cutoff point for the overall model, while the four models for the individual regions used the 5th and 95th percentile.[14]

Neighborhood Convergence

Neighborhood convergence exists when low-performing neighborhoods improve and "catch up" to more successful neighborhoods. In order for less affluent neighborhoods to catch up, they have to improve faster than successful neighborhoods, and the difference between neighborhoods eventually has to diminish. In the context of housing markets, this means that prices must rise faster in low price areas than in expensive neighborhoods, and the variation between prices in high and low price neighborhoods must decrease.

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[14] The cutoffs are different in the two models because a higher percentage of tracts were affected in some cities, and we wanted to maintain a consistent threshold in all the local models. Once all the tracts in the four counties were combined for the overall model, though, using the 1st and 99th percentile was sufficient to eliminate all of the unstable tracts.

Formally, these two kinds of changes are modeled as "beta convergence" and "sigma convergence" (Barro & Sala-I-Martin, 1990). Beta convergence occurs when lower-priced neighborhoods appreciate faster than expensive neighborhoods, and sigma convergence occurs when the variation of prices across neighborhoods decreases.

The equation to estimate the extent of beta convergence is as follows:

$$\frac{1}{T}\log\left(\frac{y_{i,T}}{y_{i,t_0}}\right)=\alpha-\left(\frac{1-e^{-\beta T}}{T}\right)\cdot\log\left(y_{i,t_0}\right)+u_i \tag{4}$$

Where:

$y_{i,T}$ is the median price in tract *i* in the final year of the sample

y_{i,t_0} is the median price in tract *i* in the first year

T is the length of the sample in years

α is a fixed effect

β is the beta convergence parameter

u_i is random error

The estimated value of β indicates whether or not beta convergence exists: if $\beta < 0$, there is beta convergence; if $\beta \geq 0$, there is not beta convergence.

To assess the extent of sigma convergence in each city, we conducted a series of tests of the equality of the variance in the first year with the variance in the final year of the sample, based on its *F* statistic and *p*-value. The null hypothesis for these tests was that the ratio of the price variance in the first year of the study period to the variance in the final year would be equal to one (i.e., prices are as dispersed at the end of the study period as they were in the initial year). We then tested three alternative hypotheses: that the ratio is not one, that it is less than one, and that it is greater than one. If sigma convergence were occurring, we expected the ratio to be greater than one, meaning that prices were less dispersed at the end of the study period than they were at the beginning.

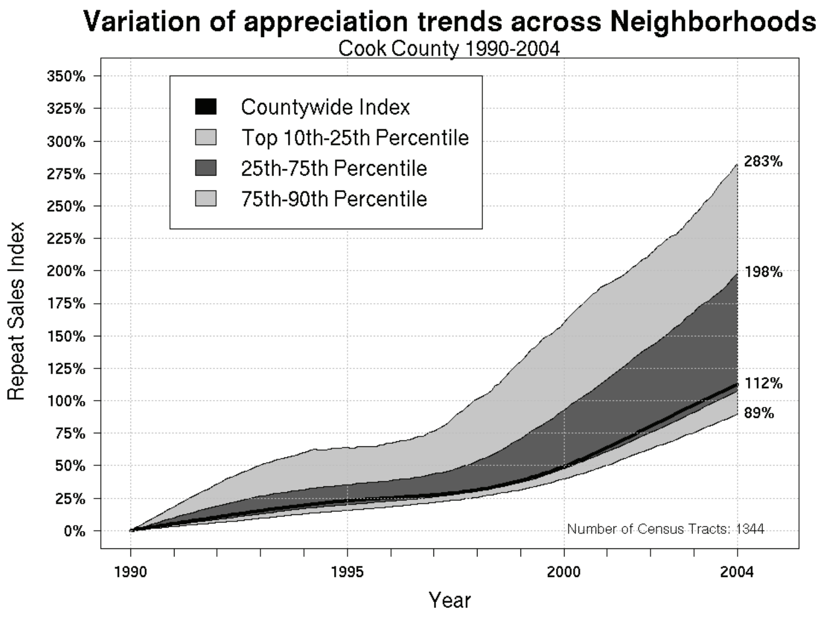
Findings

Regional Effects

The first overarching observation with respect to the question of regional effects is that at any given point in time, most neighborhoods in the same region exhibit similar trends, and do not stray far from the overall direction of their region. This is not surprising, given that the housing market operates primarily at the regional level.

This is visually presented in Figures 1 through 4. The dark gray areas show how 50% of all neighborhoods in the four sample cities and their counties are relatively tightly clustered together, and as a whole mirror the trajectory followed by their region. In many cases, 90% of all neighborhoods (the light gray areas) are remarkably similar. [15]

Figure 1.



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[15] While at any point in time all tracts are within a few percentage points of each other in terms of appreciation rates, over the entire period this can give rise to significant differences. This is why the graphs show a wider range as time goes on.

Figure 2.

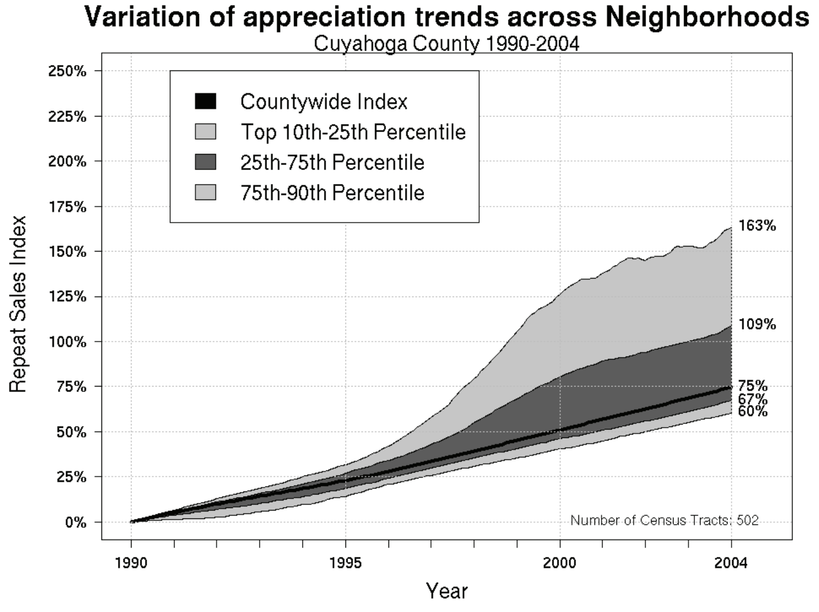


Figure 3.

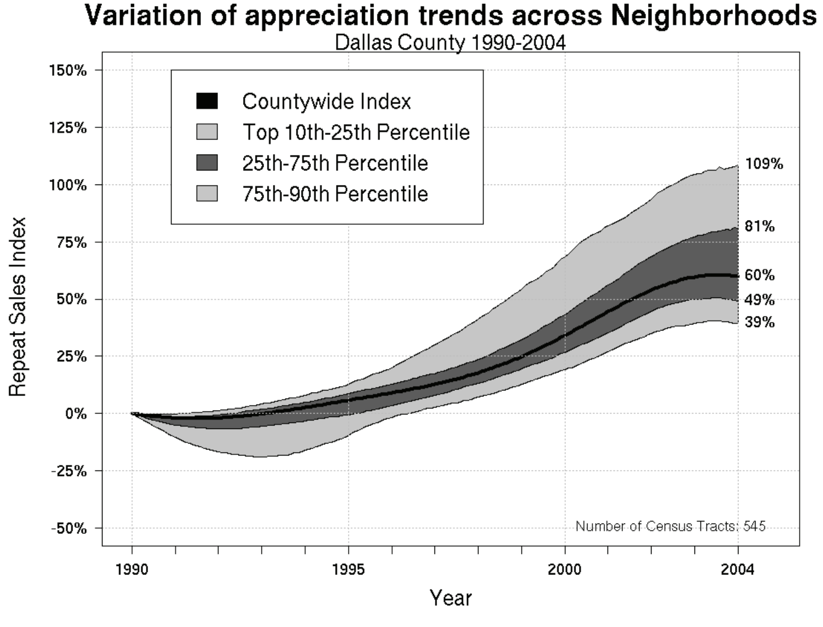
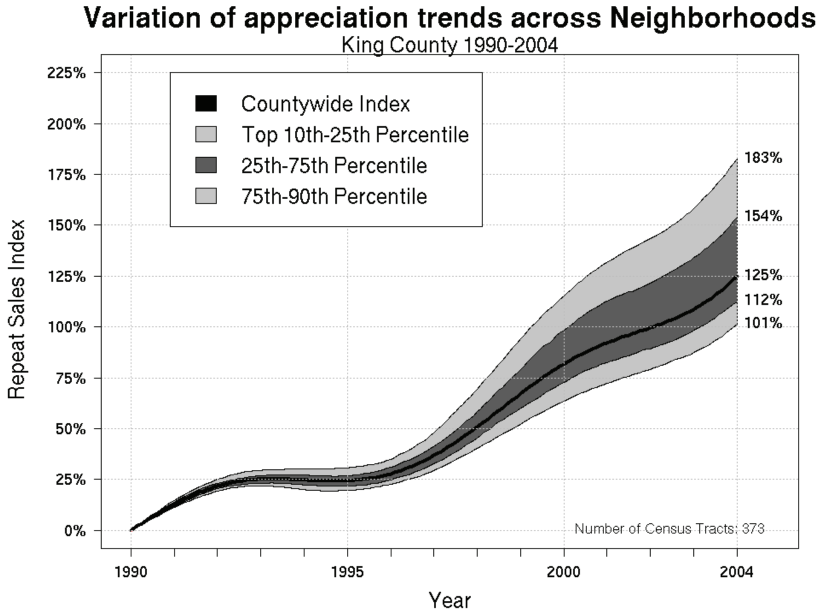


Figure 4.



The graphs also show how Dallas overall experienced the lowest growth rate (60%) among the four counties considered in this study, while housing in Chicago and Seattle appreciated approximately twice as much as it did in Dallas. We will return to this difference in appreciation rates in the discussion of the implications of the regional effects and convergence findings.

As described above, to more formally address the issue of local versus regional shocks, the project ran a set of regressions to estimate the extent to which regional forces affect local housing prices across neighborhoods. These models were run for the entire sample of tracts, as well as individually for each region.

In the regression across all tracts and all cities, regional effects accounted for 35% of the variation, meaning that overall, more than a third of neighborhood change was explained by regional trends. The results of this model are reported in Table 1.

Table 1
Overall Regional Effects, Linear Regression, 1990–2004

Diff_Tract_RSI	Coefficient
Cuyahoga_County	0.000623***
	(0.000061)
Dallas_County	-0.00122***
	(0.000026)
King_County	-0.00134***
	(0.000029)
Diff_Countywide_RSI	0.941***
	(0.0032)
Cuyahoga_County*Diff_Countywide_RSI	-0.362***
	(0.019)
Dallas_County* Diff_Countywide_RSI	0.127***
	(0.0061)
King_County* Diff_Countywide_RSI	0.0672***
	(0.0047)
Constant	0.00147***
	(0.000017)
Observations	49,3600
R-squared	0.35

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This general model, however, does not reveal the extent to which the impact of regional trends varies from region to region. To address this question, the study ran a set of city-specific regressions, which are reported in Tables 2–5. In these regressions, the coefficients were positive and significant in all cities, but the explanatory power of the model (which tells us how much of the neighborhood variation is explained by the regional trend) varied greatly from city to city. In Cleveland, for instance, the R-squared value was very low, indicating that neighborhoods there have moved largely in idiosyncratic ways. At the opposite end of the spectrum, 86% of all neighborhood change in Seattle was accounted for by regional trends.

In Dallas, regional effects also played a major role in shaping neighborhood trends. The R-squared of the Dallas model was 0.57, meaning that more than half of the overall variation across neighborhoods was explained by regional shifts (See Table 2).

Table 2

Regional Effects by County (Linear Regression, 1990–2004)

	Cook	Cuyahoga	Dallas	King
Diff_Tract_RSI	Coefficient			
Diff_Countywide_RSI	0.867***	0.545***	0.919***	0.951***
	(0.0028)	(0.010)	(0.0028)	(0.0015)
Constant	0.00163***	0.00192***	0.000503***	0.000436***
	(0.000015)	(0.000032)	(0.000010)	(0.000010)
Observations	22,4168	84,690	79,657	64,791
R-squared	0.30	0.03	0.57	0.86
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Neighborhood Convergence

Overall, the study found some evidence that most neighborhoods do tend to converge over time—at least they did over the period for which data was available. The scatter plot in Figure 5 (depicting data for the city of Chicago) shows a relatively strong negative correlation between annual growth rate and initial price, meaning that tracts that started out with low median prices in 1990 had higher growth rates over the subsequent 15 years than tracts that started out with high median prices. The same evidence of beta convergence was found in Cleveland and Seattle, even though the pattern is less pronounced in Seattle than in the other two cities.

The study also found significant evidence of sigma convergence in these three cities, as prices were significantly less dispersed in 2006 than they were in 1990. These results are reported in Tables 3–5.[16]

[16] The key test result here is reported in bold at the bottom right of each table: If we observe sigma convergence, the ratio between the variance in 1990 and the variance in 2006 should be greater than 1. If the p-value for this hypothesis is less than 0.05 (as it is for three out of the four cities) we find statistical evidence of the occurrence of sigma convergence.

Figure 5.

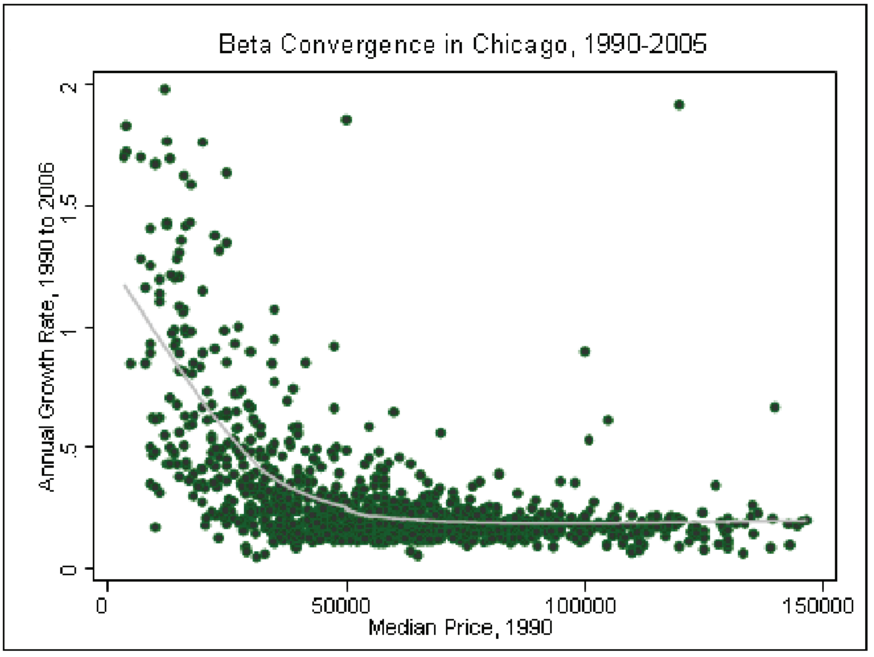


Figure 6.

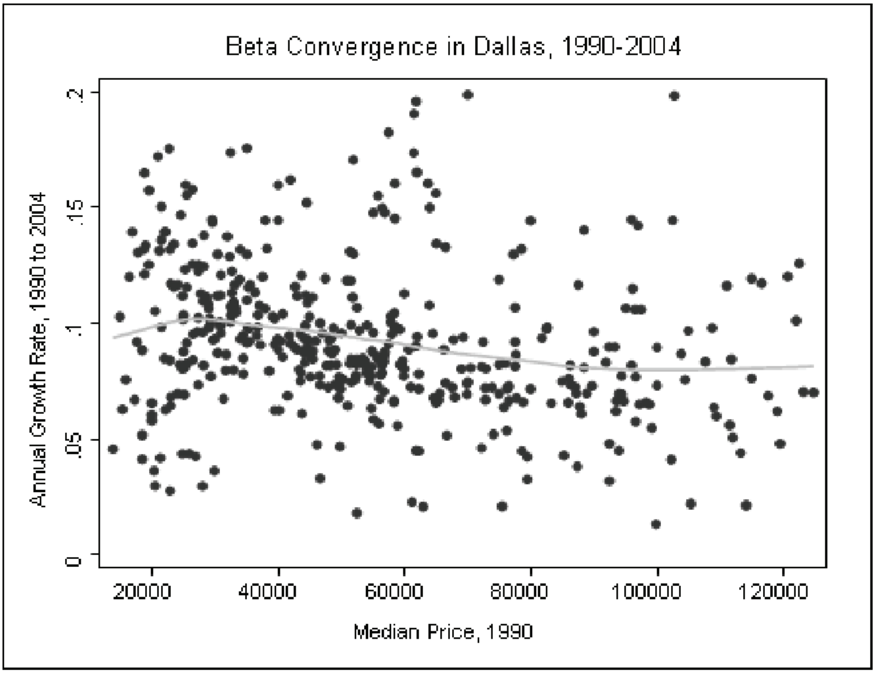


Table 3

Sigma Convergence in Chicago (Variance Ratio Test, 1990–2006)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
ln_median_ 1990	1,231	11.32606	.0178182	.6251612	11.2911	11.36101
ln_median_ 2006	1,307	12.41962	.014142	.5112686	12.39188	12.44737
Combined	2,538	11.88921	.0156658	.7892187	11.85849	11.91993
ratio = sd (ln_median_y1990) / sd (ln_median_y2006)						f = 1.4952
Ho: ratio = 1						Degrees of freedom = 1230, 1306
Ha: ratio < 1 Pr(F < f) = 1.0000			**Ha: ratio != 1 2*Pr(F > f) = 0.0000**			Ha:ratio > 1 Pr(F > f) = 0.0000

Table 4

Sigma Convergence in Cleveland (Variance Ratio Test, 1990–2006)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
ln_median_ 1990	467	10.90033	.0368908	.7972171	10.82784	10.97282
ln_median_ 2006	473	11.65834	.0260456	.566454	11.60716	11.70952
Combined	940	11.28175	.0256923	.7877108	11.23133	11.33217
ratio = sd (ln_median_y1990) / sd(ln_median_y2006)						f = 1.9807
Ho: ratio = 1						Degrees of freedom = 466, 472
Ha: ratio < 1 Pr(F < f) = 1.0000			**Ha: ratio != 1 2*Pr(F > f) = 0.0000**			Ha: ratio > 1 Pr(F > f) = 0.0000

Table 5
Sigma Convergence in Seattle (Variance Ratio Test, 1990–2006)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
ln_median_– 1990	369	11.75254	.0201313	.3867087	11.71295	10.97282
ln_median_– 2006	371	12.8482	.0177645	.3421677	12.81327	11.70952
Combined	740	12.30185	.0242066	.6584903	12.25433	12.34937
ratio = sd (ln_median_y1990) / sd(ln_median_y2006)						f = 1.2773
Ho: ratio = 1						Degrees of freedom = 368, 370
Ha: ratio < 1 Pr(F < f) = 0.9905			**Ha: ratio != 1 2*Pr(F > f) = 0.0190**			Ha: ratio > 1 Pr(F > f) = 0.0095

Dallas was the lone exception to the overall trend of convergence in the sample—it did not display the same pattern as the other three cities (see Figure 6). In fact, there appears to be little or no relationship between starting median prices and annual growth rate in Dallas. Similarly, the study found no evidence of sigma convergence in Dallas—prices remained as dispersed in 2004 as they were in 1990 (see Table 6).[17]

Table 6
Sigma Convergence in Dallas (Variance Ratio Test, 1990–2004)

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95%Conf. Interval]	
ln_median_– 1990	473	11.09645	.0315517	.6862039	11.03445	11.15845
ln_median_– 2006	492	11.66797	.0308581	.6844665	11.60734	11.7286
Combined	965	11.38784	.0238928	.7422177	11.34095	11.43472
ratio = sd (ln_median_y1990) / sd(ln_median_y2006)						f = 1.0051
Ho: ratio = 1						Degrees of freedom = 472, 491
Ha: ratio < 1 Pr(F < f) = 0.5224			**Ha: ratio != 1 2*Pr(F > f) = 0.9552**			Ha: ratio > 1 Pr(F > f) = 0.4776

[17] The result reported in bold at the bottom of the table shows how the hypothesis that the ratio of the variance was different from one was rejected in this test.

Implications

The results concerning the importance of regional effects on neighborhood change confirm that neighborhoods are indeed part of a larger regional economy that plays a significant role in determining their performance, and that the prosperity of a region and its neighborhoods are closely intertwined. Most of the increase in value of the neighborhoods in Seattle, for instance, should be attributed not to their own intrinsic characteristics but to larger scale changes in the economy of the Seattle region over the past 15 years. In Dallas, the performance of the regional economy has also played a major role in determining the fate of individual neighborhoods. The implication for community development practice, particularly in Dallas and Seattle, is that change cannot be effected simply by intervening at the neighborhood level. Rather, neighborhood improvement can best be achieved through a concerted effort that takes into account both the neighborhood and regional levels.

The results also confirm the importance of connecting the neighborhood to the region. Despite the strong influence of regional trends on neighborhood outcomes, there are still neighborhoods in Dallas (as well as in the other three cities) that are not benefiting from the economic growth of the region. This is consistent with several theories of neighborhood poverty, which all imply a degree of economic isolation affecting the poorest neighborhoods in the region.[18] Whatever its causes, this economic isolation is evident across many of the systems that normally link healthy neighborhoods and their regions: isolation from the labor market, resulting in unemployment or underemployment of neighborhood residents; isolation from financial markets, resulting in lack of capital for businesses and consumers; isolation from consumer markets, resulting in a dearth of retail and services even in areas that could support them, and so forth.

The lack of economic integration that characterizes these communities means they are less likely to benefit from positive trends at the regional level. More work is needed to understand the mechanisms that link neighborhoods to their regions and how development practices can strengthen and leverage these connections to bring investment and economic activity to underserved urban areas.

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[18] Blair and Carroll (2007) noted that the notion of economic isolation of inner city neighborhoods is embedded in many of the most common explanations for the persistence of neighborhood poverty, and is supported by empirical evidence that shows a lack of association between changes in economic welfare at the regional level and change in family income in the poorest census tracts.

With respect to the topic of neighborhood convergence, the findings raise the question of what might account for convergence across neighborhoods and why some places converge while others do not. One hypothesis, outlined above, is that neighborhoods that converge are located in places where location matters and there are constraints on the supply of land. The one inalienable feature of a neighborhood is its location; no matter how dilapidated a neighborhood becomes, it will always be located at the same distance from the central business district, the waterfront, or other regional centers of gravity. To the extent that the location of the neighborhood is valuable (due, for instance, to rising transportation costs), and that it becomes more and more difficult to find undeveloped land, there will always be a market incentive to redevelop areas that have been neglected.

There are, of course, other intervening factors that could prevent particular neighborhoods from converging. There could be other costs that offset the low cost of land (such as, for instance, brownfield cleanup costs), or there could be a lack of demand for housing in a particular neighborhood due to negative amenities associated with that location (high crime, lack of infrastructure, etc.).[19] However, none of these characteristics are unique to Dallas neighborhoods, and do not explain why Dallas behaves so differently from the other three cities in the sample.

What does distinguish Dallas is that it is the least centralized of the four cities in the sample, being more dispersed and also part of a region that includes another large central city. These features of the Dallas metropolitan area might mean there is less of a premium on location (for instance, in terms of distance from the central business district) associated with neighborhoods in the city. At the same time, Dallas has the fewest constraints on housing supply, given the availability of land and the absence of major geographical barriers to development (particularly when compared to a city like Seattle, for example).[20] As a result, there are fewer incentives to redevelop and reinvest in areas that are struggling and continue to trail other parts of the city.

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[19] The second phase of the Dynamic Neighborhood Taxonomy project will pay particular attention to the differences between the neighborhoods that do and do not converge, in the hope of generating useful insights into what accounts for one group doing better than the other and identifying the kinds of interventions that can be most effective in lifting the neighborhoods that do not converge on their own.

[20] A greater elasticity of supply in Dallas compared to the other regions is consistent with the finding that Dallas had much lower appreciation rates than Chicago and Seattle over the study period, despite experiencing more population growth.

The convergence findings also bring us back to the discussion of the interconnectedness of neighborhoods and their regions. The neighborhoods that consistently trail in terms of growth and economic performance (i.e., do not converge), in Dallas as well as in the other cities, are likely to be the ones that are more disconnected from the regional economy because they are isolated from the market forces that cause convergence in the first place. These are the areas that need interventions the most—they are less likely to improve over time if left to their own devices.

Moreover, the fact that poor neighborhoods in Dallas do not show signs of catching up could negatively impact the growth of the region as a whole. There is evidence that income inequality has a negative effect on economic growth, and that reducing poverty in the inner city results in higher income levels throughout the region (Weissbourd & Berry, 2004; Pastor et al., 2000). This is, in part, because concentrated poverty generates negative externalities for the entire region and also, in part, because leaving people and places behind is a waste of assets (in the form of underemployed labor, undeveloped land, and untapped demand for goods and services) and growth opportunities that could benefit the regional economy. In this respect, the lower housing appreciation rates in the Dallas region could be due in part to the negative impact of the large pockets of poverty in the inner city.

At the same time, unlike the other three cities in the sample, the Dallas region has experienced a very high rate of population growth over the past 15 years.[21] This provides a great opportunity to bring investment and new development into some of the neighborhoods that have traditionally been left behind. In the absence of convergence forces, though, which could spontaneously bring about change in some of the underserved areas of the city, community development interventions in Dallas (and in neighborhoods that are unlikely to be "rediscovered" by the market due to their location) are particularly important, not only for these neighborhoods but for the region as a whole.

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[21] Murdoch (2006) pointed out that the Dallas-Fort Worth-Arlington MSA ranked 32nd in the country in terms of population growth between 1990 and 2005, with a rate close to 46%. Among the top 10 metropolitan areas, only Atlanta grew faster over the same time period.

Conclusion

The analysis of detailed real estate transaction data over a period of 15 years across four counties yields useful insights into some basic dynamics of neighborhood change.

Looking at the relationship between regional and neighborhood change in housing values confirms the importance of regional trends in determining neighborhood outcomes, as close to 60% of the overall neighborhood variation in Dallas over the last 15 years is explained by the regional trend. This suggests that economic development strategies cannot effect change solely by intervening at the neighborhood level. While intervention at the local level is critical (and indeed sometimes more practical than intervention at the regional level), neighborhood improvement can best be achieved through a concerted effort that takes into account both the neighborhood and the region.

A second issue addressed in this paper is the degree to which neighborhoods tend to converge over time. The findings suggest that, overall, the phenomenon of convergence (so far tested primarily at the national and metropolitan area level) applies to neighborhoods as well, at least over the time period considered by this study. However, there are important exceptions. In particular, unlike neighborhoods in the other three cities in the sample, neighborhoods in Dallas do not generally converge over time. More research should be done on the causes of this phenomenon, but the findings suggest that, in the absence of convergence forces which could spontaneously lift low-performing areas of the city, community development interventions in Dallas are particularly important.

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