THE CORRELATES OF HOUSE PRICE CHANGES WITH GEOGRAPHY, DENSITY, DESIGN AND USE: EVIDENCE FROM PHILADELPHIA

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1.0 Abstract

The Congress for New Urbanism has commissioned this research paper to analyze how variation in urban form and composition may be influencing the relative performance of local residential markets during the recent and unprecedented downturn in the U.S. housing market. In particular, this report analyzes how varying levels of house price declines are correlated with varying characteristics of New Urbanist principles: walkability, central location, density, mixture of uses and access to public transportation. Comparing house price declines across metro areas and then examining Zip-level house price declines in the Philadelphia metro area from the market's peak in 2007 to its trough in 2012, the following results were identified:

- The magnitude of house price declines have not only varied significantly across metropolitan areas, but have also varied significantly across metropolitan areas with similar urban forms. Both Dallas and Tampa would qualify as having a sprawling urban form, but Dallas has had among the smallest declines while Tampa has had declines that significantly exceed the national average. Similarly, among the least price deflation of any large metro area. Likewise, both Boston and San Francisco are older cities with dense, walkable downtown cores containing a mixture of uses, but Boston's declines are below the national average while San Francisco's exceeds it.
- Since it would appear that the relationship between market performance, geography and urban form is more nuanced than what simply comparing appreciation rates at the metropolitan level can provide insight to, this paper examines house price performance house price performances within metro areas, using the Philadelphia metro area as a case study.
- In Philadelphia, during the first housing downturn of 1989-1995, house prices declined the greatest in the core urban center (-33.7% in Center City), second-most in the central city of Philadelphia as a whole (-17.6%) and the least in the lower-density areas the suburban counties (-14.3%). But, during the most recent housing downturn of 2007-2012, home price declines have been greatest in the relatively low-density suburbs (-32.7%), second-most in Philadelphia county (-26.7%) and the smallest in the urban core of Center City (-20.2%). Note that, from the first housing downturn to the second, the spatial pattern of house price declines reversed itself: central, urban locations have held their value better than more peripheral suburban location during the current downturn than during the last one.
- A regression of Zip-level house price declines on Zip-level housing attributes measuring the local housing stock's density, urban v. suburban location, accessibility to public transportation, mixture of uses and socioeconomic traits finds that homes in communities with New Urbanist characteristics have, on average, performed much better during the recent U.S. housing downturn than their counterparts in lower-density, single-use, exurban and auto-oriented communities.
- For example, the typical home in the Philadelphia region declined in value from an average of $240,000 at the market's peak in mid-2007 to $177,600 at the market's trough in early 2012; a 26% devaluation. But the typical home in a community with

New Urbanist characteristics only fell in value to $192,624 (a 20% decline) while the typical home in a non-New Urbanist community fell in value to $111,329 (a 54% decline).

- In general, we attribute this result to the fact that: energy costs are significantly higher during the recent downturn (making long commutes in a car and heating and cooling a larger suburban home relatively more expensive), many downtown areas and urban neighborhoods have experienced a significant revitalization in the past twenty years, and that there is a renewed desire and interest in urban living by many younger and older households.
- In conclusion, this report provides evidence that not only is the magnitude of the recent housing downturn unique, but its structure is as well. In past downturns, homes in conventional, low-density, single-use, auto-oriented suburban developments held their value relatively better. During the current downturn, however, it has been dwellings located in an urban form that takes advantage of walkable densities to allow access to amenities such as transit and mixed-use districts that have exhibited greater price stability.

2.0 Project Motivation

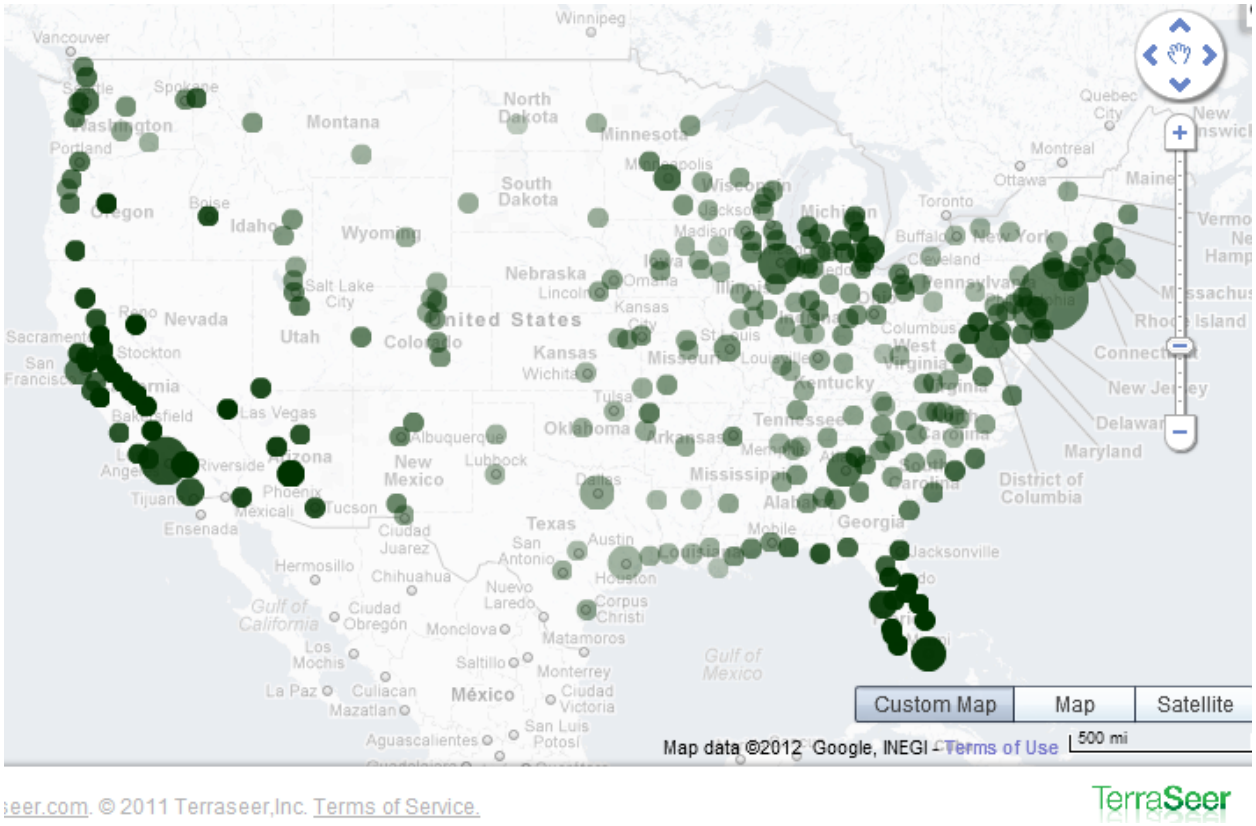
The Congress for New Urbanism (CNU) is the leading organization promoting walkable, mixed-use neighborhood development, sustainable communities and healthier living conditions. The CNU has commissioned this research paper to analyze how variation in urban form and composition may be influencing the relative performance of local residential markets during the recent and unprecedented downturn in the U.S. housing market.

A confluence of factors, including increasing energy costs, growing awareness of environmental issues, escalating infrastructure costs, rapid changes in credit markets, demographic trends, and changing attitudes towards urban lifestyles have potentially altered the real estate landscape. We analyze the market performance of residential properties in centrally-located, walkable, transit-oriented, mixed-use, sustainable communities and compare them to the performance of their counterparts in peripherally-located, conventional, auto-oriented, single-use, low-density housing developments. The goal of this research paper is to identify and quantify how the relative variation in house price behavior during the biggest housing deflation event since the Great Depression is explained by variation in the location and design of different residential communities.

We believe this paper is particularly well-timed, as data (at the time of this writing) seems to indicate that the U.S. housing market has hit its bottom, and has begun to recover. Hence, the data analyzed in this report covers the full evolution of the downturn, from its peak to its trough.

While the downturn in the housing market has been national in its scope, there is substantial local variation in its intensity. Figure 1 on the following page color-codes U.S. metropolitan area by their change in house prices over the last five year. The darker the circle for each metropolitan area, the greater the decline in its house prices. The circles are scaled in size by population, with larger circles representing more populous metropolitan areas.

Figure 1. Total Decline in House Prices, by Metropolitan Area

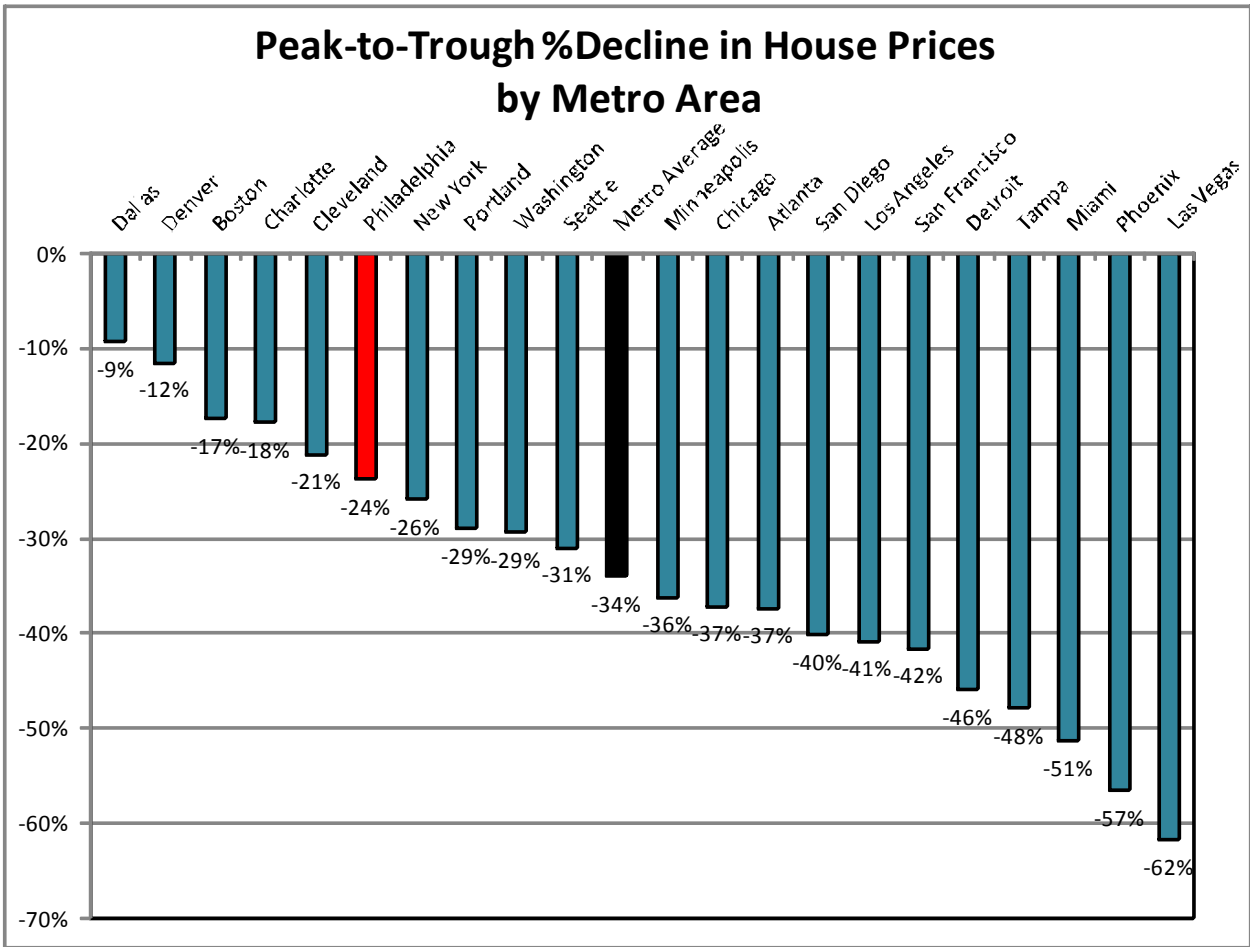


Source: Federal Housing Finance Agency (FHFA) and
http://www.justinholman.com/2012/03/03/housing-price-index-changes-by-msa/

As the map indicates, the most significant declines in house prices are in the cities of the Rust Belt and the Sun Belt. While the Southeast, Midwest and Rocky Mountain states have not been spared from house price declines, their depreciation has been of a relatively lesser nature compared the aforementioned hard-hit areas. The performance of the housing markets of the cities of the Northeast lie somewhere in between these two aforementioned extremes.

To more explicitly quantify this variation in house price declines, the following chart shows total peak-to-trough deflation in house prices, for the top 21 largest U.S. metro areas.

Figure 2. Total Peak-to-Trough Decline in House Prices, by Metro Area



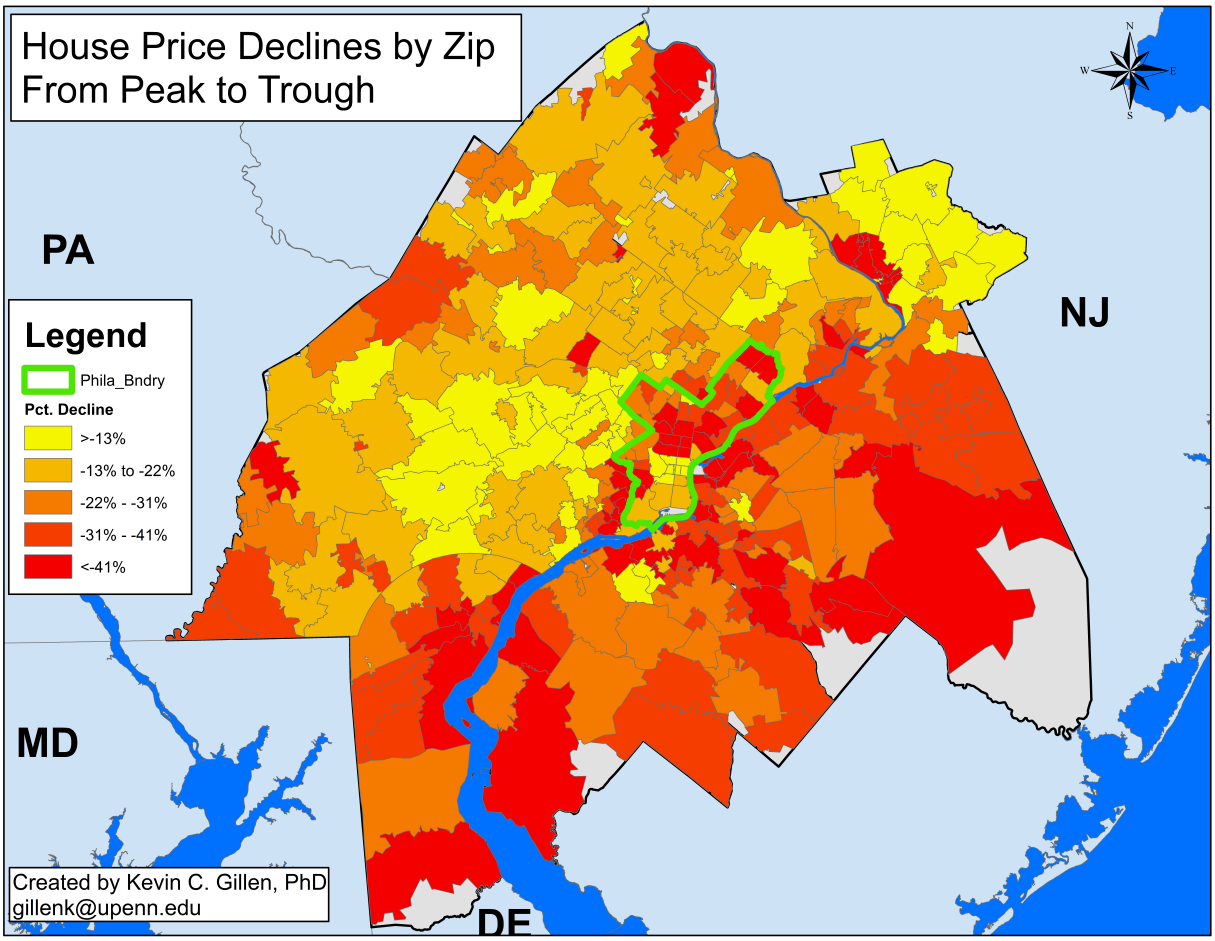
Source: Case-Shiller MacroMarkets and Kevin C. Gillen, 2012

The degree of price deflation would not seem entirely explainable by either geographic location or urban form at the regional level. The two cities with the greatest price deflation, Las Vegas and Phoenix, would certainly qualify as metro areas with a non-New Urbanist form; i.e. low-density, auto-oriented "sprawling" metro areas. However, metro areas that have also experienced significant deflation, such as San Francisco and Miami, have significantly greater densities and a walkable downtown urban core. At the other end of the spectrum, Dallas and Denver are often described as having a sprawling urban form, yet have experienced among the least price deflation of any large metro area. Both cities, however, are in transition, with, expanding rail transit systems and robust infill development in their centers. Similarly, Philadelphia and Boston have dense, walkable downtown cores, and also experienced relatively little house price deflation. Moreover, the age of a city (older cities tend to have more mixed-use development) or geographic clustering of cities does not seem to be a uniformly explanatory factor, either. Both Cleveland and Detroit are older Rust Belt cities, but Cleveland has experienced below-average price declines while Detroit has experienced above-average house price declines.

Similarly, both Charlotte and Tampa are relatively young cities[1], but Charlotte's house price declines are well below the national average while Tampa's is well above it. As such, it would appear that the relationship between market performance, geography and urban form is more nuanced than what simply comparing appreciation rates at the metropolitan level can provide insight to.

We now move from examining house price performance across metropolitan area to house price performances within metro areas. When the variation in the performance of real markets within regions the potential role of geography and urban form may become more apparent. Figure 5 displays the decline in house prices in Philadelphia area Zip Codes, as measured by the peak-to-trough percent change in the average house price in the years following the housing boom of the mid-2000s[2].

Figure 3: Total Decline in House Prices, by Zip Code, in the Philadelphia Metropolitan Area



[1] Although the year of the founding these cities may be considered old, their growth into large cities has only occurred in recent decades.

[2] A separate house price index was estimated for each Zip Code using a hybrid hedonic regression with Ln(Price) as the dependent variable. For the region and most Zips in it, the peak of the index occurred in mid-2007 and the trough occurred in early 2012.

Each Zip is color-coded by the relative magnitude of its average house price decline. Darker shades of red represent greater declines while the relatively lighter shades of orange and yellow represent relatively lesser house price declines. The categories are demarcated based upon the quintiles of the univariate distribution of house price declines across Zips, meaning exactly twenty percent of all Zips fall into each of the five categories of house price declines. The outline of Philadelphia County is represented by the green polygon in the center of the map.

Again, while there does appear to be some clustering of house price declines of similar magnitude, a uniform relationship with respect to location or urban form is not clear. The urban neighborhoods of downtown Philadelphia had among the least house price declines, but so did the far-flung, outer-ring suburban communities of Mercer County in New Jersey, to Philadelphia's northeast. The high-density, walkable and mixed-use neighborhoods of North and West Philadelphia had among the highest house price declines, but so did the low-density, auto-oriented and single-use communities of southern New Jersey and northern Delaware.

So, the relationship between recent housing market performance and urban form would appear to be more complicated and nuanced one than what simple summary statistics can capture. While there does appear to be some clustering of similar price declines that are correlated with location, density and type of use, this relationship is likely more multi-dimensional than what the simple cross-correlation can convey. We hypothesize that location and density are but two factors explaining why housing market performance varies within and between metro areas, and that other design factors such as mixture of uses, predominant modes of transportation and sustainability of design are also important.

Empirically examining and explaining how such variation can be explained by form, use and design is the key objective of this research. In this analysis, we assess whether the recent increases in energy costs have adversely affected sprawling, auto-oriented communities that have comprised a significant part of recent residential real estate development. In addition, we evaluate the extent to which changes in the real estate market have changed the relative risk, as reflected in patterns of house price deflation, of traditionally developed communities compared to sprawling communities.

3.0 Existing Research

The proposed analysis is particularly timely as is reflected in the number of recent press articles and studies from during the recent recession focused on changing patterns of development.

- Studies done by University of Utah professor Arthur C. Nelson ("The Next One Hundred Million", January 2007) have estimated that the current supply of unattached single-family housing already exceeds projected demand and will continue to do so until 2037. Further analysis by Nelson ("Reshaping America's Built Environment", August 2009) indicates that as the glut of large-lot homes continues to flood the market, an emerging demand for smaller housing in walkable, traditional neighborhood settings is on the rise.

- An article in *Business Week*, (February 11, 2008), for example, argues that the best solution to addressing greenhouse emissions and improving quality of life is to invest in denser communities.

- In "The Next Slum?" (*Atlantic.com*, March 2008) Chris Leinberger examines alarming negative trends in many sprawling communities on the exurban fringes of our metropolitan areas.

- A report issued by the organization "CEOs for Cities" (www.ceosforcities.org, May 2008) even claims to find that, contrary to conventional wisdom, that it was high fuel costs and not subprime lending that caused the housing bubble to pop.

- A paper by two researchers investigates the impact of urban form on U.S. residential energy use, and finds that residents of sprawling counties are more likely to live in single-family detached homes and subsequently suffer a higher energy penalty (Journal of Housing Research, 19(1), 2008).

- Recent data collected by both the National Association of Homebuilders and the American Institute of Architects (www.nahb.org and www.aia.org) indicate that, since the bursting of the national housing bubble several years ago, the average size of the U.S. home has shrunk, reversing a decades-long trend towards larger homes. The research has hypothesized that "The cost of furnishing a bigger house, heating and cooling the structure, and even the commutation between it and the place of employment was always imposing, but now there is no longer the appreciation factor that in the past made the situational sacrifice worth it."

- An article in Inman News (www.inman.com, January 2011) titled "The Sun Sets on McMansions" provided anecdotal evidence that "The cost of furnishing a bigger house, heating and cooling the structure, and even the commutation between it and the place of employment was always imposing, but now there is no longer the appreciation factor that in the past made the situational sacrifice worth it." The

author concludes that [the current recession] "has -- at least for the time being -- killed off the McMansion Era."

- In an article for the Philadelphia Inquirer (www.philly.com, January 2012) titled "Suburbia's Outer Ring Losing Shine", columnist Inga Saffron discusses new evidence from planner Chris Leinberger and economist Ed Glaeser that "suburban sprawl has finally reached its limit", and that recent sales data indicate that "single-family homes in outer-ring suburbs—like Oakcrest (a community located 45 minutes from Philadelphia—ed.)—are hemorrhaging value", while "urban housing has generally held its value during the bust."
- In another article for the Philadelphia Inquirer (www.philly.com, April 2012) titled "Census: Cities, Not Exurbs, Have Been Growing,"reporter Al Heavens cites data from the U.S. Census and research by Kevin Gillen to that "Since 2010, the annual growth rate of cities and adjacent communities has surpassed metropolitan fringe areas."
- A recent Brookings Institution study ("Walk this Way: The Economic Promise of Walkable Places in Metropolitan Washington, D.C." by Chris Leinberger and Mariela Alfonzo, May 2012) highlights the economic appeal of amenity-rich, walkable, convenient communities, noting "each step up the walkability ladder adds $9 per square foot to annual office rents, $7 per square foot to retail rents, more than $300 per month to apartment rents and nearly $82 per square foot to home values." (See "Now Coveted - A Walkable, Convenient Place" - New York Times, May 25, 2012.)
- A recent report by the U.S. Census examined population changes from 2000 to 2010 in the downtown areas (defined as" areas within two miles of a city hall") of major U.S. metropolitan areas, The study found that "The growth rate in downtown areas is more than double the growth rate in other areas of the cities" and that "Chicago saw the largest numeric gain. But Philadelphia, New York, Salt Lake City and Washington also posted large population increases close to city hall." Philadelphia's increase in downtown population "marked an almost 10 percent increase since 2000" in a city that has seen declining population since 1950. (www.philly.com, September 2012. U.S. Census: "Patterns of Metropolitan and Micropolitan Population Change: 2000 to 2010")

To explain this phenomenon, the academic research to date has been primarily focused on the "cost" side of this issue: higher energy costs have influenced both the timing and geographic intensity of the downturn. Less attention has been paid to the "benefit" side of the issue: have the benefits of sustainable design accrued to communities in the form of greater retained value and decreased risk? We propose to rigorously and quantitatively address the issue of whether there has, in fact, been a housing market paradigm shift that has resulted in differential market performance between sustainable "New Urbanist" communities and single-use, low-density "Suburban Sprawl" developments in the U.S.

While there is substantial anecdotal evidence that indicates increased value and decreased risk for New Urbanist communities, no research has either proven or quantified this in a comprehensive, systematic or empirically rigorous way. We endeavor to quantify and evaluate the market performance of dwellings in sustainable communities relative to other communities over the housing cycle. We test the hypothesis that properties in sustainable

communities have retained more of their value more successfully in the current housing market downturn, and have suffered a smaller incidence of delinquencies and foreclosures. We also evaluate whether there has been a change in the relative attractiveness of sustainable communities versus conventional and less dense communities over the last 20 years. The extent to which these results vary by the type of sustainable community, for example old versus new communities or suburban versus urban communities, is also examined.

The recent bursting of the U.S. housing bubble provides a unique laboratory for examining the economic viability of sustainable developments compared to more conventional suburban-type developments. This analysis seeks to provide the evidence to evaluate the extent that the anecdotal and perceived changes in the traditional American Dream are actually reflected in the nation's housing market. This analysis is intended to provide new insight on the recent and expected trends in the housing market, providing some of the basis for evaluating public polices focused on both housing and urban form.

4.0 Project Approach

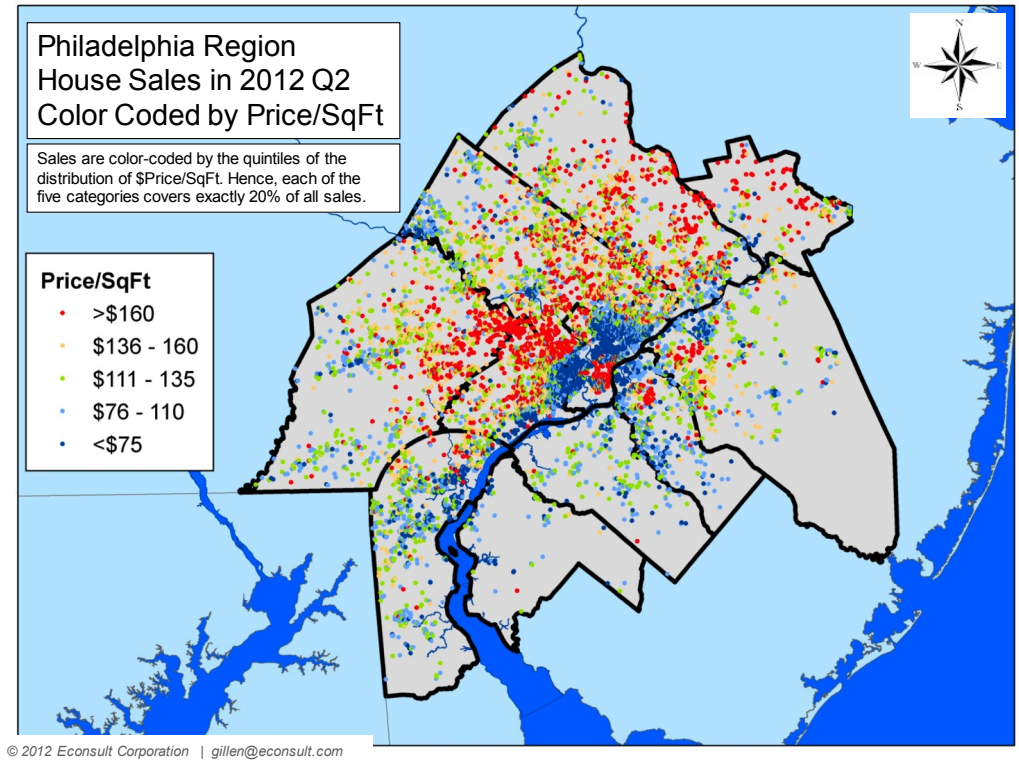
We evaluate the market performance of sustainable communities by analyzing patterns in house prices in New Urbanist-style, sustainable communities[3], and comparing patterns in those communities with patterns in conventional, lower-density, auto-oriented single-use residential developments. Using standard regression techniques, we will evaluate the paths and trajectories of house values in conventional and New Urbanist communities over time while controlling for other observable differences in housing characteristics. Our analysis is based on housing market and other data for the Philadelphia metro area; the findings of this report should be compared with future research using data from other metropolitan areas in the U.S.

5.0 Philadelphia Home Price Trends By Location

The author collected data on the universe of home sales in the region from 1980-2011. The following map shows the Philadelphia area home sales in the second quarter of 2012, color-coded by their respective quintiles of price/square foot.

- [3] We use "New Urbanist-style, sustainable communities" to define patterns of development within an urban form that take advantage of walkable densities to allow access to amenities such as transit and mixed-use districts, in contrast to the conventional postwar patterns of development that have lower density, segmentation of uses and are auto-oriented.

Figure 4. Philadelphia-area home sales in 2012 Q2



Source Kevin C. Gillen., 2012

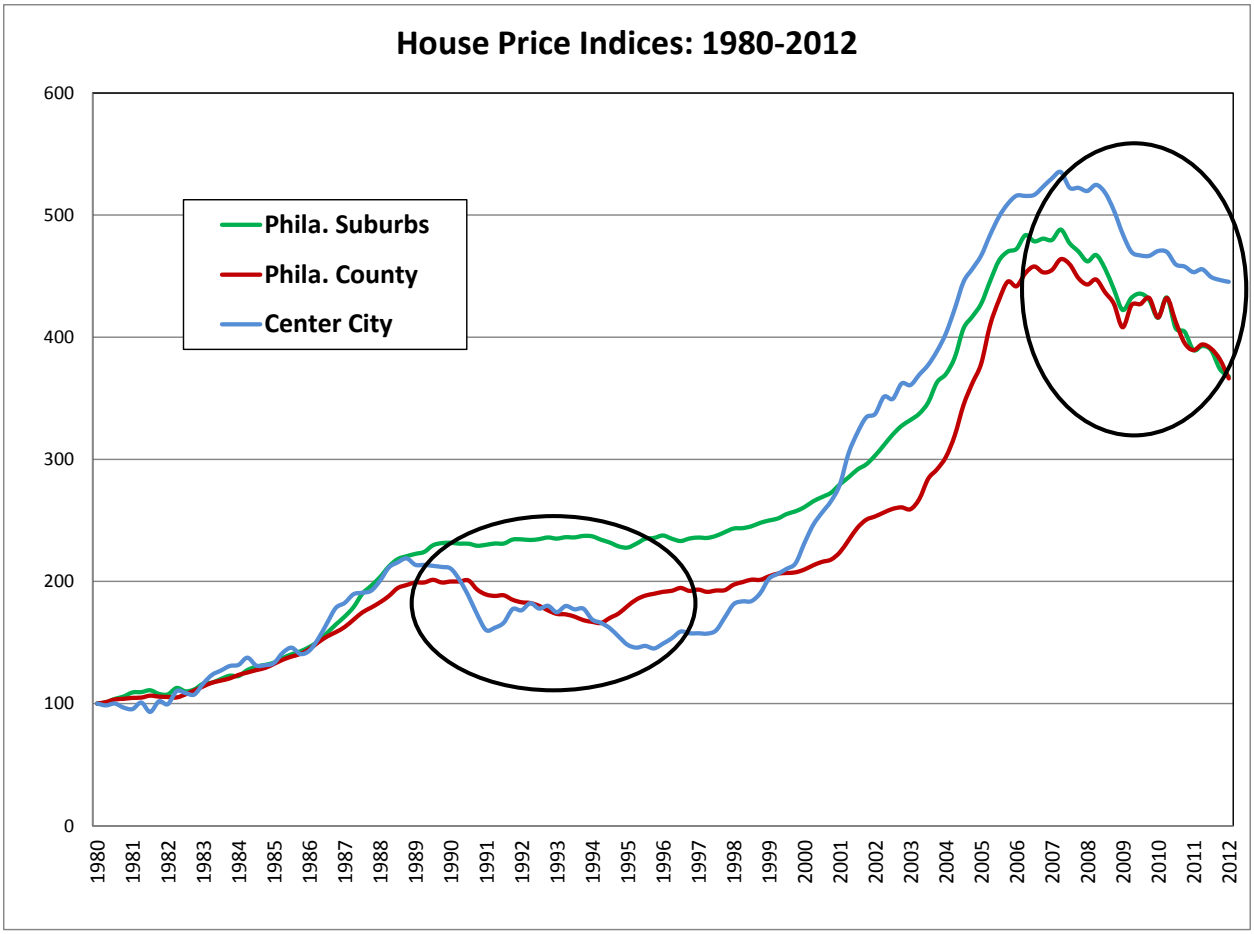
In terms of price levels, in most of the densest areas in the region—particularly the city of Philadelphia continue to have low house prices. The major exception is the region's densest area, Philadelphia downtown, or "Center City", which has very high prices. House price levels appear to be the highest in suburban communities closest to the city, but there are significant exceptions to this general statement. For example, Camden NJ to Philadelphia's immediate east and the inner-ring suburbs of Delaware County PA to Philadelphia's immediate west have among the lowest house prices in the region. Similarly, the bedroom communities of central Bucks county PA to Philadelphia's north and the suburban communities of Mercer County NJ (where Princeton is located) have among the highest house prices in the region.

The path of prices over time, however, show that the market performance of these different communities not only exhibit distinct patterns, but a change in these patterns as well. The author estimated house price indices (HPIs)[4] for three distinct geographic locales: Center City[5] Philadelphia, Philadelphia County and Philadelphia suburbs. All home sales were classified and segmented according to one of these three locations, and separate HPIs were estimated for each. The results are shown in the following figure:

[4] The indices were estimated via regression, using a hybrid hedonic specification and the universe of all home sales in the MSA during the 1980-2012 period.

[5] Center City is geographically defined as Zip Codes 19102, 19103, 19106 and 19107. They cover the approximately two square miles encompassing Philadelphia's downtown urban core, which has the highest density of both businesses and residents in both the city and region.

Figure 5: Philadelphia House Price Indices: 1980-2012

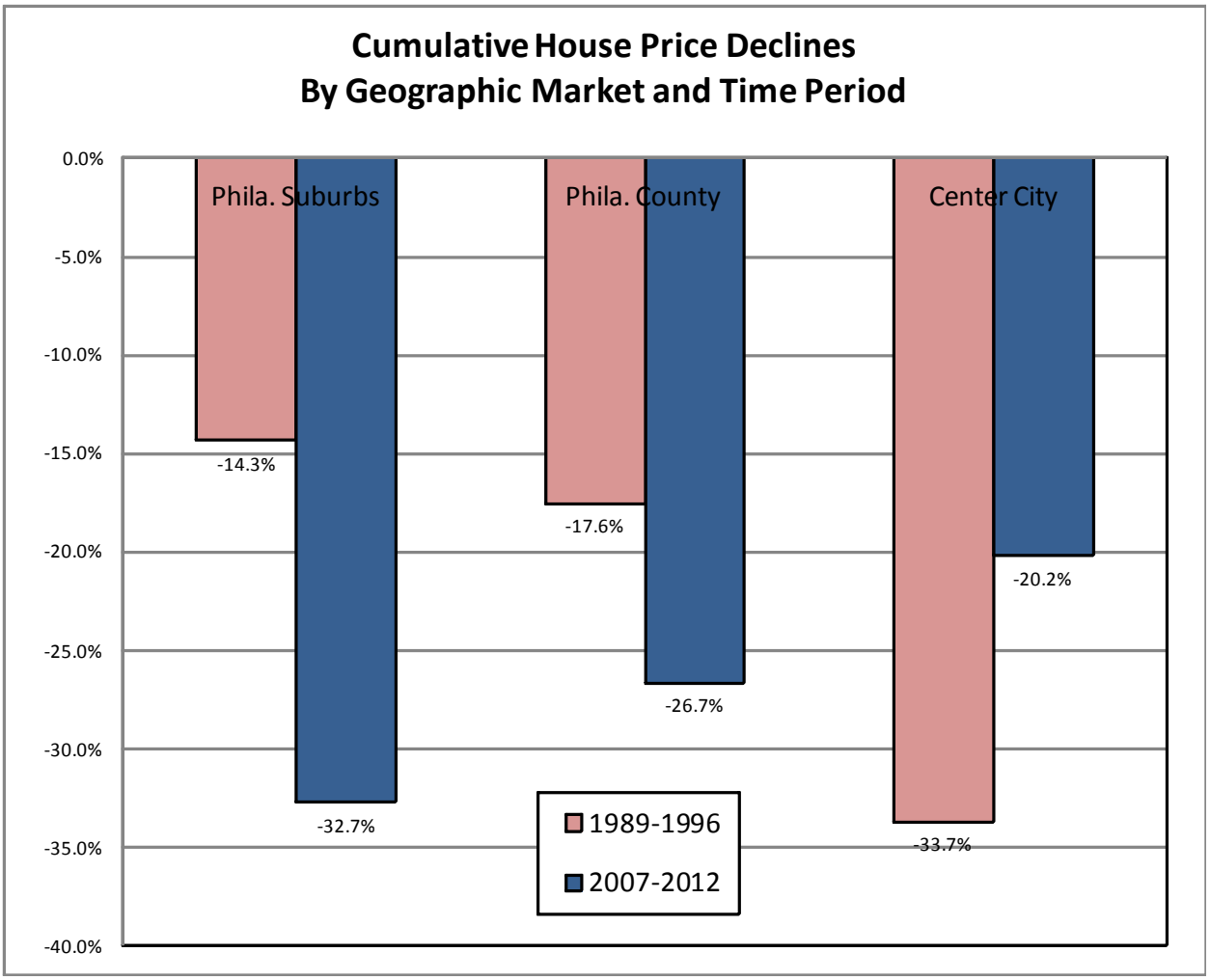


The black circles represent periods of house price deflation. Note that there are two periods of falling house prices, which are indicated by the black ovals

- 1989-1996: recession
- 2007-2012: bursting of the national housing bubble and recession

Close examination of the data reveals that the patterns of price declines across the three geographies differed significantly between these two periods. Figure 6 on the following page compares house price declines for the three geographies for these two periods. The declines are measured by the percent change in the HPIs, from peak to trough, during the periods characterized by the black ovals:

Figure 6: Philadelphia-Area House Price Declines 1989-1995 and 2007-2012



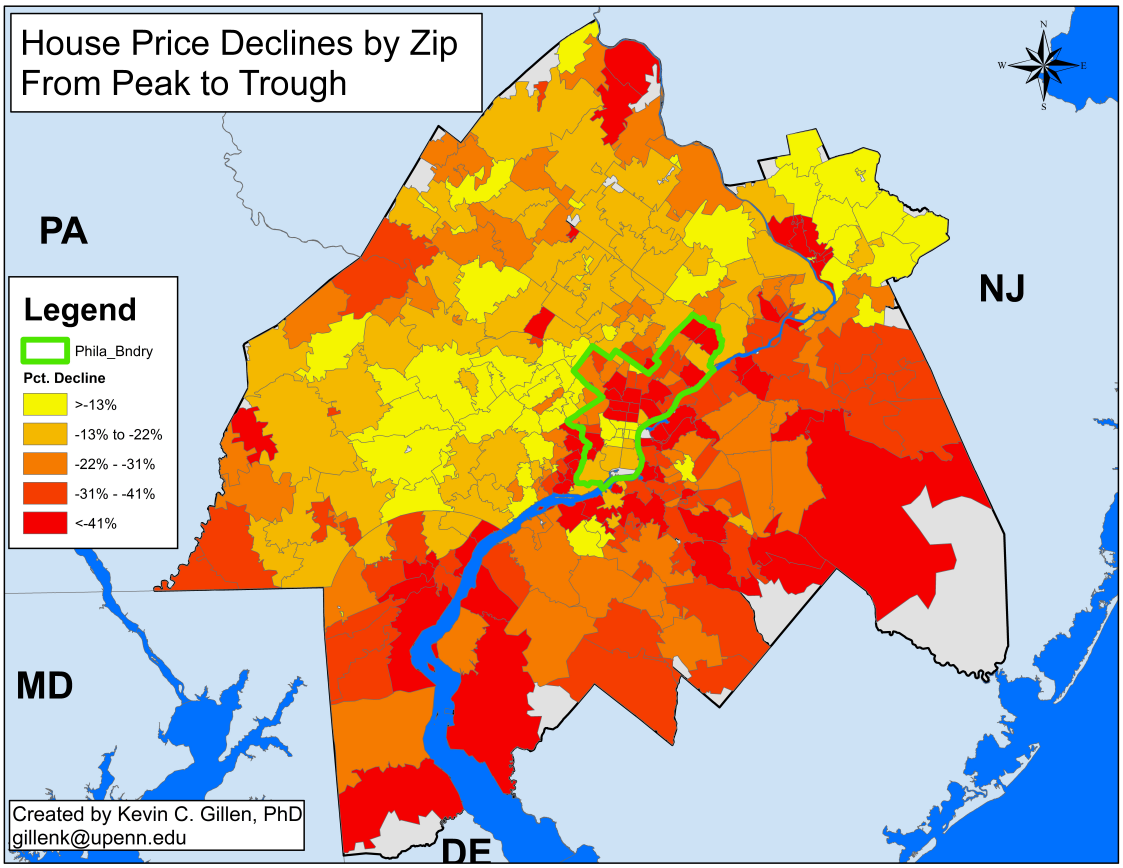
- During the first housing downturn of 1989-1996, house prices declined the greatest in the core urban center (-33.7% in Center City), second-most in the central city of Philadelphia as a whole (-17.6%) and the least in the lower-density areas the suburban counties (-14.3%).
- During the most recent housing downturn of 2007-2012, house price declines have been greatest in the relatively low-density suburbs (-32.7%), second-most in Philadelphia county (-26.7%) and the smallest in the urban core of Center City (-20.2%).

Note that from the first housing downturn to the second, the spatial pattern of house price declines reversed itself. During the first downturn, declines increased as you moved from the suburbs to the city to downtown. During the most recent downturn, price declines increased as you moved from downtown to other city neighborhoods to the suburbs. Moreover, the magnitude of house price declines in the downtown urban core of Center City is actually less during the current downturn than the previous one, despite the current downturn generally being of much greater magnitude than the previous one, at both the

national and regional level. This is especially notable when you consider that Center City had the greatest percentage increase in its housing stock during this period (i.e. new condos), which also exerts downward pressure on property values as the market has tried to absorb it. Thus, these results suggest an improved performance in urban locales and walkable, mixed-use communities during the current housing downturn.

Although this reversal of deflationary house price trends between urban and suburban locales is interesting, direct comparisons between suburban markets and city markets potentially masks a great deal of variation in housing market performance. As is evident in Figure 12, which shows a map of the Philadelphia region that color-codes each Zip code by its total decline in average house values from their peak in mid-decade, that geography cannot be the sole explanation of market performance.

Figure 7: Total Decline in House Prices, by Zip Code, in the Philadelphia Metropolitan Area



As can be visually discerned, while there does appear to be some clustering in house price declines by zip codes, the spatial pattern does not appear to be as evident at the local level as at the regional level that the previous analysis indicated. House price declines do not appear to be uniformly split between the city and its suburbs. Thus the explanation of house price declines must be a more nuanced story than simply city versus suburbs. To

explain the variation in appreciation, we take a more in-depth look at the various elements of both design and location of the different communities throughout the region.

6.0 Data on Community Characteristics

While the home price trends described above are illustrative, our goal is to more explicitly quantify and evaluate the extent to which urban form affects these trends. To address this issue, the author collected data on the characteristics of the housing stock and urban form in the region. These characteristics cover categories such as location, density, proximity to public transportation and mixture of uses. The author also collected community-level demographic and socio-economic data such as the local poverty rate and median household income to use as control variables in our analysis.

To be consistent with CNU's definition of "New Urbanism," we identified and classified these different characteristics according to CNU's definition, which defines "New Urbanist Communities" as having the following characteristics[6]:

- Livable streets arranged in compact, walkable blocks.
- A range of housing choices to serve people of diverse ages and income levels.
- Schools, stores and other nearby destinations reachable by walking, bicycling or transit service.
- An affirming, human-scaled public realm where appropriately designed buildings define and enliven streets and other public spaces.
- The following table gives the community-level characteristics of the housing stock and neighborhoods in the region, which were collected at the Zip Code level:

Based upon these definitions, we categorized each community's characteristic to one of five general "New Urbanist" categories:

- **Density:** attached v. detached homes, walkable v. auto-oriented
- **Location:** city v. suburb, town center v. auto-oriented community
- **Public Transportation:** accessible to public transportation v. auto-oriented commuting pattern
- **Socioeconomic:** poverty concentration v. mixed-income
- **Usage:** single-use v. mixed use development

The following table lists all of the characteristics, color-coded by the above New Urbanist categories:

Table 1. Color-Codes of New Urbanist Characteristics

Purple	Density
Green	Location
Orange	Public Transportation
Red	Socioeconomic
Blue	Use

[6] Source: http://www.cnu.org/who_we_are

The author also created interaction terms between variables in different categories in order to allow for the possibility, for example, that different characteristics have different effects in different locales. The following table enumerates and describes each variable, and lists its source.

Table 3. Housing and Community Characteristics in the Philadelphia Region

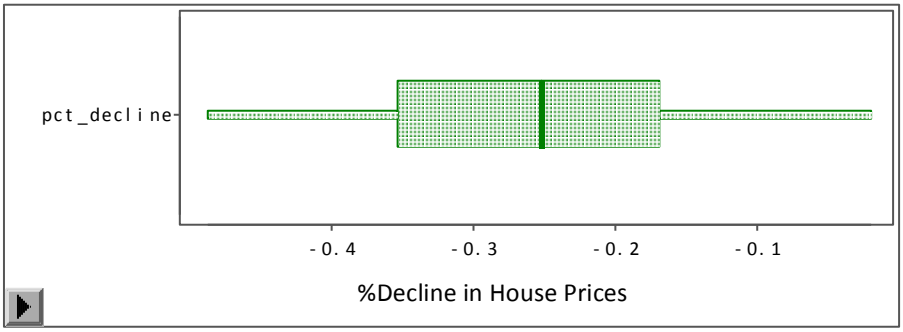
Variable	Description	Source
high_sub_density	dummy if suburban Zip is in75-100%% quartile of hhld density	calculated
mid_sub_density	dummy if suburban Zip is in 50-75% quartile of hhld density	calculated
pct_detached	percent of housing stock that is detached	Terradatum
percent_hi	percent of the land area of the zipcode in high-density residential uses	DVRPC
pop08_sqmi	the estimated population density in 2008 per square mile	ESRI
pop2008	the estimated population in 2008	ESRI
res_densit	residential addresses per square mile	Terradatum
Sqmi	the size of the zipcode in square miles	calculated
suburb_pct_detached	(1-phila_dum)*pct_detached	CENSUS
SUBURB_PERCENT_HI	(1-phila_dum)*PERCENT_HI	calculated
SUBURB_POP08_SQMI	(1-phila_dum)*POP08_SQMI	calculated
SUBURB_RES_DENSIT	(1-phila_dum)*RES_DENSIT	calculated
dist_cbd_mi	philadelph/5280	calculated
dist_cbd_sq	dist_cbd_mi squared	calculated
dist_interact	dist_cbd_mi*dist_sec_cbd_mi	calculated
dist_sec_cbd_mi	sec_cbd_ds/5280	calculated
dist_sec_cbd_sq	dist_sec_cbd_mi squared	calculated
Downtown	dummy if Zip is in Center City	calculated
phila_dum	dummy if Zip is in Philadelphia county	calculated
Philadelph	distance to the Philadelphia CBD	calculated
sec_cbd_ds	distance to the closest secondary CBD	calculated
sec_cbd_na	name of the closest secondary CBD	calculated
suburb_dist_cbd	(1-phila_dum)*dist_cbd_mi	calculated
suburban_town_center	dummy if Zip contains a suburban town center; e.g. West Chester	Sales data
bus_stops	number of bus stops in the zipcode	SEPTA and NJ Transit
city_substops	phila_dum*rail_stops	calculated
percent_al	percent of the land area of the zipcode within .25 miles of any transit stop	calculated
percent_bu	percent of the land area of the zipcode within .25 miles of a bus stop	calculated

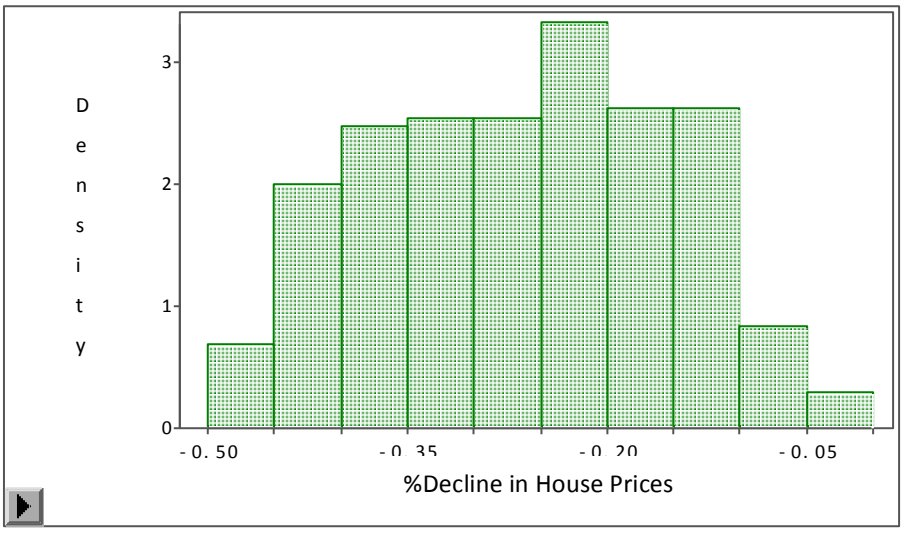
percent_ra	percent of the land area of the zipcode within .25 miles of a commuter rail stop	calculated
percent_su	percent of the land area of the zipcode within .25 miles of a subway stop	calculated
rail_stops	number of commuter rail stops in the zip code	SEPTA and NJ Transit
sub_stops	number of subway stops in the zipcode	SEPTA and NJ Transit
suburb_busstops	(1-phila_dum)*bus_stops;	calculated
suburb_rail	(1-phila_dum)*percent_ra	calculated
suburb_railstops	(1-phila_dum)*rail_stops	calculated
total_tran	number of total bus, commuter rail, and subway stops in the zipcode	SEPTA and NJ Transit
low_inc	dummy=1 if tract households are majority low-income households	CENSUS
low_inc_city	=phila_dum*low_inc	calculated
low_inc_suburb	=(1-phila_dum)*low_inc	calculated
med_hinc	median hhld income	CENSUS
pct_vac	(vacant_res+vacant_bus+vacant_oth)/total_othe	calculated
percent_po	percent hhlds below poverty line	CENSUS
vacant_bus	number of vacant business addresses	USPS
vacant_oth	number of vacant other addressess	USPS
vacant_res	number of vacant residential addresses	USPS
bus_other_	number of business and other addresess combined	calculated
bus_other_	business and other addresses per square mile	calculated
mix_ratio1	tot_res_ad/tot_bus_ad	ESRI
mix_ratio2	percent_re/percent_co	calculated
mixed1	dummy=1 if in interquartile range of mix_ratio1	calculated
mixed2	dummy=1 if in interquartile range of mix_ratio2	calculated
pct_bus	tot_bus_ad/total_othe	ESRI
pct_res	tot_res_ad/total_othe	ESRI
percent_co	percent of the land area of the zipcode in commercial uses	DVRPC
percent_pu	percent of the land area of the zipcode in public uses	DVRPC
percent_re	percent of the land area of the zipcode in single-family residential uses	DVRPC
SUBURB_BUS_OTHER0	(1-phila_dum)*BUS_OTHER0;	calculated
suburb_mixed1	=(1-phila_dum)*mixed1	calculated
suburb_mixed2	=(1-phila_dum)*mixed2	calculated
suburb_mixratio1	=(1-phila_dum)*mix_ratio1	calculated
suburb_mixratio2	=(1-phila_dum)*mix_ratio2	calculated
tot_bus_ad	number of total business addresses	USPS
tot_res_ad	number of total residential addresses	USPS
total_othe	number of total other addresses	USPS

7.0 House Price Changes by Location, Density and Design

We now expand the scope of the analysis to include additional attributes of the housing stock as possible correlates of housing market performance. We do this via regression, where the dependent variable is the total percent change in house prices from peak to trough. This was computed at the Zip Code level, where we estimated a hedonic HPI for each Zip code in the metropolitan area, using each dwelling's physical characteristics as control variables. The author then computed the total percent change in each HPI from its most recent peak (typically, in mid-2007) to its trough (typically, in early 2012). Figure 8 shows the distribution of house price changes across all 340 Zips codes for which we had a sufficient number of home sales to estimate an HPI:

Figure 8. House Price Changes from Peak to 2011Q2, Across Zips





As can be visually observed, no Zip code has experienced positive appreciation since the regional and national housing market began its downturn in the latter half of the most recent decade. But, the variation in HPI declines is significant, ranging from a maximum of

-49% (Wilmington, DE) to -1.9% (Center City, Philadelphia). To further describe this variation in regional house price declines, the following tables provide some summary stats on this distribution:

Table 3. Summary Statistics of House Price Changes

HPI Declines

Percentile	%Decline
Max.	-48.8%
90%	-42.2%
75%	-35.4%
Mean	-26.0%
50% Median	-25.3%
25%	-17.0%
10%	-11.4%
Min.	-1.9%

As the tables indicate, the median decline in house prices at the Zip level is 25.3% with a mean of -26%. 25% of Zips experienced HPI declines greater than 35.4%, while, at the other extreme, 25% of Zips experienced HPI declines of less than 17%.

To identify what might explain this substantial variation in house price declines across communities, the author regressed the Zip-level changes in the HPI on the variables in Table 1, using an iterative, stepwise procedure to identify those variables that had the greatest explanatory power. Since all Zips had an HPI change that was less than or equal to Zero, the author used the absolute value of the HPI change as the dependent variable. Hence, positively signed coefficients indicate characteristics associated with greater house price declines while negatively signed variables indicate characteristics associated with relatively smaller house price declines. The results of this regression are given in Table 5.

Table 4. Regression Results

DepVar=|%Decline in HPI|
N=340, Adj. R-Sq.=0.76

Variable	Description	Est. Coeff.	t-value
Intercept	Intercept	0.63868	10.32
med_hinc	median household income	-0.00000184	-3.58
low_inc_city	low-income city Zip	0.17827	3.63
low_inc_suburb	low-income suburban Zip	0.03002	0.54
pct_vac	housing vacancy rate	0.02006	3.78
downtown	Center City Zip	-0.09615	-10.1
suburban_town_center1	Located in suburban town ctr.	-0.08387	-3.8
dist_cbd_mi	Distance to Phila. CBD	0.01348	1.95

dist_cbd_sq	Distance to Phila. CBD Squared	0.00027113	3.36
suburb_dist_cbd	=(1-phila_dum)*dist_cbd_mi	0.02979	4.98
sec_cbd_ds	Distance to suburban town ctr.	0.0000011	2.68
suburb_percent_hi	Pct. High Density in Suburb	-0.12944	-2.44
suburb_pop_sqmi	Suburban Population/SqMi	-0.00002874	-3.23
percent_hi	Percent of Zip high-density residential	-0.20213	-1.91
suburb_pct_detached	Pct. Of Suburban Zip that are Detached Homes	0.10794	2.19
percent_re	Percent of Zip Residential	0.44432	6.94
mixed1	Dummy=1 if Mixed-Use Zip	-0.06642	-1.86
suburb_mixed1	Dummy=1 if Suburban Mixed-Use Zip	-0.06849	-1.87
suburb_bus_oth0	(1-phila_dum)*BUS_OTHER0	-0.00009691	-1.99
suburb_busstops	# of Bus Stops in Suburban Zip	-0.00055682	-3.73
suburb_rail	# of rail stops in Suburban Zip	-0.09214	-2.05
city_substops	# of subway stops in City Zip	-0.00583	-3.61

All variables, with the exception of median household income, are significant at the 5% or 10% level; the standard threshold for "statistical significance". The R-squared indicates that 76% (out of a possible 100%) of the regional variation in house price declines are explained by the location, design and socio-economic characteristics of the individual communities. The estimated coefficient in the regression gives the average change in percentage points of house price declines, given a unit increase in that characteristic.

For example, the coefficient on a Zip's vacancy rate is 0.02006. This implies that each percentage point increase in a community's vacancy rate is associated with slightly more than a two percentage point increase in that community's average house price declines. Since the average Zip-level house price decline was 26%, then a Zip code that had a vacancy rate that was one percentage point higher than the region's average was likely to have an average house price decline of 28% (=26%+2%).

The full set of results are interpreted as follows. They are listed in the same order as the variables in Table 5:

- Every $1 increase in a Zip's median household income is associated with a -0.00018% decrease in the magnitude of house price declines.
- A city Zip code with a majority low-income population is associated with a 19.5% increase in the magnitude of house price declines.
- A suburban Zip code with a majority low-income population is associated with a 3.05% increase in the magnitude of house price declines.

- Every 1% increase in a Zip's vacancy rate is associated with a 2.006% increase in the magnitude of house price declines.
- Being located in Center City, Philadelphia is associated with a 9.17% decrease in the magnitude of house price declines.
- Being located in a walkable town center in the suburbs is associated with an 8.05% decrease in the magnitude of house price declines.
- Every mile further that any Zip is located from Center City, Philadelphia is associated with a 1.4% increase in the magnitude of house price declines[7].
- Every mile further that a suburban Zip is located from Center City, Philadelphia is associated with an additional 3.0% increase in the magnitude of house price declines[8].
- Every mile further that a suburban Zip is located from a suburban town center is associated with an additional 0.00011% increase in the magnitude of house price declines[9].
- Every 1-person increase in a Zip's population density is associated with a -0.00287% decrease in the magnitude of house price declines.
- Being a relatively high-density community in the suburbs is associated with a 20.2% decrease in the magnitude of house price declines.
- Every 1% increase in the percent of a Zip's building stock that is classified as "residential" is associated with a 70.4% increase in the magnitude of house price declines[10].
- Every 1% increase in the percent of a Zip's housing stock that is classified as "detached" (as opposed to "attached") is associated with a 10.8% increase in the magnitude of house price declines.
- Being a Zip code that contains a balanced mix of both residential and commercial properties is associated with a 6.4% decrease in the magnitude of house price declines.
- Being a suburban Zip code that contains a balanced mix of both residential and commercial properties (i.e. "mixed use" is associated with an additional 6.6% decrease in the magnitude of house price declines.
- Every additional business (per square mile) that a Zip code has is associated with a 0.01% decrease in the magnitude of house price declines.
- Every additional bus stop in a suburban Zip code is associated with a 0.06% decrease in the magnitude of house price declines.
- Every additional commuter rail stop in a suburban Zip code is associated with a 9.2% decrease in the magnitude of house price declines.

[7] This is computed by combining the coefficients on distance and distance-squared. The squared term is in the regression to capture the apparent non-linearity of the relationship.

[8] So, for example, if two different Zip codes are both 1 mile from Center City, but one is located in Philadelphia while the other is located outside of Philadelphia, the decline in the suburban Zip is on average 4.4% (=1.4% + 3.0%) greater than Zips in Center City, Philadelphia.

[9] So, for example, if two different Zip codes are both 1 mile from Center City, but one is located in Philadelphia while the other is located outside of Philadelphia, the decline in the suburban Zip is on average 4.4% (=1.4% + 3.0%) greater than Zips in Center City, Philadelphia.

[10] The author recognizes this is an implausibly large effect and future versions of this paper will work to identify its cause.

- Every additional subway stop in a city Zip code is associated with a 0.6% decrease in the magnitude of house price declines.

So, in summary, house prices declined less in areas that:

- have fewer households living below poverty,
- have lower vacancy rates,
- are located in the downtown of the central city,
- are closer to the central city,
- are either a suburban town centers or are closer to suburban town centers,
- are suburbs with relatively higher densities and have attached homes,
- have a balanced mix of both residential and commercial uses,
- have relatively more businesses,
- are suburbs with relatively larger numbers of rail and bus stops,
- are city neighborhoods with subway stops.

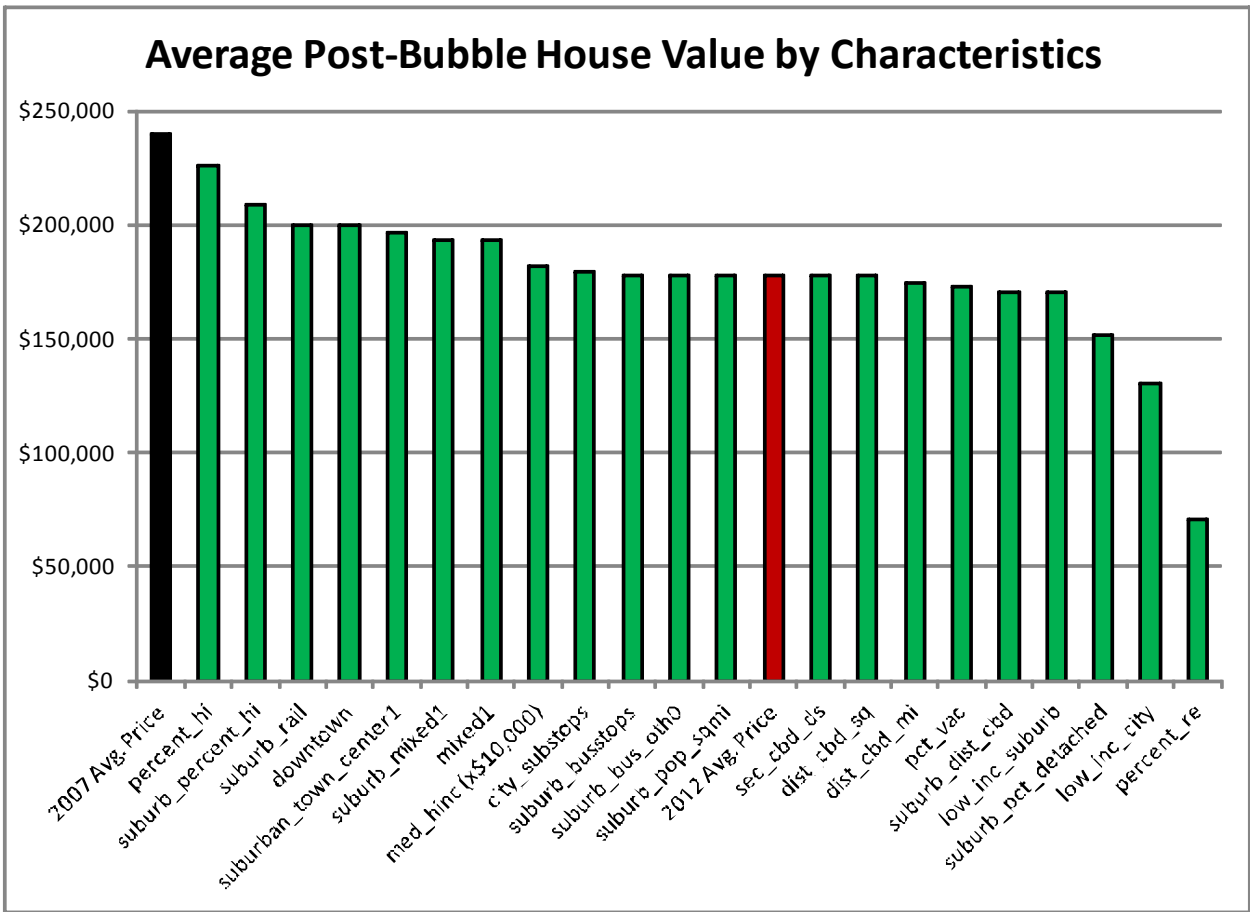
Since almost all of these characteristics are consistent with New Urbanist principles, the empirical evidence indicates that communities and neighborhoods with New Urbanist characteristics have generally held their value better during the most recent housing downturn.

Lastly, in order to scale these results into dollar terms, we compute what the average post-bubble house value would be for the average home with these different characteristics. We do this by applying the above estimated coefficients to the mean pre-bubble house price and the mean post-bubble house price decline. According to the data, the average house price in the Philadelphia region at the market's peak in 2007 was $240,000. By the market's trough in 2012, the average house had fallen in value by 26%. This yields an average post-bubble value of $177,600.

But, if, for example, a home is in a city Zip code that has a balanced mix of both residential and commercial dwellings, then it has typically declined by only 19.6% (=26%-6.4%). So, if this dwelling started out as having being worth $240,000 in 2007, then at the market's trough it is worth $193,023, which is higher than average home now valued at $177,600. It has only lost $46,977 of its value as opposed to the loss in value of $62,400 for the typical regional home; a relative gain of $15,423.

We repeat this exercise for all of the characteristics quantified in the regression in order to compute the typical post-bubble value for a home with these differing characteristics. The results are presented in the following chart, ranked from highest value to least, from left to right.

Figure 9. Average Post-Bubble House Value, by New Urbanist Characteristic



The black bar on the left represents the value of the average home in the region, pre-bubble: $240,000. All of the bars to the right represent post-bubble values, so they are all naturally lower than the black bar since all homes experienced some devaluation. The red bar represent the average devaluation to $177,600. Bars to the right of that represent homes whose devaluation exceeded the region's average, while bars to the left of represent homes whose devaluation was smaller than the region's average.

The dwellings that best held their value were located in high-density residential neighborhoods. Their average post-bubble value was $226,111. Similarly, homes in mixed-use, walkable, relatively higher-density neighborhoods and communities with access to public transportation retained relatively more of their value during the bust. They were worth an average of $192,624 by the time the market hit its bottom in 2012.

By contrast, the dwellings that lost the most of their value were in areas that had a high degree of residential-only development and a high percentage of detached homes. Their average post-bubble value was $111,329, which is significantly less than either the regional

average or homes in communities with New Urbanist characteristics. Further examination of these homes revealed them to be disproportionately exurban communities located far from the city and with little to no public transportation options. In general, homes in communities without New Urbanist characteristics were worth an average of $155,160 by the time the market hit its bottom in 2012.

8.0 Summary and Conclusion

This report was commissioned by the Congress for New Urbanism to analyze if variation in urban form and composition is correlated with the relative performance of local residential markets during the recent and unprecedented downturn in the U.S. housing market. In particular, this report analyzed if different magnitudes in house price declines were associated with varying characteristics of New Urbanist principles: walkability, central location, density, mixture of uses and access to public transportation. Using comprehensive data on Zip-level house price declines in the Philadelphia metro area from the market's peak in 2007 to its trough in 2012, the following main results were identified:

- Being located in Center City, Philadelphia is associated with a 9.17% decrease in the magnitude of house price declines.
- Being located in a walkable town center in the suburbs is associated with an 8.05% decrease in the magnitude of house price declines.
- Every mile further that any Zip is located from Center City, Philadelphia is associated with a 1.4% increase in the magnitude of house price declines.
- Every mile further that a suburban Zip is located from Center City, Philadelphia is associated with an additional 3.0% increase in the magnitude of house price declines.

In general, we attribute these results to the following conditions that have prevailed during this most recent downturn that did not prevail during previous ones: First, energy costs were significantly higher during this recent downturn, thus making long commutes in a car and heating and cooling a larger suburban home relatively more expensive. Second, many downtown areas and urban neighborhoods have experienced a significant revitalization in the past twenty years due to investments in public services by these municipalities that have resulted in an improved quality of life; e.g. better policing, business improvement districts, etc. Lastly, there appears to have been a shift in consumer preferences towards a renewed desire and interest in urban living by many younger and older households.

In conclusion, this report provides evidence that not only is the magnitude of the recent housing downturn unique, but its structure is as well. In past downturns, homes in conventional, low-density, single-use, auto-oriented suburban developments held their value relatively better. During the current downturn, however, it has been dwellings located in an urban form that takes advantage of walkable densities to allow access to amenities such as transit and mixed-use districts that have exhibited greater price stability. The Philadelphia story thus seems to demonstrate that communities with center city locations, mixtures of usage and suburban rail-served town centers out perform sprawl.

This is also consistent with much of the other recent research, and is also consistent with the results that Chris Leinberger found in the District of Columbia.

About the Author

Kevin C. Gillen Ph.D. is an economist who holds a position as a Senior Research Consultant with the University of Pennsylvania's Fels Institute of Government. With a background in urban economics and real estate finance, Dr. Gillen's research is concentrated in applied work in the analysis of real estate developments and operation of real estate markets, including their fiscal, economic and financial implications.

His research has been cited in the *Wall St. Journal, New York Times, Philadelphia Inquirer, Philadelphia Daily News* and *Philadelphia Magazine.* He has testified multiple times on matters of real estate markets and public policy to Philadelphia City Council, the Pennsylvania State Legislature and the U.S. Congress.

Dr. Gillen received his Ph.D. in Applied Economics in 2005 from the Wharton School of the University of Pennsylvania, and received both the U.S. Department of Housing and Urban Development Dissertation Award and Lincoln Land Institute Dissertation Fellowship. His research in urban economics appears in numerous publications and is cited in various policy applications, and his quarterly reports on the current state of the Philadelphia region's real estate markets receive substantial local attention.

The Philadelphia Inquirer has described him as "*the foremost expert on property values in the Philadelphia region*[11]" and "*an economist who has brought order and credibility to housing data over the last several years as a neutral, not an industry, source*[12]."

Dr. Gillen also serves as a board member of the Building Industry Association of Philadelphia, the Pennsylvania Builders' Association and the Greater Philadelphia Association of Realtors. Prior to attending Wharton, Dr. Gillen worked for the Federal Reserve Board of Governors and HUD's Federal Housing Finance Agency (FHFA). He is currently a Senior Research Consulatant with the Fels Institute of Government at the University of Pennsylvania. This report was begun when he was with his previous employer, Econsult Corp., an economics consulting firm based in Philadelphia, Pennsylvania.

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Cover Photo: Courtesy Genvessel, via Flickr

[11] "Few Delinquent Properties Worth Less Than Tax Debt", Philadelphia Inquirer, 8/14/2011.

[12] "Trying a different tack on home-price survey", Philadelphia Inquirer, 10/16/2011.