THE IMPACT OF RACIAL SEGREGATION, INCOME SORTING AND RISK-
BASED MORTGAGE PRICING ON HOUSING WEALTH INEQUALITY: A
COMPARISON BETWEEN URBAN REGIONS IN THE UNITED STATES

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The Impact of Racial Segregation, Income Sorting and Risk-Based Mortgage Pricing on Housing Wealth Inequality: A Comparison Between Urban Regions in The United States

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Ia muamua ane lava se fale.

First of all, a house.

Samoan proverb

I would like to dedicate this work to my mother, Roreta Lee, who inspired me with her love of reading. She never took the concepts of money or private property for granted, having grown up in a nation where neither were deeply established, leading me to question their workings from a young age. And to my father, Robert Raymond, who brought me along on his travels, filled my childhood with impromptu architectural tours, and taught me to consider the built environment as I made sense of the world.

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American Housing Survey data (AHS)

Annual Percentage Rate (APR)

Community Development Blog Grant (CDBG)

Community Development Finance Institutions Fund (CDFI)

Core Based Statistical Area (CBSA)

Equifax Credit Risk Insight Servicing McDash Data (includes link to data from McDash Analytics, LLC, a wholly owned subsidiary of Black Knight Financial Services) (CRISM)

Federal Reserve Bank of New York's Consumer Credit Panel/Equifax Data (FRB CCP)

Herfindahl-Hirschman Index (H)

Home Affordable Refinance Program (HARP)

HOME Investment Partnerships Program (HOME)

Housing Wealth Inequality (HWI)

Lender Processing Services (LPS)

Metropolitan Statistical Area (MSA)

Multi-City Study of Urban Inequality (MCSUI)

Panel Survey of Income Dynamics (PSID)

Quantitative Easing (QE)

Half the Squared Coefficient of Variation (GE2)

Summary

Housing wealth is the cornerstone of U.S. households' balance sheets and the largest store of wealth in the United States. This research examines rising housing wealth inequality between 2005 and 2015 in an urban context. The literature suggests that rising income inequality, rising income segregation, or racial segregation could be a cause. Other research highlights the role of mortgage lending in generating inequality. The subprime and foreclosure crises have a well-documented association with housing inequality. Research also highlights risk-based mortgage pricing more generally as a mechanism for widening inequality.

I first examine the drivers of urban housing wealth inequality with a cross-sectional regression analysis in 2000-2005. I examine how income and racial segregation affect housing wealth inequality between cities prior to the crisis, and find that income inequality is weakly correlated with housing wealth inequality, but income and racial segregation have strong effects. Then, I examine how changes in segregation explain rising housing wealth inequality during the real estate and financial crises of the 2000s, or if mortgage market factors explain the rise. I find that changes in income inequality lead to higher housing wealth inequality; that rises in Black racial segregation again explain much of the increase, and that subprime lending does not fully account for that effect. Finally, I use individual level data in a series of quantile regressions to understand the drivers of housing wealth inequality during the housing market recovery years of 2010-2015. I find that risk-based mortgage pricing and income segregation significantly

interact to produce significant and meaningfully large increases in housing wealth inequality over a 5-year period, from 2010-2015.

In Chapter 5, I briefly discuss the ramifications for national housing finance reform, as well as for state and local mortgage programs and policies like inclusionary/exclusionary zoning. The current administration has put housing finance reform at the top of its agenda. Many proposals suggest partial or complete privatization of the government sponsored enterprises (GSE)s, which would lead to increase in risk-based pricing and market segmentation. Additionally, reform could disrupt GSE subsidization of state and local mortgage revenue bond programs. State and local actors should seek to preserve these capacities through the budgetary process and housing finance reform; and scale up local programs to guarantee mortgages and provide down payment assistance where possible. Cities should weigh carefully the costs of exclusionary zoning not only on income segregation, but on widening wealth inequality within their region.

This dissertation contributes to the literature by situating the phenomenon of rising housing wealth inequality in a spatial context and describing the impact of individual, neighborhood, and regional characteristics on the production of housing wealth inequality. I also tie these results to policy remedies at the national and local levels.

Chapter 1: Introduction

Wealth inequality is growing in the United States. Three decades of eroding middle class wealth – in particular, housing wealth - is a key factor (Saez & Zucman, 2014). The magnitude of housing wealth as an asset class is such that changes in the distribution of housing wealth has the power to drive overall wealth inequality. Housing wealth – the difference between the current market value and the outstanding debt against one's home - constitutes over half of household balance sheets. As of 2014 Q4 Flow of Funds data, U.S. housing wealth stands at 11.25 trillion, roughly 64% of GDP.

Recently, housing wealth has become much more unequal. The richest 20% now have nine times the home equity of the middle 20%. Thirty years ago that ratio was five to one (A. Mian & Sufi, 2014). As of 2010, 60% of housing equity was held by the top quartile of the income distribution, compared to 6% held by the bottom quartile (S. J. Smith & Searle, 2010). This upward trend began in 1995.

Because the dynamics of wealth accumulation are thought to lead to a higher degree of concentration than the dynamics of income, the ratio between returns to wealth and returns to income govern overall economic inequality (Piketty & Goldhammer, 2014). Returns to wealth have begun to outpace returns to income in the current era; preliminary research suggests that housing appears to be the primary driver of this growing gap (Rognlie, 2014). As a key component of the nation's finances and of

households' wealth accumulation strategy, growing inequality in housing wealth is increasing overall economic inequality (Rognlie, 2014).

What is housing wealth? Housing wealth is the difference between the current market value of a home and any debt against that asset. Because housing is the largest purchase most households make, often the only leveraged asset, and for many, the only investment of any kind, housing wealth forms the majority of household portfolios. There are multiple ways in which homeownership helps families build home equity. Regular mortgage payments create a forced savings effect. Housing debt and capital gains are tax advantaged. When land prices are increasing, homeownership allows households to avoid rental increases and capture the benefits of rising land prices. Housing is a leveraged investment, meaning that the return on the down payment can be quite large, particularly in an environment where mortgage rates are subsidized. Conversely, in non-recourse states, where lenders' only avenue to resolving delinquent loans is foreclosure, regardless of whether the debt outstanding exceeds the value of the home, the borrowers' downside risk is limited. That is, families can only lose what they initially ventured. Finally, housing allows homeowners to convert effort expended on home improvements – "sweat equity" – into financial equity.

Housing wealth is a financial concept, but the dynamics of housing wealth accumulation are not governed solely by financial and economic concerns. Social facts dominate the distribution of housing wealth and the performance of housing as an asset. Racial minorities tend to have less wealth than White households and to hold less of that wealth in stocks and more in housing. Prior to 2005, homes formed 44% of median White

households net worth and 56% of net worth for Black households (Flippen, 2004). This differential exposure to housing wealth has the potential to generate converging fortunes in the wealth position of these groups. If home prices were to rise equally for all homeowners (and at a faster rate than other sorts of investments), groups with higher exposure to housing would accumulate wealth at a faster rate than groups with less exposure. However, research into the housing wealth gap between Black and White households show it has been growing, not closing. A recent NAACP study uses Oaxaca decomposition and the Survey of Consumer Finances data to determine that, in the current era, while years of White homeownership contribute positively to household wealth, Black households have not had the same ability to grow home equity over time. Years of homeownership were responsible for over 25% of the racial wealth gap, while income accounted for just 20%; education and gifts accounted for 5% apiece (Shapiro, Meschede, & Osoro, 2013). Other research cites divergent returns to homeownership as the number one contributor to the growing wealth gap between White and Black families (Oliver & Shapiro, 2006; Taylor, Kochhar, Fry, Velasco, & Motel, 2011).

This research is motivated by the theoretical framework of financialization, which relies on institutionalist or political economy approaches. Financialization theory asserts that the last half century has been defined by the increasing importance of financial firms, the importance of financial processes, and accelerated financial deepening. Financialization scholars find that financial deepening will be accompanied by widening inequality (Arrighi, 1994; Krippner, 2005). The financialization of housing markets has focused

particularly on the practice of risk-based pricing as a factor which might amplify inequality (Aalbers, 2008).

Home equity - the degree to which people actually own their homes, as opposed to effectively renting them from lenders, has significance for those interested in determining the class orientation of homeowners. Marxist political economy tends to collapse homeowners into rentiers and renters. In the second case, the financial terms of homeownership are such that accumulation is not possible. Due to predatory lending, slumlords have been replaced by bankers; mortgagors find themselves in the position of renters, who pay rent to the bank and are not able to accumulate wealth through their investment. In this view, housing provides the illusion of property ownership, channeling working class aspirations towards capitalism without providing material benefits. (E Wyly, Hammel, & Atia, 2004; Elvin Wyly, Moos, Hammel, & Kabahizi, 2009). Recently, financialization scholars have argued that the infrastructure of mortgage markets has shifted away from facilitating individual homeownership and towards facilitating corporate profits. If the 1920s and 1930s saw the creation of institutions to enable widespread middle class homeownership, the 1970s onwards saw these institutions repurposed to enable the corporate ownership of bundles of homes, nominally to provide liquidity to the primary mortgage market (Aalbers, 2008; Immergluck, 2011; Krippner, 2005; Levitin, 2013). A shift in the architecture of homeownership and mortgage finance should have ramifications for the distribution of housing wealth and inequality, though our understanding of how this plays out is still unfolding (Carruthers & Kim, 2011).

The institutionalist view emphasizes that homeownership provides the middle class with real opportunities for accumulation. This opportunity is sufficient for class formation, thereby providing a set of material interests which are distinct from rentiers and renters. Housing is viewed as property, a source of accumulation, but also a commodity which owner-occupiers use and consume (Thorns, 1981). Tracing back to Weber, this approach analyzes how the institutional framework of homeownership in this country allocates housing wealth by place, race, and class, and how housing and mortgage markets contribute to the material basis for the formation of conflicting political interests. For example, if one racial group is systematically able to benefit from housing as an investment, while another is not, this uneven set of opportunities could pit the two groups against one another in a political competition for control of urban space. This institutional framework places the potential for accumulation at the center of questions of class formation. How is housing wealth allocated? Who is allowed to benefit, and how have recent institutional shifts altered the distribution of home equity (Aalbers, 2008; G. Dymski, Hernandez, & Mohanty, 2013; Fox O'mahony & Overton, 2014; Thorns, 1981)?

The current institutional framework for housing in the United States was formed over the course of the twentieth century. There are three distinct policy eras which structured housing wealth accumulation in the United States. The first era stretches from the New Deal to the 1970s as the federal government worked to promote homeownership, particularly in newly constructed suburbs. The second era stretches from the 1970s to the 1990s. During this time, Fair Housing legislation reduced formal supports for segregation and ended policies which excluded racial minorities from mortgage markets. In the

1990s, deregulation and technological change prompted the shift from credit rationing to risk-based pricing and the rise of subprime lending and private label securitization. These changes restructured mortgage finance, culminating in the real estate and financial crises of the 2000s and the housing market slump that has persisted through the 2010s.

Following the widespread foreclosures of the Great Depression, a series of mortgage institutions were created to reshape mortgage markets. These institutions extended the benefits of homeownership to a wider audience and provided stable pathways for low and middle class families to accumulate housing wealth. Beginning in 1930, the Federal Home Loan Banks provided a conduit from capital rich urban areas to the local network of Building and Loans (B&Ls) responsible for lending to prospective homeowners. Federal Housing Administration mortgage insurance created a standardized mortgage product with characteristics appealing to both borrowers and lenders. Borrowers benefited from the predictable, low, fixed payments of the 30-year fixed rate loan. Lenders benefited from a reduction in lending costs as mortgages were consolidated into one popular product, and federally subsidized insurance reduced lenders' exposure to risky borrowers. Federal Housing Authority (FHA) insurance was complemented with the creation of the Federal National Mortgage Association (FNMA) four years later. FNMA purchased FHA insured loans from banks and other lenders, further capitalizing mortgage lenders. These interventions, alongside others – the creation of the Veterans Administration lending program, FNMA's partner institution, the Federal Home Loan Mortgage Corporation (FHLMC), and the Government National Mortgage Association (GNMA) which initiated mortgage securitization – resulted in a rise in the

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homeownership rate from 48% in 1930 to 65% in the late 1970s. Government efforts to expand homeownership to moderate income households are fixtures in the U.S. housing and mortgage markets. FHA insures roughly 15% of mortgages (FHA, 2012). Leading up to the crisis, FNMA and FHLMC combined hold or have securitized roughly 40% of the market, and that share has grown to nearly 50% since (FHFA, 2014; Immergluck, 2011; Squires, 1992).

Unfortunately, while these institutions were effective in expanding the benefits of homeownership to moderate income households, racial exclusion was widespread in policy design. Redlining, which prevented lending in majority-minority neighborhoods in the inner city, was introduced with the Home Owners Loan Corporation in the 1930s, and was continued with FHA insurance and VA mortgage products through the 1970s. These programs amplified White flight and the suburbanization of middle income, White households (Jackson, 1985; Kruse, 2013; Sharkey, 2013). The result of practices like redlining were broad racial disparities in homeownership, housing wealth, and neighborhood well-being. Researchers and activists advocated for equal treatment in housing and fair access to credit, arguing this would provide a pathway to greater economic equality, among other benefits. These efforts resulted in landmark legislation and programs, including the Fair Housing Act, the Equal Credit Opportunity Act, the Home Mortgage Disclosure Act, and the Community Reinvestment Act. Research suggests that these policy changes were effective in improving homeownership rates among minority families, resulting in a reduction in Black-White segregation in

particular, and expanding housing and mortgage choice (Immergluck, 2011; Squires, 1992).

Two key trends have emerged since the 1970s. The first is that Black-White racial segregation declined following civil rights reforms of the late 1960s and 1970s, while income sorting[1] increased. As explicit legal and institutional support for exclusionary zoning, redlining, and other tools of segregation declined, and as income inequality has increased, segregation has become increasingly driven by distributed decisions in the market for residential housing (Massey, 2012). The second key trend is the emergence of subprime lending. Following financial deregulation and technological advances in the 1990s, subprime lending emerged as a new mortgage product. In response to rising demand for high-risk mortgages in the secondary mortgage market, subprime purchase and refinance mortgages were heavily marketed in minority neighborhoods in cities where racial segregation remains elevated (Rugh, Albright, & Massey, 2015; Rugh & Massey, 2010). Multiple MSA and city-level studies have demonstrated that subprime loans are powerfully associated with racial segregation, even after controlling for a variety of housing, borrower and neighborhood characteristics (Calem, Gillen, & Wachter, 2004; Immergluck, 2011; Rugh & Massey, 2010; Squires, Hyra, & Renner,

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[1] Throughout the text I use income sorting and income segregation interchangably. The terms emerge from separate strands of theory, but refer to the same phenomenon. Sorting was used by economists Shelling and Tiebout to describe particular mechanisms for residential self-selection into cohesive groups; income segregation is used more generally to describe residential clustering by income.

2009). The subprime and foreclosure crises have radically restructured housing markets and increased inequality in housing wealth. Because of the racialized nature of subprime lending and the devastating effect that clustered foreclosures and blight had on segregated neighborhoods, and because of additional factors to do with the recovery that are still being uncovered, the housing recovery has been disproportionately difficult in minority areas.

At the national level, housing wealth inequality has widened along class and racial lines over the last thirty years. A recent report by Brandeis on growing wealth inequality cites divergent returns to homeownership as the number one contributor to the growing wealth gap between White and Black families. In their thirty-year timeframe, this gap grows by more than $150,000. The authors attribute the bulk of this widening gap to housing and the effect of the housing crisis (Shapiro et al., 2013). Other research confirms that the housing crisis hit Black households hardest. During the downturn, the median net worth of Black families in the five hardest hit states declined by 76%; this figure was 48% nationwide. Whites, by contrast lost 44% of their net worth in the five hardest hit states, and just 8% nationwide (Taylor et al., 2011). While these declines reflect losses from a peak that was undoubtedly inflated and not representative of real housing wealth, the racial discrepancies in these losses are stark.

Housing wealth is a cornerstone of the American middle class and a key component of rising economic inequality. Over the past thirty years, housing wealth has become more unequally distributed between income groups and between races. The changing bases of racial segregation, the concomitant rise in income sorting, and the vicissitudes of

subprime lending are all plausible contributors to rising housing wealth inequality. Research has confirmed that in aggregate, housing inequality is widening between races and classes. Research has also confirmed that home values and mortgage prices are governed by metropolitan-level factors and linked to segregation and income sorting. However, no research has attempted to understand how urban processes contributes to the dynamics that generate housing wealth.

In this research, I examine the relationship between racial and income segregation, and housing wealth inequality. I construct a dataset of individual housing wealth across the nation and with this data, measure the distribution of home values and home equity by urban region. This research provides descriptive data about the geographic distribution of housing wealth, measuring how housing wealth is distributed within major American cities, evaluating whether there are regions where net housing wealth is more or less equally distributed, and comparing the distribution of housing wealth to the distribution of income.

With this dataset, I use spatial variation to analyze the relationship between racial and income segregation and housing wealth inequality. In particular, I evaluate whether inequality in housing wealth is completely driven by income inequality, or if sorting and segregation have a separate effect. Finally, assuming sorting and segregation do have an effect, I investigate whether mortgage finance is a mechanism by which income and race based segregation impacts housing wealth inequality.

The major research questions I address are:

1. Does regional housing wealth inequality merely reflect income inequality or does income sorting also contribute?

2. Does mortgage lending explain why racial segregation amplifies housing wealth inequality separately from income sorting?

3. Do income sorting and mortgage lending amplify housing wealth inequality?

In chapters 2 and 3, I examine regional housing wealth inequality in a series of cross sectional analyses of Core Based Statistical Area (CBSA) level housing wealth inequality. Chapter 2 addresses question 1, examining the drivers of urban housing wealth inequality in 2005. In this period, just prior to the housing crisis, I inspect the relationship between housing wealth inequality and urban racial and income segregation or sorting. Chapter 3 addresses Question 2, and probes the role of the foreclosure crisis in generating housing wealth inequality, addressing the impact of subprime lending and the foreclosure crisis on housing wealth inequality during and following the crash. Then, in Chapter 4, I address question 3 with individual-level data to estimate housing wealth inequality in 2015 among individuals who originated mortgages in 2010, investigating regional, neighborhood, and individual drivers of inequality using a set of borrowers who were unlikely to have obtained subprime mortgages.

Chapter 2: Income Inequality, Segregation and Urban Housing Wealth Inequality Before the Crash (2000-2005)

Introduction

Home equity is the foundation of American household wealth, and inequality in wealth has been rising since 1995. Some theories suggest that housing wealth inequality would primarily be driven by income inequality. Others expect income segregation to be an important component of market segmentation and uneven home price appreciation. Still others focus on racial segregation as a major component of uneven accumulation of housing wealth. In this section, I ask how income inequality and racial segregation affect housing wealth inequality. I use cross sectional regressions of MSAs in the United States in the early 2000s to understand how spatial variation in income inequality and different residential patterns of segregation correspond with higher and lower levels of housing wealth inequality. I examine urban housing markets in the lead up to the housing market crisis of the late 2000s. During this period, risk-based pricing was high, and though the foreclosure crisis of the 1990s was ongoing, housing market distress was not yet widespread.

Literature Review

This literature review describes research on the factors that drive unequal financial returns to homeownership within and between urban areas. The four components of

housing equity are the value of the home, the cost and amortization of mortgage, the degree of leverage, and the ability of the homeowner to take advantage of tax benefits such as the mortgage interest tax deduction. Some researchers define housing wealth in a way that takes into account imputed rent, the value of housing services, the ability to transform sweat equity of home improvements into capital, and the ability to borrow cheaply using home equity lines of credit. Those types of mechanisms are outside the scope of this study, except to the extent that all three can be capitalized into the value of the home. While this study evaluates the financial returns to homeownership, homeownership can be the pathway to other non-financial benefits that are not within the scope of this study. These benefits include access to better quality housing than what is offered in the rental market; shorter commutes and expanded job search opportunities; higher quality schools and other neighborhood amenities. The focus of this research is on the financial returns to homeownership, so again, these attributes will only be considered to the extent that they are capitalized into price.

Because home price appreciation is a strong determinant of housing wealth, I will begin by discussing the literature which explains variation in home prices within cities. I will follow by discussing the cost and distribution of mortgage finance, and finally by describing studies which directly examine patterns in home equity.

Market Segmentation

Market segmentation is one way to conceptualize uneven home price growth within a city or region. Market segments or submarkets have commonly been defined by housing type, geography, and price point. If housing submarkets cater to different consumers, and offer

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goods that poorly substitute for one another, then these markets will appreciate and depreciate at different rates and respond differently to changes in supply and demand.

Early literature on market segmentation describes urban housing markets as being segmented by quality, such that not all houses are viewed by buyers as substitute goods, leading to a situation in which shocks to one submarket ripple though the rest of the system depending on how that market is related to other submarkets through substitutability. Demand is heterogeneous too; renters have a demand function based on consumption while owner-occupiers have a demand function based on the investment and consumption aspects of housing.

One source of segmentation is by home value. Markets for high and low cost housing can become distinct because low income buyers cannot afford expensive homes. Conversely wealthy households are not interested in low cost homes. Herbert and Belsky (2008) summarize a set of studies about home price appreciation among different market segments. One set of studies review home price appreciation by price tier, finding no consistent differences in home price appreciation; another finds that low value homes are more likely to experience strong growth. Another set of studies reviews price appreciation by structure type, contrasting single family homes with condominiums, finding that these dynamics are specific to place and time period. Di and Liu (2007), using PSID, and Krumm and Kelly (1989), using the Survey of Consumer Finances, find that during the 1990s, the returns to homeownership are greater for high income families than low income families. Belsky and Duda (2002) analyze whether low cost housing appreciates at the same rate as other housing using a panel which matches purchase and

sales in Boston, Denver, Philadelphia and Chicago. They do not account for the effect of amortization on equity buildup. They find that in all four cities, low cost homes appreciate far more strongly than mid and high cost homes. Their study points to the importance of the timing of purchases and sales as a key determinant of whether homeowners made a nominal profit or loss on the sale of their homes. Low income households tend to have shorter spells of homeownership, increasing the impact of transaction costs, and sensitivity to the financial impact of the timing of purchases and sales, particularly because low income households are generally unable to take advantage of the mortgage interest tax deduction. Another key factor is location. The study confirmed that the probability that low-cost home buyers to made a profit varied strongly by Metropolitan Statistical Area (MSA).

Another source of segmentation emerges from the demand side. McMillen (2008) investigates home price change within one city, Chicago, between 1995 and 2005. Over this time period, the percentage of expensive homes increased. McMillen reviews two hypotheses as to why the shape of the distribution changed. The first hypothesis is that this change in the distribution is due to supply, or changes in the housing stock. The second that it is due to changes in demand for housing due to shifts in the preference and income distribution of residents. Using an Oaxaca decomposition analysis, McMillen finds that housing stock and locational change do not explain this shift; rather a shift in demand for high end homes explains the change in the distribution. Housing demand can also be stratified by age and family status, and these demographic differences can lead to uneven home price growth. Different demographic groups require different public

amenities – for example, proximity to jobs, hospitals, or good elementary schools. Case and Mayer (1996) study intra-metropolitan home price dynamics in Boston in the 1990s and find that rapid changes in demographics and slower changes in local amenities and housing stock lead to a mismatch between supply and demand, causing prices to change along jurisdictional lines. As households aged, the need for good schools declined, and places with strong school districts declined while towns with amenities suited to retiring households appreciated.

In a national study, Boehm and Schlottmann (2008) find that housing wealth increases with income. They estimate a dynamic model of family wealth accumulation using PSID's longitudinal data on household wealth from 1984-1992. They focus on the impact of home purchase timing on the probability of acquiring housing wealth, considering the propensity of different socioeconomic groups to have "spells" of homeownership intermixed with spells of renting. After splitting their sample into four groups by race (White, Black) and income (above median, below median), they observe that housing appreciation is roughly the same for all groups. They evaluate housing wealth gains between socioeconomic groups and against other forms of wealth. They find that average annual housing wealth accumulation increases with socioeconomic status.

Overall, investigations of intra-metropolitan home price dynamics have not revealed systematic patterns in how different market segments respond to cyclical price movements. In some regions, the housing cycle was observed to result in high volatility for expensive homes; in others, that volatility is associated with low cost housing (Belsky & Duda, 2002; Case & Mayer, 1996; Li & Rosenblatt, 1997).

Racial Segregation, Income Sorting and Home Prices

There is a long literature establishing that racial segregation and income sorting are key determinants of uneven home price appreciation. The classic model of segregation is that it is the result of institutionalized, structural rules which are enforced by a variety of government and private sector players (Massey, 1993). Institutional discrimination in housing markets has been conceptualized in a variety of ways – as "collective action racism" by some (Cutler, Glaeser, & Vigdor, 1999), and as a component of "place stratification" by others. Collective action racism draws on political economy and refers to exclusionary zoning, racial covenants, and other institutions put in place by racist majorities to enforce segregation. Place stratification describes these same institutions, but also incorporates a concept of a hierarchy of places, and the role that zoning, housing associations, deed covenants and other institutions play in enforcing spatial order (Logan & Molotch, 2007). Initially formulated to explain White flight and suburbanization, this concept has been adapted to understand the hierarchy of places within the suburbs. The group threat theory can be combined with place stratification to suggest that racial majorities work more intensely to enforce segregation in cities that have a large, unified minority population (Bellman, 2014; Blalock, 1967; Pais, South, & Crowder, 2012).

Institutionalized segregation can generate uneven home prices by reducing competition for housing in White areas, lowering prices. By creating pent-up demand in minority neighborhoods and simultaneously restricting supply, segregation may generate increased prices for minorities (Cutler et al., 1999). Viewed solely from the lens of home equity, these price movements could have the effect of raising home equity for minority

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homeowners, and reducing home equity for majority homeowners. The opposite effect

would occur when segregation is paired with unequal access to public goods like

mortgage finance, transportation, education, and other amenities (Lindstrom, 1997).

These amenities are capitalized into price, and bid up prices in high status areas and

decrease prices in low status areas. This price effect will be true so long as preferences

for amenities are homogenous. To the extent that they are not, households may reach a

sorting equilibrium that is not reflected in price (Yinger, 2015).

Since fair housing reforms of the 1960s, institutional segregation has declined and

decentralized forms of segregation have become increasingly prevalent (Massey,

Rothwell, & Domina, 2009). Scholarly work has turned to forms of segregation which

arise out of individual preferences, socioeconomic differences and the atomized

competition within the market for land. Thomas Schelling (1971) provided an early

model for segregation emerging from residential preferences. Using a simple

checkerboard with two types of coins, Shelling created decision rules for the two types of

residents based on their preferred racial mix of their immediate surroundings. The model

demonstrated that even if almost all residents prefer to live in an integrated

neighborhood, slight preferences for the degree of racial mix can result in high levels of

segregation without the presence of active discrimination in any other arena of housing

markets or residential choice.

Another framework for understanding of the aggregate impact of individual location

preferences is spatial assimilation. Spatial assimilation situates individual preferences in

a social context. In this view, the economic and cultural differences among minorities

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that may lead them to choose to live in segregated areas, and a multigenerational acculturation process which is thought to lead to home buying and neighborhood attainment, among other forms of integration (Charles, 2005; Friedman, Tsao, & Chen, 2013; Pais et al., 2012).

When racial segregation is the result of individual preferences, this decentralized segregation can result in lower home prices in areas that are predominantly inhabited by racial and ethnic minorities if these groups have lower incomes and lower ability to compete for homes in desirable neighborhoods. Another possibility is that even if incomes are roughly equal, if the majority group prefers not to buy homes in minority areas, this will result in lower prices in those places. If segregation results in two separate markets, it's thought that commodities sold by minorities will not command as high a price because there are fewer buyers. This effect is thought to be related to the relative size of the buying pool – the "returns to trade" with the majority increases the larger the majority is relative to the minority (Becker, 1971).

Segregation solely by income or wealth is often called sorting (Davidoff, 2005; Tiebout, 1956; Yinger, 2015). There are a variety of ways that income sorting is thought to occur and simultaneously, to affect home prices. The bid rent curve suggests that commuting costs are capitalized into home prices, such that wealthy people will sort into the suburbs so long as the income elasticity of transportation costs are less than the income elasticity of home size (Brueckner, 1987). Amenity-based models propose that home prices reflect the quality of a home's location, with higher prices paid to live near parks and lower prices offered for homes near sources of pollution. Tiebout sorting between jurisdictions

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is thought to occur when households capitalize public goods that vary by jurisdiction into home prices (Dawkins, 2005; Tiebout, 1956). Shelling sorting has been expanded to describe households' preferences to live near certain kinds of people. When neighbors themselves are the amenity, the process of income sorting becomes dynamic and path dependent (Cutler et al., 1999; Massey et al., 2009).

Rising income inequality amplifies whichever mechanisms govern income sorting. As the gulf between rich and poor grows, households of different income cohorts become even less likely to pay similar amounts for location-related attributes, and residential segregation by income becomes more complete (McMillen, 2008). Not only does most economic theory predict that rising income inequality will result in stronger income sorting, but so long as preferences are homogenous, home prices are the mechanism by which sorting will occur (Watson, 2009; Yinger, 2015).

Trends in Segregation and Sorting

Institutionalized segregation, which tended to create barriers along jurisdictional lines or between city and suburb, declined strongly after the Fair Housing Act was passed. Wilson (1987)'s *The Truly Disadvantaged* describes this period of modest desegregation for middle class Blacks. As middle class Blacks were able to escape segregation, and as manufacturing jobs fled overseas, the poor were left behind in the inner city in neighborhoods with concentrated poverty. Wilson's work emphasized economic distinctions as a key barrier for Blacks and Whites escaping poverty, and was interpreted by some to deemphasize the importance of race.

Massey and Denton's 1993 book *American Apartheid* re-established the importance of racial segregation as a force which interacted with structural changes in the economy, and with poverty to create the persistent underclass (Charles, 2003; Jargowsky, 1997; Massey et al., 2009; Oliver & Shapiro, 2006; Wilson, 2012).   How does racial segregation persist in the absence of explicit legal support? In part this is the result of subtler forms of discrimination in housing markets which still exist. There is a long literature demonstrating that racial discrimination and segregation are reproduced at every step of the home purchase process – from realtor behavior (Immergluck, 2011) to mortgage prices (Rugh & Massey, 2010) to zoning decisions and the choice to annex or form new jurisdictions (J. T. Rothwell & Massey, 2010) .

Another source is the rise of segregation which results from individual preferences for neighborhood composition as described by Schelling (1971) and others. In an empirical examination, Charles (2005) examines three drivers of preferences for neighborhood racial mix. The first is that race is a visible marker for class, and that residents attempt to select neighbors of higher economic class, using race as a marker. The second is that all races are ethnocentric and prefer to live near people like themselves. The third draws on Hubert Blumer's theory of race as a method of maintaining group status. Blumer's theory establishes a group hierarchy, with Whites at the top, Blacks at the bottom, and other races between. Individuals avoid races with lower status in an effort to maintain group position. In order to understand the influence of different drivers of segregation, Charles (2005) analyses data on preferences for neighborhood racial mix in the Multi-City Study of Urban Inequality (MCSUI), drawn from Atlanta, Detroit, Boston and Los Angeles in

1992-1993. The MCSUI results confirm that racial prejudice is a stronger driver of residential segregation than in-group attachment or perceived economic differences between races. Racial prejudice is confirmed as a particularly strong driver of Whites' residential preferences, and less so for those of other races.

Levels of racial segregation vary widely between metropolitan areas and individual cities may depart from national, secular trends (Bellman, 2014; Bischoff & Reardon, 2013; Reardon et al., 2008). For example, Watson (2009) finds that outside of the South, income sorting is lower for Blacks in cities with higher racial segregation. When the concept of segregation is split into five distinct dimensions of spatial variation: unevenness, exposure, clustering, concentration and centralization, a variety of patterns emerge (Massey, 2012). Some cities display rising levels of racial and economic integration, others falling into the category of hyper segregation (Massey & Tannen, 2015), with high levels of Black-White segregation along most or all dimensions. Some regions are seemingly integrated when measured at larger spatial scales, but seemingly segregated when measured at the neighborhood or block level.

There is a long literature examining the impact of Black-White segregation on uneven home price movements through the impact of market segmentation on supply and/or demand. Cutler et al. (1999) investigate whether segregation is the result of "collective action racism" enforced through legal and other measures, or if segregation is the result of voluntary, Shelling-style sorting of Whites into predominantly White areas. They propose that in the first case, Whites will pay more for housing because demand for housing in White areas will be higher. In the second case, they reason that Blacks will

pay more because segregation constrains supply for Black housing, concentrating demand for housing in a few neighborhoods. The authors find that prior to 1970, in segregated cities, Blacks paid more for housing than Whites, but in the later period, Whites paid more for housing in segregated cities than Blacks.

Rusk (2001) describes how housing wealth might amplify income inequality in the existence of race based segregation. Rusk calculates the ratio between income and housing value by race. He finds that this ratio is much lower for Black homeowners than White homeowners, and dubs the discrepancy between the two the "segregation tax". Rusk conducts a linear regression using census-tract level data for the 100 largest metro areas in 2000, examining the impact of a dissimilarity and isolation indices on the segregation tax. The dissimilarity index calculates the proportion of members of a given racial group who would have to move for that racial group to be distributed evenly across a given area. The isolation index indicates the average racial mix of the places in which members of a given group live. Rusk (2001) demonstrates that after controlling for household income, the Black-White gap in housing values increases with segregation, though the impact of other minority groups' racial segregation did not lead to any conclusive results. In a similar study, Raymond, Wang, and Immergluck (2015) find that zip code level segregation is the predominant explanation for home price volatility and persistent recession through the 2000-2015 housing bubble, crisis, and recovery. These results hold even after controlling for income, housing stock composition and quality. Dong and Hansz (2015) control for regional and urban form variables, which do help explain the depth and duration of the housing crisis. They find that the impact of racial

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composition is highly dependent on whether subprime lending is included in the model, suggesting that in the current crisis, uneven home price movements in racially segregated areas is mediated by the dynamics of predatory mortgage lending.

Flippen (2004) examines whether and why Black-owned homes might appreciate more slowly than White owned homes. She notes that while three studies conducted in the 1960s and 1970s found lower rates of home price appreciation for Blacks, though two studies conducted in the late 1970s found no difference when controlling for other observable factors. She differentiates between three different mechanisms which could cause a racial gap in home price appreciation. The first potential cause is that, following Becker (1971), racial neighborhood composition could lower the appreciation of Black-owned homes if White households have a 'taste' for White neighbors, reducing market demand and home price for Black-owned homes. Second, neighborhood transition could be associated with a certain pattern of home price appreciation. Third, if race is highly correlated with neighborhood amenities, home prices could reflect the location of the homes, and not their occupants. Flippen estimates a hedonic model using neighborhood racial composition, neighborhood change, and measures of neighborhood amenities. She finds that all three factors appear to influence home prices. Minority presence was negatively associated with home price appreciation, as were increases in minorities over time, over and above controls for quality of housing stock and neighborhood quality.

Oliver and Shapiro (2006) find that Black-owned homes are lower priced and appreciate more slowly than homes in White neighborhoods. They examine home price appreciation for Black and White homeowners nationwide from 1967-1988 and find that White-owned

home price appreciation was almost twice that of Blacks. This gap persisted when controlling roughly for price cohort, and when examining the 1960s and 1970s separately. They tie their results to segregation, and to discrimination in mortgage markets, but do not explicitly control for these factors.

There's a long literature associating segregation and sorting with uneven home price movements. The majority of the works cited suggest that homes in segregated areas are appreciating more slowly than those in majority White areas, with the exception of the gentrification of inner city areas which are experiencing rapid neighborhood transition. As the nation shifts from legally established segregation to income sorting and racial segregation driven by individual preferences, some empirical work suggests that the impact of segregation on home values will reverse. In the contemporary era, segregated areas may tend to suffer from depressed demand. Other research focus on the continued impact of fragmentation and exclusionary zoning as key drivers of residential inequality.

This literature review suggests that several reasons why the distribution of housing equity in urban areas has been growing more unequal. Growing income inequality generates higher gaps between submarkets, as wealthier groups pay more for desired amenities, and poorer groups cannot. More complete income sorting should be another effect of rising income inequality. At the same time, income sorting may reflect intense competition by elites for local amenities or jurisdictional level public goods. So, the mechanisms that translate income inequality into home price inequality include competition for high end housing; competition for shorter commutes and associated transportation costs;

competition for desirable public goods provided at the jurisdiction level; and competition for place-based amenities including neighborhood composition itself.

In places where race-based segregation is high, as the nature of race based segregation has shifted from a macro level force through "collective action racism" and towards one which is organized through decentralized sorting, the relationship between segregation and home price appreciation may have changed. Where neighborhoods self-sort into racially and ethnically segregated spaces, we might expect slower home price appreciation in majority Black neighborhoods and higher home price appreciation in majority White neighborhoods (Cutler et al., 1999). These theories suggest that in an era of rising income equality, and reduced state level segregation, the enforcement of fair housing laws may result in diverging home prices and widening housing wealth inequality.

Simultaneously, the rise of risk-based pricing and the geographic distribution of predatory lending may contribute to housing wealth inequality through the uneven spatial distribution of debt and risk. In places where mortgage finance has been denied or overpriced, and in particular where subprime lending was densest, we should expect the greatest declines in housing equity. This effect should occur in part because borrowers are paying inflated prices for loans, and in part because clustered foreclosures and vacancies continue to weigh down local housing market recovery. In the post-crisis era, risk-based pricing may have an effect as well, as wealthy households clustered into the wealthiest neighborhoods of the wealthiest cities receive the cheapest debt, while neighborhoods of poorer households are charged more, and build equity more slowly.

There has been little work examining the urban processes which generate social stratification in housing wealth. Although metropolitan factors are indicated as drivers of housing wealth inequality, here has been no research into relationship between income sorting, racial segregation and the intra-metropolitan distribution of housing wealth. The growing liberalization of housing and mortgage markets against a backdrop of rising inequality has led to higher spatial sorting, and more risk-based pricing. This research seeks to examine whether patterns of self-sorting lead to rising inequality, or whether other culprits: traditional institutionalized racial segregation can explain the rising housing wealth gap. This research investigates housing wealth inequality in a spatial context, with particular attention paid to how racial and economic segregation predict housing wealth inequality. The literature suggests three potential relationships between segregation and the distribution of housing wealth.

1. Housing wealth mirrors widening income inequality but plays no role in enhancing or mitigating inequality generated in labor markets.

Figure 1: Income Inequality causes Housing Wealth Inequality

2. Economic segregation leads to rising home prices for the wealthy and stagnating home prices for the less well to do, above and beyond income inequality, due to social stratification processes (G. A. Dymski, 2009); and/or

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housing price externalities which amplify the impact of economic sorting
(Immergluck & Smith, 2006).

Figure 2: Income Inequality, Income Segregation cause Housing Wealth Inequality

3. Particular forms of racial segregation – in particular, the ongoing shift in the
   bases of segregation, from "collective action racism" which separated Blacks
   and Whites of all incomes, to self-organized micro level economic and racial
   segregation, are associated with decreased home price appreciation for racial
   minorities and widening housing wealth inequality (Massey et al., 2009; Rugh
   et al., 2015).

Figure 3: Income Inequality, Income Segregation cause Housing Wealth Inequality

In this and subsequent sections, I seek to unpack the relationships between housing
wealth inequality, income inequality, and racial segregation, using spatial variation. In
order to understand the relationship apart from the financial crisis, I analyze housing

markets in the period directly preceding the real estate and financial crisis. To understand how income inequality, income and racial segregation inform housing wealth inequality, I analyze these factors in a sample of US cities from 2000-2005, when homeownership peaked at 69% and before the recession and the foreclosure crisis occurred. Using a panel of 258 cities measured in the years prior to the crisis, I compare the impacts of income inequality, income segregation, and racial segregation on housing wealth inequality.

Methods and Data

In this analysis, I seek to answer the following question: does regional housing wealth inequality merely reflect income inequality or does income sorting also contribute?

H0: Housing Wealth Inequality mirrors the underlying income inequality in an MSA; segregation and income sorting have no separate impact.

H1: Housing Wealth Inequality amplifies the effects of income inequality in the presence of strong income sorting.

Some theories of home prices in the city assume that income inequality is the primary driver of home prices, and rule out a role for spatial factors like income sorting and segregation. Other theories suggest that clustering by income or race will impact the distribution of home prices. To investigate these theories, I use a dataset measuring the distribution of housing wealth in 258 MSAs across the U.S., representing 70% of metropolitan areas. Using data on individual mortgages, purchase prices, and a home price index, I calculate the current distribution of home equity. Equation 1 employs a basic cross-sectional approach, using variation between MSAs to establish a relationship

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between housing wealth inequality, income inequality, income sorting, and racial segregation.

(1) Housing Wealth Inequality$_{2005}$ = + $_1$ Income Inequality$_{2000}$ + $_2$ Income Segregation$_{2000}$ + $_3$ Racial Segregation$_{2000}$ + $_2$ Age of Housing Stock$_{2000}$ + $_3$ Owner Occupancy Rate$_{2000}$ + $_4$ Commute Times$_{2000}$ + $_5$ Population Density$_{2000}$ +

The last four covariates are included for robustness checks, to prove that third variables which might influence both the variables of interest (income inequality, income sorting) and the outcome variable (home equity) are not inflating the coefficients. I include two measures of the variation in quality of housing stock, age of housing and the owner occupancy rate. I also control for city compactness with two measures: population density and average commute times within the MSA. To control for regional differences, regional fixed effects are also included.

The regression is performed incrementally to demonstrate how the coefficient for income inequality is impacted as income and racial segregation is added, and as subsequent controls are added.

Data

To understand how income and race predict housing wealth inequality, I construct a dataset measuring these and other important controls. I evaluate housing wealth inequality in 2005, the earliest year for which I have reliable data. I use Census 2000 and ACS data to collect dependent variables. The dataset is composed from several sources as

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depicted in Table 1.   Due to data availability of different datasets, the final dataset

contains observations for 258 metropolitan areas using 2000 census definitions. The

MSAs range from small metropolitan areas like Fairbanks, Alaska, to large metropolitan

areas like Atlanta, Georgia, and represent 70% of all metropolitan areas in this timeframe.

The Gini Coefficient of housing wealth inequality is constructed from the Equifax Credit

Risk Insight Servicing McDash dataset, which includes a link to data from McDash

Analytics, LLC, a wholly owned subsidiary of Black Knight Financial Services, referred

to hereon as CRISM. This dataset combines rich data on mortgages from Lender

Processing Services (LPS) with demographic and credit report data from the Federal

Reserve Bank of New York's Consumer Credit Panel, which provides individual level

credit report data collected by Equifax. The coverage is a non-scientific sample of all

mortgage-holders contained in the Lender Processing Services (LPS) dataset, covering

40-70% of all mortgage holders, depending on the year. This dataset is organized around

individuals, allowing one to total the balances on first and second liens. I exclude all

homeowners with more than one property due to the difficulty in correctly matching

mortgages with their collateral. Using location, date and price at the time of purchase, I

estimate 2005 home value using CoreLogic's zip code level home price data. I choose

2005 because it is the earliest year prior to the crisis for which I have confidence in the

coverage of the mortgage data; in years prior to 2005, there is a strong survivor bias, such

that records prior to 2005 do not adequately capture mortgages that went into foreclosure

in later periods. This approach to using assessing market value has been widely used in

other research estimating housing value and loan to value (Adelino, Gerardi, & Willen,

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2013). The resulting measure can be thought to be a measure of housing wealth inequality among mortgaged homeowners in 2005.

After calculating 2005 housing wealth for individuals in the sample, for each MSA I calculate housing wealth inequality. Because housing wealth can take on negative values, I use the Gini coefficient. For a group of n individuals with a housing wealth of x for each individual i, the Gini coefficient is defined as:

$$G = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} |x_i - x_j|}{2n \sum_{i=1}^{n} x_i}$$

The Gini coefficient measures the area described by the cumulative density function and a 45-degree line, with 1 being the highest possible inequality, and 0 being complete equality. Where negative values are an issue, as in housing wealth, the Gini coefficient can take on values above 1; and when mean wealth is below zero, the Gini coefficient can take on values below zero (Jenkins, 2005).

To measure income inequality, I use the earliest available year calculating the Gini coefficient of income inequality from the American Community Survey of the Census. To measure income segregation, I use Herfindahl's index on the segregation of wealth at the census tract level, drawing on Brown University's Diversity and Disparity Project datasets on income segregation using Census 2000 data. The Herfindahl-Hirshmann index is defined as follows. When s is the share of each minority group i and n is the number of groups. The isolation of affluence and poverty can be measured

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$$H = \sum_{i=1}^{N} s_i^2$$

Both the isolation of poverty and affluence have reasons to influence housing wealth inequality. The isolation of affluence can create pockets of extremely high home prices, and by removing wealthy buyers from other segments of the housing market, can generate declines elsewhere. The isolation of poverty could reduce neighborhood competition between wealthier homeowners. Because the wealthy are more likely than the poor to be homeowners; and because of high collinearity between the isolation of poverty and racial segregation, I choose to include the isolation of wealth in this model.

To understand racial and ethnic segregation I look at Black, Asian and Hispanic residential patterns using isolation indices. If a_i represents the racial or ethnic group population of a census tract, t_i represents the total population of the census tract, A_i represents the total population of the metropolitan area, and entire geographic region, then the isolation index is defined as:

$$I = \quad (a_i / A) (a_i / t_i)$$

From the same Diversity and Disparities 2000 dataset I draw a series of metrics on racial isolation. I use Black-Black isolation index, which can be thought to measure the average percentage of Black families in the typical Black family's census tract; and similarly, the Asian-Asian isolation index. To measure ethnic segregation, I use the Hispanic-Hispanic isolation index. These measures are dependent on the evenness capture the degree to

which racial and ethnic minorities are able or interested in living in racially and ethnically diverse census tracts.

Finally, I also include a series of controls drawn from the 2000 Census. These include two housing market metrics: the owner occupancy rate and the average age of housing. The first measure captures the affordability and accessibility of housing in each region. The average age of housing captures the quality of housing stock and the age of city. I include two measures of MSA compactness, population density and average commute times. Population density is intended as a rough measure of land costs and the supply elasticity of housing in a city, and the degree to which urban areas have the geographic and legal frameworks to build new housing. Commute times are better adapted to capturing how housing is supplied in polycentric cities (Park & Quercia, 2015). Transportation costs are a major factor in home prices, and inclusion helps capture how well a city supplies homes close to jobs. All MSAs are measured using Census 2000 boundaries.

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max	Source
Gini Housing Wealth Inequality	0.53	0.08	0.36	0.87	Author Calculated, 2005
Income Segregation (H, 90th Pctile)	0.14	0.04	0.06	0.29	Diversity & Disparities; Census 2000
Income Inequality (Gini)	0.44	0.03	0.36	0.54	ACS 2006
Black-Black Exposure Rate	26.63	20.88	0.38	71.37	Diversity & Disparities; Census 2000
Hispanic-Hispanic Exposure Rate	14.55	16.78	0.66	89.45	Diversity & Disparities; Census 2000
Asian-Asian Exposure Rate	4.43	4.33	0.70	37.57	Diversity & Disparities; Census 2000
Average Commute Time (minutes)	22.55	2.89	16.29	33.00	Census 2000
Population Density (ppl per sq. mile)	273.96	222.33	18.06	1,552.53	Census 2000
Average Year Built (years)	1970	7.85	1949	1989	Census 2000
Owner Occupancy Rate	0.68	0.05	0.52	0.84	Census 2000
Average Home Value ($)	$106,217	$40,974	$42,800	$418,346	Census 2000
MSA Size	566,579	703,206	71,435	4,715,407	Census 2000

Results

I calculate inequality metrics for all metropolitan and micropolitan areas nationwide in 2005. The overall Gini coefficient for urban housing wealth inequality in the United States in 2000 is .54. This is considerably higher than income inequality, which falls around .37 in this time period (Jenkins & Van Kerm, 2009). As shown in Table 1, in the sample of 258 cities, average housing wealth inequality is almost exactly the national average at .53, and varies widely from .36 to .87. The distribution of values is normal.

To investigate the relationship between housing wealth inequality and other forms of inequality, I calculate correlations between MSA-level housing wealth inequality with a variety of demographic measures and measures of income and racial segregation. In Table 2 I show bivariate correlations between housing wealth inequality and several measures of income segregation. Correlations between housing wealth inequality (HWI) and measures of income sorting vary. The overall measures of income sorting, the Herfindahl-Hirschman Index, also called the entropy or information theory index (H), show a weak relationship with HWI. Sorting of the 10th percentile and at the 90th percentile have weak relationships with higher HWI.

Table 2: Income Sorting and Housing Wealth Inequality

258 MSAs

Census 2000 measures of income segregation	Correlation with 2005 Gini HWI
Overall segregation (H)	0.04
Segregation of the poor (H10)	0.10
Segregation of the wealthy (H90)	0.06

Source: US2010 Diversity and Disparities Project, Brown University

Next, I examine how housing wealth inequality varies with racial segregation. It's important to first note that housing wealth inequality at the MSA level varies with racial composition. As shown in Table 3, urban regions that are predominantly White; and those that have larger Black populations tend to have higher housing wealth inequality. MSAs with higher Asian and Hispanic populations, have lower housing wealth inequality. This may be because of differences in social factors driving segregation; in differences in income between different minority demographic groups, or because of geography. Figure 4 shows the distribution of racial minorities in 2015.
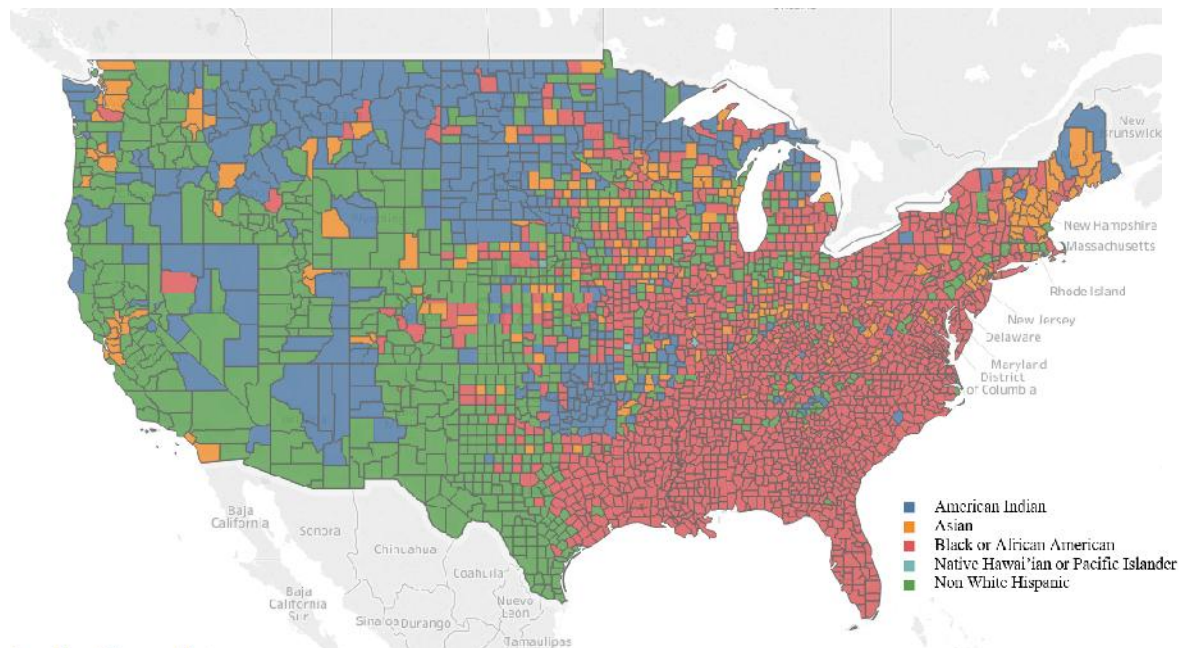
Figure 4: Largest Minority Group by County, 2015.

Source: 2015 American Community Survey 1 Year Estimates, Author's Calculations

Racial and ethnic minorities cluster in states and regions that also have unique housing

market dynamics. In 2015 as shown in Figure 4, Black Americans were the primary

minority group in the Southeast; Hispanics were the predominant minority in

metropolitan areas in the Pacific states and states in the Southwest. The results in Table 3

suggest it will be important to disambiguate between region, size of minority population,

and minority segregation patterns in understanding the relationship between racial

segregation and housing wealth inequality.

Table 3: Correlations between Racial Composition of MSA and HWI

Census 2000 MSA level demographics	Correlation with HWI Gini
Percent White	0.09
Percent Black	0.28
Percent Hispanic	-0.22
Percent Asian	-0.46
Percent Other Race	-0.21

Table 4 shows bivariate correlations between racial segregation and housing wealth

inequality. Like Table 3 above, metrics of Hispanic and Asian segregation are correlated

with lower housing wealth inequality; measures of White and Black segregation are

correlated with higher housing wealth inequality. Dissimilarity and exposure indices are

dependent on the relative size of different populations. The exposure index is less reliant

on the size of the minority population in a given region. Examining the exposure of

Whites to Whites, and the exposure of Blacks to Blacks, these are both strong, positive

correlations.

Table 4: Bivariate Correlations: Racial Segregation and Housing Wealth Inequality

Isolation of Whites	0.15	White-Black Dissimilarity	0.31
Isolation of Blacks	0.37	White-Hispanic Dissimilarity	-0.04
Isolation of Hispanics	-0.25	White-Asian Dissimilarity	0.19
Isolation of Asians	-0.41	Black-White Dissimilarity	0.31
White-Black Exposure	0.26	Black-Hispanic Dissimilarity	0.28
White-Hispanic Exposure	-0.21	Black-Asian Dissimilarity	0.39
White-Asian Exposure	-0.47	Hispanic-White Dissimilarity	-0.04
Black-White Exposure	-0.14	Hispanic-Black Dissimilarity	0.28
Black-Hispanic Exposure	-0.23	Hispanic-Asian Dissimilarity	0.12
Black-Asian Exposure	-0.47	Asian-White Dissimilarity	0.19
Hispanic-White Exposure	0.13	Asian-Black Dissimilarity	0.39
Hispanic-Black Exposure	0.31	Asian-Hispanic Dissimilarity	0.12
Hispanic-Asian Exposure	-0.44		
Asian-White Exposure	0.17		
Asian-Black Exposure	0.27		
Asian-Hispanic Exposure	-0.23		

To unpack the question of how income sorting and income inequality affect housing wealth inequality at the regional level, I perform a series of incremental regressions using robust standard errors in Table 5.

Table 5: Regression Results

N: 258 MSAs

Predicted: MSA Level Gini of Housing Wealth Inequality, 2005	(1)	(2)	(3)	(4)	(5)
Income Segregation of Wealth (H, 90th Pctile)	0.18*** 0.01	0.13 0.11	0.13** 0.07	0.14** 0.03	0.13** 0.05
Income Inequality (Gini)		0.09 0.21	0.03 0.61	0.08 0.20	0.04 0.56
Black-Black Exposure Rate			0.28*** 0.00	0.35*** 0.00	0.22*** 0.00
Hispanic-Hispanic Exposure Rate			-0.11** 0.05	0.00 0.99	0.05 0.35
Asian-Asian Exposure Rate			-0.35*** 0.00	-0.09 0.11	-0.09 0.09
Average Commute Time				-0.33*** 0.00	-0.24*** 0.00
Population Density				-0.11** 0.04	-0.13** 0.02
Average Year Built				-0.12** 0.04	-0.26*** 0.00
Owner Occupancy Rate				0.28*** 0.00	0.18*** 0.00
Average Home Value				-0.15** 0.02	-0.06 0.30
MSA Size		X	X	X	X	X
Census Division Fixed Effects					X
R-squared	0.02	0.03	0.30	0.50	0.55

Table 5 shows an incremental regression results and p-values. The beta coefficients in the

top row are standardized, indicating the effect of a one standard deviation increase in the

dependent variable. So, for instance, in model (1), a one standard deviation increase in

income segregation corresponds to a .18 standard deviation increase in housing wealth inequality. The second row contains the p-value.

A one standard deviation increase in segregation of the wealthy increases housing wealth by .13 standard deviations in most specifications. This coefficient is stable when other variables are included. Income inequality has a positive but small effect on housing wealth inequality, with standardized coefficients ranging between .01 and .05 in the five models.

The inclusion of measures of racial segregation increased the r-squared from .03 to .30, suggesting that these spatial divisions explain far more of the variation in housing wealth inequality than measures of income inequality and sorting alone. Measures of the isolation of Blacks has the strongest relationship with housing wealth inequality, increasing housing wealth inequality by .22 standard deviations in the full model. The isolation of Asians and Hispanics has a negative coefficient when first introduced, but this impact may be because racial segregation is proxying for the characteristics of regions like California cities where Asian and Hispanic populations are highest. When housing and regional characteristics are included, these effects disappear. The 5th model includes census division fixed effects, absorbing the average impact of each census division, and providing estimates that evaluate the impact of the variables within divisions.

Conclusions

Though spatial variation in home prices and mortgage lending have been systematically and thoroughly studied, this is the first attempt to systematically evaluate housing wealth

inequality by urban region. Much work on home equity has focused on individual decisions about timing, mortgage quality, and neighborhood choice. This research takes a systemic view, finding that regional residential patterns are strong drivers of housing wealth. Strong variation in housing wealth inequality between cities validates this approach: there is something about regional housing dynamics that structures the opportunity for homeowners to accumulate wealth through housing. As a low risk leveraged investment, through mechanisms of forced savings and the ability to transform sweat equity into home equity, housing offers a pathway to the middle class and for many American households, the only opportunity to accumulate wealth. However, this opportunity not only varies with demographics, but by city. Wealth inequality not only varies substantially by MSA, but is highly correlated with residential patterns of income, and particularly racial segregation – even without taking into account the vicissitudes of the foreclosure crisis and the uneven recovery on housing wealth.

Contrary to theories that income must be the strongest driver of housing dynamics, income inequality was not strongly related to housing wealth inequality in bivariate correlations, nor in any specifications of the regression model. These results demonstrate that, in this time frame, various forms of spatial segregation have a far stronger impact than income inequality on housing wealth inequality. This research uses granular measures of segregation, that measure concentration at the census tract level. Without a measure of jurisdictional segregation, this analysis cannot clarify which mechanisms are responsible for the relationship between housing wealth inequality and segregation. For instance, some mechanisms of granular sorting include proximity to amenities like parks

or public transportation hubs; or self-sorting into communities of preference as individuals choose to buy homes near others who are similar to them in race, family status, and income. Jurisdictional-level segregation can be the result of home price discontinuities where public goods are gated by jurisdiction. This could be due to strong differences in school quality, differing tax rates between counties and municipalities, or exclusionary zoning (Lens & Monkkonen, 2016).

In 2000, in regions where the wealthy clustered in enclaves, housing wealth inequality is higher. The segregation of wealth was shown to have a moderate, positive impact on housing wealth inequality even when controlling for income inequality and other factors. This suggests that housing wealth inequality responds strongly to residential patterns, and forces like exclusionary zoning, jurisdictional fragmentation, and self-sorting. Whether this is related to jurisdiction level sorting or the more granular sorting caused by distributed self-selection that increasingly characterizes our era is beyond the scope of this analysis.

Racial segregation was a strong predictor of housing wealth inequality, even after controlling for income inequality and income segregation. The isolation of Blacks is associated with far higher housing wealth inequality. These results come prior to the housing market crash and foreclosure crisis, and are measured during the peak of the bubble, when subprime lending and loose credit was at its highest. In 2005, Black homeownership was still at record levels. At this time, predominantly Black communities had been experiencing predatory lending and high foreclosure rates for a decade, but the vicissitudes of the subprime mortgage crisis were not yet realized.

There was no confirmed relationship between housing wealth inequality and Hispanic residential isolation. I checked whether this was related to the regional concentration of Hispanics in the Pacific and Southwest regions. I tested the regression in Table 5 by census division, and then in a limited sample of cities where Hispanics are greater than 10% of the population. However, Hispanic isolation was not significant in these regressions either. This is similar to analyses of negative equity and Hispanic race; when controls and regional fixed effects were added, there was no relationship between high concentrations of Hispanic populations and negative equity (Raymond, 2016). It is possible that Hispanics tend to live in cities that had low housing wealth inequality in 2005; but the results also suggest that non-Black racial and ethnic segregation is less detrimental to housing wealth accumulation than Black racial segregation.

Lens and Monkkonen (2016) found that local pressure to regulate land uses results in increasing segregation of affluence. In this research, we find an important consequence of the isolation of affluence: even more than income inequality, income segregation drives widening wealth inequality. Segregation by race has a similar, and even stronger impact. This research underscores the importance of equitable and fair zoning policy at the local level.

Chapter 3: Racial Segregation, the Subprime an Foreclosure Crises, and Urban Housing Wealth Inequality During the Crash (2005-2015)

Introduction

The period from 2005 to 2015 saw steep increases in housing wealth inequality. The Black-White housing wealth gap widened drastically, with Black housing wealth substantially depressed relative to the early 2000s. It is well documented that subprime lending was targeted at predominantly Black communities and that the problem of clustered foreclosures, persistent negative equity, and sluggish home price recovery was disproportionately an issue in majority Black neighborhoods (Reid, Bocian, Li, & Quercia, 2016). Nonetheless, analysis in the prior section confirms that housing wealth inequality was an issue even during the previous era. In this section I evaluate the change in MSA level housing wealth inequality and see whether changes are attributed to racial segregation or other causes. In particular, I ask whether subprime lending and the associated fallout accounts for most or all of the association between Black segregation and rising housing wealth inequality.

Literature Review: Mortgage Debt and the Impact of Mortgage Markets

A key determinant of housing wealth accumulation is mortgage finance. The cost of mortgage finance and the amortization schedule directly affects the ability of homeowners to acquire home equity. Additionally, the riskiness of mortgage finance

affects the ability of homeowners to weather economic downturns, and sell their homes at a time which will allow them to maximize capital gains, rather than at the low point of the market. Finally, mortgages have been found to be strong determinants of home prices. Mortgage market imperfections can increase or reduce home prices and can amplify sorting and segregation.

Mahoney and Thelen (2010) and Streeck and Thelen (2005) describe institutional change as a process which can occur through layering. The institutional landscape of mortgage lending changed dramatically in the 1990s in ways which interacted with urban landscapes of segregation. Mortgage finance has historically operated to exacerbate existing social divides. The post-war programs put into place to support mortgage markets engaged in race-based geographic discrimination called redlining. Under this practice, government agencies marked out urban neighborhoods with high concentrations of minorities as high risk. These areas were denied mortgage finance for renovations or home purchase, thereby pushing urban, minority communities to seek higher risk finance, or to forgo homeownership or improvements altogether. In the 1990s and 2000s, many of these neighborhoods were targeted with high concentrations of predatory loans (Immergluck, 2011; Rugh et al., 2015; Rugh & Massey, 2010).

The lack of formal relationships with traditional mortgage lenders has been documented as one reason why minority borrowers were receptive to subprime lenders in the 1990s and 2000s, with some authors emphasizing a lack of familiarity or existing networks and experience to integrate borrowers with trustworthy borrowers (Williams, Nesiba, & McConnell, 2005). Others blame credit segmentation and risk-based pricing itself,

arguing that in an era of restricted market areas and standardized products, banks cross-subsidized loans, reducing the tendency of loan terms to amplify existing inequalities in wealth. In the era of risk-based pricing and geographical deregulation, these pressures were reduced (G. A. Dymski, 2009). Squires et al. (2009) believe that segregation and subprime lending are connected through four pathways. The first is that historic exclusion from traditional prime mortgage markets created concentrated demand for mortgage products. The second is related to the idea that informed financial decision making may be transmitted through social networks. Segregated minority communities may be less experienced financial consumers. Third, lenders may market heavily in high minority areas, a strategy dubbed "reverse redlining." Fourth, though subprime mortgages were offered to many borrowers who were qualified for a prime loan, subprime products were targeted at higher risk borrowers. Because segregation is associated with economic distress, it is possible that highly segregated cities have higher numbers of high risk borrowers to begin with.

These different pathways correspond to different types or spatial patterns of segregation. Financial exclusion can sometimes be related to the distribution of financial institutions in a given area. Social network and "reverse redlining" phenomena should be related to large areas with high minorities, those typically measured by an isolation index, or perhaps related to the patterns of segregation seen in the "group threat" or jurisdictional forms of segregation. The fourth relationship suggests that subprime lending is related to income sorting which may underlie racial segregation, suggesting that once one controls

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for economic characteristics like income and creditworthiness, the association between racial segregation and high cost mortgages should disappear.

In general, the idea that income and creditworthiness alone can explain why minorities disproportionately received subprime loans has been discredited. Multiple individual-level studies with rich data on borrower income and creditworthiness have been performed which demonstrate that race was a significant predictor of more expensive loans, even after controlling for relevant loan and borrower characteristics (Bocian, Ernst, & Li, 2008; M. M. Smith & Hevener, 2014). Other research has established the relationship between subprime lending and segregated neighborhoods. Rugh and Massey (2010) find that segregated, minority neighborhoods were the disproportionate recipients of high risk loans. They note that while Black-White segregation has declined in cities with small Black populations, hyper-segregation or segregation which is high across multiple measures has remained high in cities with large Black minorities. In a regression controlling for a variety of credit and economic factors, they find that the degree of Hispanic and minority segregation is the strongest predictor of foreclosure. They confirm the role of racialized lending in a two-stage least squares regression which instruments for segregation using the Black-White gap in subprime lending. This study draws a tight link between high risk lending targeted at hyper-segregated minorities and foreclosures. Similarly, Rugh et al. (2015) studies the relationship between predatory lending and segregation in the hyper-segregated city of Baltimore. Their analysis confirms that subprime lending increased with income among Blacks, and decreased with income

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among Whites. This suggests that income sorting will not have as strong relationship with subprime lending as racial segregation.

The dynamics of mortgage lending during the 2000s probably increased inequality in housing equity in hyper-segregated regions by saddling Black homeowners with higher debt levels and lower ability to build equity (Rugh et al., 2015). Mortgages may also have increased inequality through their impact on home prices (Levitin & Wachter, 2012, 2013; A. R. Mian & Sufi, 2009). Because so many high risk loans created local housing bubbles ending in crashes and foreclosures, that as the foreclosure crisis progressed, neighborhoods with long periods of vacancy exhibited the cumulative effect of multiple downward pressures (Harding, Rosenblatt, & Yao, 2009; Immergluck & Smith, 2006). Vacant homes have a well-researched negative effect on neighboring home prices during this crisis (Whitaker & Fitzpatrick, 2011). In addition, in many of these neighborhoods, low income homeowners may have been the wealthier residents. When foreclosures forced them to leave, they left more highly concentrated poverty behind. Under these circumstances, the disposition of vacant homes becomes very important for alleviating poverty, creating mixed income neighborhoods, and reducing crime.

There are a variety of studies which cover national trends in housing wealth inequality leading up to the 1990s (Flippen, 2004; Oliver & Shapiro, 2006) and through the subprime and foreclosure crises (Shapiro et al., 2013; Taylor et al., 2011) but few which examine this phenomenon at a local scale. Krivo and Kaufman (2004) examine the unique processes which drive inequality in housing wealth between socioeconomic groups, and include some regional measures. They examine housing wealth accumulation

using the 2001 American Housing Survey data (AHS) and a rich household-level of

covariates. In a set of models predicting home equity by race/ethnicity, they find that

higher levels of Black-White segregation are associated with higher home equity for

Blacks. Living in the South and West predicted higher levels of equity for most groups;

living in the central city was negatively associated with home equity for all groups. Prior

homeownership and down payment size were key determinants of home equity for

Whites and Asians, but not for Blacks and Hispanics. Many theories of the relationship

between home prices and segregation describe how demand or supply constraints are the

mechanism by which unevenness occurs. However, when Krivo and Kaufman (2004)

estimate the impact of metropolitan level starts and home prices on home equity for

Whites, Blacks, Hispanics and Asians, they find no significant impact of starts on equity,

but home price level has a strong impact on equity by race.

One study that tries to examine wealth inequality in a spatial context (Foster & Kleit,

2014) addresses this question of what drives wealth inequality with three (1990, 2000,

2010) decade-lag, county-level regressions. This study evaluates the impact of mortgage

type on wealth inequality. The main weakness of the study is that they cannot measure

wealth inequality directly and instead use a proxy, income inequality, as their dependent

variable. Their findings – similar to Lee (2013) – are that subprime lending in some time

periods and local contexts reduced income inequality, though in other time periods and

contexts, it increased inequality. For example, subprime lending temporarily lowered

racial and income segregation during the bubble, but exacerbated segregation trends

during the crash and recession. Foster and Kleit (2014) suggest that housing had an

equalizing effect until the 2000s and that subprime lending had mixed impacts on wealth inequality. One weakness of their study is that they estimate inequality at the county level, which can alternatively be interpreted as a measure of integration. This suggests that subprime lending may have reduced segregation at the county level.

Another recently released study most relevant to the goals of this research is *Underwater America*, released by the Haas Institute (Dreier, Bhatti, Call, Schwartz, & Squires, 2014). In a cross-sectional study of underwater housing using primarily simple descriptive statistics, they find that underwater homes are extremely concentrated in a handful of cities, and within those cities, in a few zip codes. They found indications of strong correlations between negative equity, low income, and minority status, suggesting that segregation is strongly correlated with the uneven housing market recovery and the loss of, or lack of wealth accumulation of some households. Using the same dataset, Zillow issued a 2014 brief on housing wealth inequality, using the Gini index calculated at the county level (Hubbard, 2014). Again, in cities with small counties, this might be a better measure of integration than housing inequality. They find that housing wealth inequality is highest along the coasts. They split housing equity into quintiles, and estimate the contribution to the Gini index measured at four spatial scales: city, county, MSA and state. They found that the low and high ends of the spectrum contribute strongly to housing wealth inequality. Raymond (2016) uses this same dataset to predict negative equity in the Southeast and finds that predominantly Black neighborhoods have far higher rates of concentrated negative equity. This was true even after controlling for an array of

economic and housing market indicators, as well as mortgage market indicators like subprime lending and the density of foreclosures.

The key assumption I wish to test in this chapter is that housing wealth inequality relates to racial and income segregation significantly through mortgage practices like risk-based pricing and subprime lending. High risk lending in racially segregated areas, the subprime and foreclosure crises, and uneven response, are key drivers of widening inequality (G. A. Dymski & Veitch, 1996; Immergluck, 2011). In the post-crisis era, tightening credit and risk-based pricing amplify income sorting or segregation between and within cities and generate increasing returns to income/wealth through regressively pricing of mortgage debt.

Figure 5 depicts in blue the relationship between forms of income sorting and racial segregation, and housing wealth inequality. In an analysis testing the relationship between the variables of interest, and the outcome variable, housing wealth inequality, there are other variables which can be included to reduce variation or control for alternative explanations. First, there are variations in housing quality and variation in location quality, depicted in yellow. Second, the institutional framework of mortgage markets, shaded in red, vary from city to city and has been found to govern the local intensity of subprime lending.
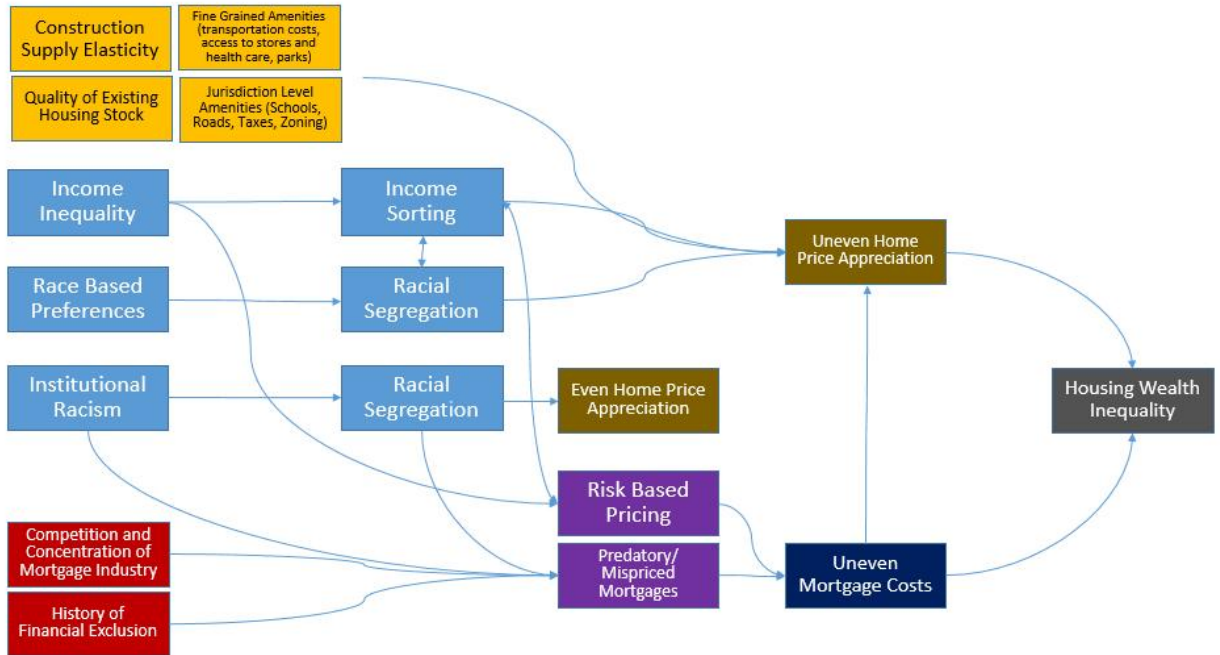
Figure 5: Conceptual Map

There are several complications attending to an investigation of the relationship between segregation and housing wealth. First, mortgage lending is often cited as a contributing factor to segregation, whileanother strain of research suggests that segregation lead to predatory lending in the 1990s and 2000s. This suggests the relationship between mortgage debt and segregation has endogeneity, at least over the long term. Second, theory suggests the relationship between segregation and home prices is not monotonic – segregation can cause home prices to increase or decrease, depending on the presence of supply constraints like exclusionary zoning. Third, the degree to which preferences are heterogeneous or homogenous, and the degree to which preferences are capitalized into price or whether a sorting equilibrium is reached mediates the impact of income sorting on home prices. That is, income sorting has been theorized to increase home price

inequality by some, and to decrease it by others. Fourth, the geographic scale of segregation is a key aspect of measurement.Capturing segregation at the appropriate spatial scale will be technically difficult but key to results.

Methods and Data

Methods

In this chapter I seek to understand how the subprime mortgage crisis affected regional housing wealth inequality between 2005 and 2015, and whether it provides a stronger explanation for increases in housing wealth inequality than other relevant factors.

Question 3: Is mortgage lending a significant mechanism by which racial segregation impacts housing wealth inequality?

H3: Housing Wealth Inequality is higher in the presence of racial segregation, primarily through the mechanism of subprime lending which resulted in long-term depression in home prices and higher mortgage prices in hyper-segregated areas.

The previous two sections investigated relationships between housing wealth and racial segregation and sorting suggested by the literature on home price dynamics. This section examines the contribution of mortgage markets in the contemporary housing markets. In order to see whether subprime lending is the mechanism by which segregation influences housing wealth inequality, I will add measures of mortgage lending to the equation, using data from before and after the housing market crisis. Because of the association, I expect here that the inclusion of factors related to the housing crisis will deflate the measures of racial segregation, particularly measures of Black isolation.

$$(1) \text{ Change in Housing Wealth Inequality}_i = \ + \ _1 \text{ Change in Income Inequality}_i + \ _2$$
$$\text{Change in Income Segregation}_i + \ _3 \text{ Change in Racial Segregation}_i + \ _5 \text{Subprime}$$
$$\text{Loan Share } 2005_i + \ _6 \text{Post-Crisis Vacancies}_{i2012} + \ _7 \text{Change in Age of Housing}$$
$$\text{Stock}_i + \ _8 \text{Change in Owner Occupancy Rate}_i + \ _9 \text{Change in Commute Times}_i +$$
$$_{10} \text{Change in Population Density}_i + \ _i$$

The main challenge to validity here is that racial minorities tend to live in regions with particular urban characteristics, and the size of a minority community tends to be mechanically positively correlated with measures of segregation. For example, Hispanic populations are clustered in Southern California, and the Southwest: cities which tend to be sprawling and have low density. Cities with the largest Black populations are found throughout the Southeast, in cities which tend to be even more sprawling than those to the West. Urban processes affected the trajectory of the recovery in many cities. Included in the model are two measures of housing market, the age of housing stock and owner occupancy rate; and two measures of compactness, population density and commute times. In order to measure the impact of segregation and sorting on housing wealth inequality, I use a first differences approach, estimating the impact of change in income sorting, income inequality, and racial segregation, among other variables. The only variables which are not expressed as change scores are the variables of interest, subprime lending, and post-crisis vacancies.

Data

I use the same 258 MSAs as in the analysis in Chapter 2 for continuity of results. In this analysis, I calculate the change in Housing Wealth Inequality between 2005 and 2015. I

also calculate changes in factors included in the analysis in Chapter 1: income sorting, income inequality, racial segregation, housing market and measures of regional compactness. I then include two measures of the subprime and foreclosure crisis: the percentage of all mortgages that were subprime in 2005, and the percentage of vacant homes in 2012.

Housing wealth is again calculated using CRISM's credit records and mortgage administrative records for 2015. Using data on the date, price and location of the initial home sale, I estimate current market value using Corelogic's home price indices. I then calculate Gini coefficients for each metropolitan and micropolitan area in 2015, and subtract from that each city's Gini coefficient for 2005. A weakness in this metric stems from the limitation that this data can only be used to calculate housing wealth inequality among mortgaged homeowners. This means if over time, in one city, distressed homeowners tended to exit homeownership either through foreclosure or home sales; and in another, distressed homeowners held onto their homes but remained in negative equity, all else equal, the second city would have a higher housing wealth inequality. Since we know that between 2005 and 2015, as many as 5% of households exited homeownership, this dynamic could be important.

Measures of income and racial segregation are drawn from the Diversity and Disparities project, 2000-2012. Other measures, including those capturing income inequality, housing market and regional compactness are drawn from the 2000 Census and 2012 American Community Survey.

To estimate the magnitude of subprime lending, I calculate the percentage of subprime loans using 2005 HMDA data. The year 2005 is chosen because it was near the peak for the issuance of subprime loans, and because underwriting was particularly poor in this year and led to high rates of subsequent default. From 2004 onwards, HMDA required reporters to report the annual percentage rate (APR) for all loans in which the rate spread between the loan and a comparable maturity treasury security was higher than benchmark. For primary mortgages, that benchmark was 3%. For second liens, it was 5%. These loans meet the definition put out by the Consumer Finance Protection Bureau of subprime or higher-priced loans. This is the definition I used to identify the percentage of mortgage originations that were subprime in 2005.

There were multiple channels by which the foreclosure crisis depressed home prices and created uneven home price appreciation in a city. Distressed sales tended to depress local home prices when they were included as comparable by appraisers for non-distressed sales. The period of deterioration leading up to a foreclosure tended to depress nearby home prices. One of the most deleterious effects of the foreclosure crisis for home prices was prolonged vacancies in bank-owned or investor owned homes. To measure the prevalence of these properties, I use the ACS measure of other vacant homes that are not for sale or rent in 2012.

Again, as in Chapter 2, I include measures of housing market, owner occupancy rate and average age of housing and measures of regional compactness, population density and commute times. Summary statistics for all variables are found in Table 6.

Table 6: Summary Statistics

Observations: 258 MSAs	Mean	Std. Dev	Min	Max	Source
Housing Wealth Inequality	0.11	0.19	-0.21	1.12	Author Calculated, 2005-2015
Change in Isolation of Wealth	0.01	0.01	-0.05	0.08	Diversity & Disparities; Census 2000-ACS 2012
Change in Income Inequality	0.01	0.02	-0.06	0.06	ACS 2006-ACS2012
Change in Black-Black Exposure Rate	-3.32	3.14	-13.82	13.75	Diversity & Disparities; Census 2000-ACS2012
Change in Hispanic-Hispanic Exposure Rate	4.02	2.44	-2.72	10.92	Diversity & Disparities; Census 2000-ACS2012
Change in Asian-Asian Exposure Rate	1.98	1.74	-4.71	15.00	Diversity & Disparities; Census 2000-ACS2012
Percent of loans subprime in 2005	0.26	0.05	0.11	0.48	Census 2000-ACS2012
Vacant Homes, 2012	7.10	4.43	2.26	53.17	Census 2000-ACS2012
Change in Commute Times	0.43	1.87	-4.06	10.71	Census 2000-ACS2012
Change in Population Density	21.99	129.28	-510.01	276.44	Census 2000-ACS2012
Change in Year Built	6.05	3.76	-2.96	25.49	Census 2000-ACS2012
Change in Owner Occupancy Rate	66.27	5.03	52.24	80.03	Census 2000-ACS2012

Results

Housing wealth rose dramatically over the 10-year period between 2005 and the 2015.
From the peak of the housing crisis through to 2015, among all US metro and
micropolitan areas, housing wealth inequality rose by .12, from .54 in 2005 to .68 in
2015. In the 258 MSA sample, the housing wealth Gini coefficient rose by an average of
.11. By contrast, income inequality only rose by .01. While housing wealth inequality
increased across the board, some cities saw declines in housing wealth inequality, but
others saw extremely strong increases. Because of high levels of negative equity, some
Gini coefficients in the 2015 period are higher than 1, and in one case rose by 1.12 over
the decade (Jenkins, 2005).

In Figure 6, I have broken out the change in housing wealth inequality by region. In this
chart, we see that the Pacific and Mountain regions went from having the lowest housing
wealth inequality to the highest housing wealth inequality in the nation. The Northeast
also rose from the bottom to the middle of the pack.
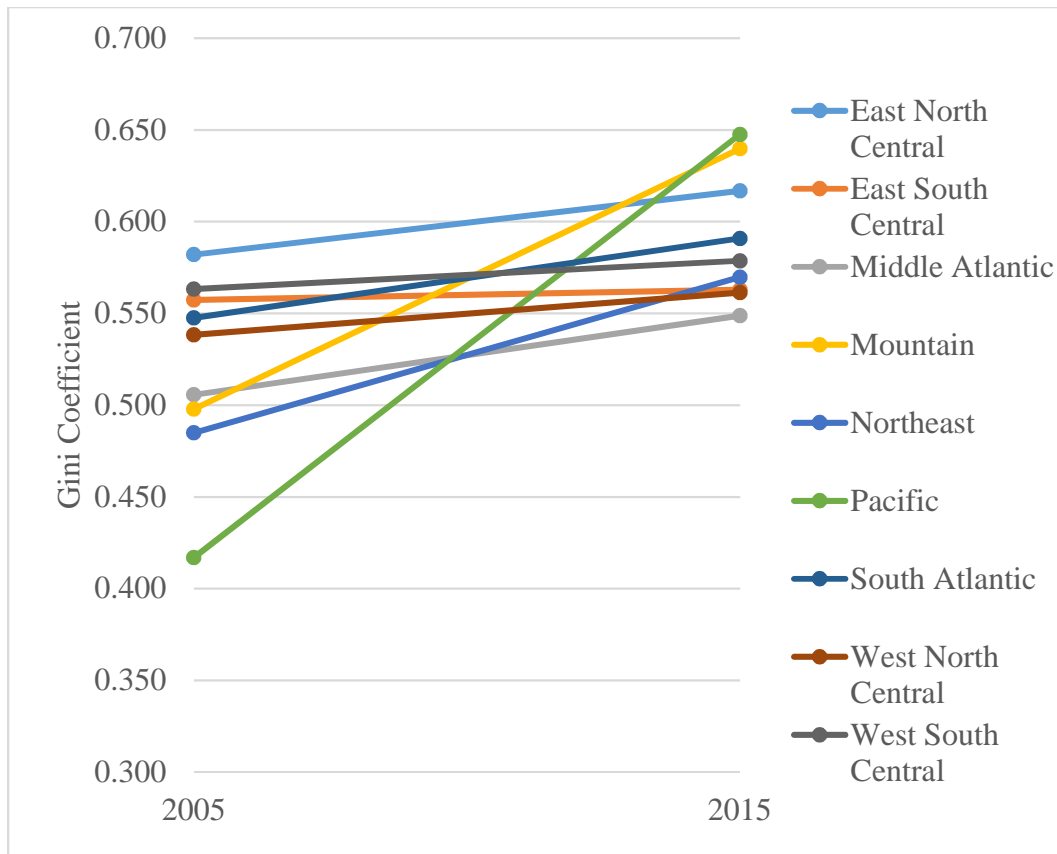
Figure 6: Change in Housing Wealth Inequality by Region, 2005-2015

Housing markets in census regions can share characteristics like a low housing supply elasticity, or high Hispanic population, which do not change substantially over a 10-year period. Many of the factors thought to influence home prices do not change at the rate which housing wealth inequality shifted over the last 15 years. In a cross sectional regression, this could increase the risk of omitting relevant variables. Using a first differences approach to understand the impact of social factors on the change in housing wealth helps to ensure that any detected correlation between high housing wealth inequality and independent variables is not spurious, but is indeed related to changes in the underlying factors.

In Table 7, I display the results for the regression. Sometimes a first-differences approach eliminates too much variance to have explanatory power, but in this model the r-squared value is .29; the model explains one third of the variance. The VIFs for all variables were below 2. The leftmost column displays standardized or beta coefficients; as before, they show how a one standard deviation increase in the variable impacts the dependent variable. So, a one standard deviation increase in income inequality is associate with a .19 standard deviation increase in housing wealth inequality. Variables in blue are significant at the .05 level.

Changes in the isolation of the wealthy were not strongly associated with housing wealth inequality. This counters other research at the zip code level that suggests that housing wealth inequality is driven primarily from price increases at the high end (Hubbard, 2014).

However, changes in income inequality and changes in racial and ethnic segregation were strong and significant. Income inequality increased slightly over the 12-year period, and had a strong and significant association with higher housing wealth inequality. On average, Black isolation declined by 3%, while Hispanic isolation rose by 4%. Both factors were positively associated with strong increases in housing wealth inequality at the regional level. Average change in Asian residential isolation was lower, at 2%, and this change was not significantly related to housing wealth inequality in the model.

Table 7: Regression Results

Obs 258   R squared: .30

Predicted: Change in Housing Wealth Inequality, 2005-2015	Coefficient	Standard Error	t	P>t	Beta
Change in Isolation of Wealth	1.49	1.01	1.48	0.14	0.09
Change in Income Inequality	2.08***	0.74	2.83	0.01	0.19***
Change in Black-Black Exposure Rate	0.01***	0.00	2.58	0.01	0.17***
Change in Hispanic-Hispanic Exposure Rate	0.02***	0.01	2.53	0.01	0.21***
Change in Asian-Asian Exposure Rate	0.02*	0.01	1.84	0.07	0.17
Percent of loan originations that are subprime in 2005	0.65**	0.29	2.26	0.03	0.17**
Vacant Homes, 2012	0.01***	0.00	2.48	0.01	0.19***
Change in Commute Times	0.01	0.01	1.41	0.16	0.10
Change in Population Density	(0.00)	0.00	(0.72)	0.47	(0.07)
Change in Year Built	0.00	0.00	0.68	0.50	0.05
Change in Owner Occupancy Rate	(0.01)***	0.00	(3.09)	0.00	(0.26)***
Constant	0.43	0.21	2.08	0.04	

Subprime lending in 2005 varied from 11% to nearly half of all mortgage originations for some metropolitan areas. This factor and long-term vacancies were both large and significant predictors of housing wealth inequality. Additionally, the change in the owner-occupancy rate can be thought to be a third measure of the foreclosure crisis. From 2005 to 2015, nearly 6% of households exited homeownership as the homeownership rate

fell from its all-time high of 69% to a 50-year low of 63%. In this model, declines in homeownership correspond with a .05 increase in housing wealth inequality Gini. I did test models with foreclosure rate as an independent variable and the standardized coefficients were extremely high, approaching 1. However, foreclosure was highly collinear with both subprime lending and vacancies. For this reason and because the foreclosure dataset matched with just under 100 MSAs, cutting the sample by more than half, I used other metrics instead.

In a model without these three measures of the financial crisis - subprime lending, vacancies, and homeownership declines - coefficients for Black and Hispanic isolation is .17 and .27, respectively. The inclusion of these factors related to subprime lending in the model had no impact on the explanatory of changes in Black segregation, but reduced Hispanic segregation by a fifth. This contradicts my expectation prior to performing the analysis, which was that housing wealth inequality increases associated with Black segregation would be largely, if not completely, explained by the subprime crisis and subsequent foreclosures and clustered. These findings suggest that in cities where racial segregation increased through the downturn and recovery, wealth inequality increased strongly. In cities with strengthening Hispanic segregation, this was directly related to the subprime and foreclosure crisis. In cities with strengthening Black segregation, it is possible that other factors to do with the unevenness of the housing recovery may be more important.

Conclusion

This research confirms results found elsewhere that housing wealth inequality rose swiftly between 2005 and 2015. Metropolitan areas in the Northeast, the Pacific, and Mountain regions saw swifter increases in inequality than other regions.

As in the pre-crisis era analysis in Chapter 1, this analysis confirms that racial segregation is strongly associated with metropolitan housing wealth inequality. Unlike that analysis, changes in income inequality rather than changes in income segregation were the more powerful driver of housing wealth inequality.

A second goal of this research was to understand if the effects of the foreclosure crisis were the primary way in which racial segregation relates to housing wealth inequality in the current era. This model evaluates the impact of changes in racial segregation over the decade on changes in housing wealth inequality over the decade. However, measures of subprime lending and vacancies did not completely deflate these coefficients; in the case of Black residential isolation, the coefficient was largely unchanged by the introduction of subprime lending to the model. Other research has established that subprime lending was primarily targeted at predominantly Black communities. The finding in this model is likely due to the way racial segregation was measured. High rates of Black residential isolation have been connected to high rates of predatory mortgage lending, followed by clustered foreclosures and vacancies that directly impact home equity. However, expressed as a change score, metropolitan trends in racial isolation are probably indirectly related to subprime lending through patterns of gentrification and neighborhood change. While measuring the change in segregation allows for a stronger

link to be made between measures of segregation and housing wealth inequality, it weakens the tie between subprime lending and segregation.

The model in Chapter 2 showed relationships between housing market characteristics like overall age of housing and owner-occupancy rate, and between measures of compactness like population density and commute times. This regression finds no association between a decade of change in housing market characteristics and increases or declines in housing wealth inequality. The relationships between these factors may take longer than a decade to evolve, or it is possible the housing crisis altered fundamental relationships that may have characterized an earlier era. Similarly, there is no relationship between changes in measures of compactness. Some research has suggested that cities with low price elasticity of supply had more prolonged and uneven recoveries, as the overhang of properties built during the bubble depressed home prices in the suburbs. This model does not confirm those findings.

There is a growing body of research demonstrating the impact that the subprime and foreclosure crises had on housing wealth of individuals, and in widening the wealth gap between White, Black and Hispanic homeowners. This chapter examines how dynamic changes during the crisis and recovery period may have structured outcomes for homeowners in those regions. The housing crisis of the late 2000s was a period of massive and rapid change in housing markets, policy implementation, and institutional framework for mortgage markets. This analysis evaluates the impact metropolitan level changes had on the evolution of housing wealth inequality over a 15-year period. In the

next section, I examine the impact of segregation and mortgage lending on housing

wealth inequality in a series of individual level models.

Chapter 4: Risk-Based Mortgage Lending, Income Segregation, and Urban Housing Wealth Inequality During the Recovery (2010-2015)

Introduction

Mortgage terms and availability are a key determinant of a homeowner's ability to accumulate home equity. Simultaneously, the cost of a mortgage, tax benefits, and tie between balance sheet and the performance of the home as an asset is thought to increase pressure on homeowners to self-sort into locations where prices are expected to rise. In this chapter, I examine the impact of risk-based mortgage pricing and income sorting on housing wealth inequality using individual-level data on home mortgage borrowers.

Mortgage market institutions have changed drastically over the past decades. The infrastructure of mortgage markets has shifted away from public agencies subsidizing affordable, low-risk mortgage products for homeowners, facilitating individual homeownership. Mortgage markets have shifted towards private markets and segmented products since the post-war creation of institutions to engender wide spread homeownership. The institutions supporting individual homeowners have moved towards supporting corporate lenders and mortgage markets (Aalbers, 2008; Immergluck, 2011; Krippner, 2005; Levitin, 2013). In the current era, Fannie Mae and Freddie Mac remain under conservatorship following losses during the subprime and foreclosure crisis. Management under conservatorship implemented many risk-based pricing policies. Most recently, the Obama administration proposed privatizing the mortgage giants, and the

Trump administration has made this even more likely. Scholars studying the financialization of housing markets have focused particularly on the practice of risk-based pricing as a factor which might amplify inequality (Aalbers, 2009).

Mortgage policy is not executed in a vacuum, but is implemented in the social space of neighborhoods and real estate markets. There are some indications that, like racial segregation, income segregation is highly correlated with rising housing inequality. At the national level, housing wealth inequality has widened along class lines over the last thirty years. In the current era, legalized racial segregation at the jurisdictional level is declining, while decentralized income segregation is rising. Rising housing wealth inequality could plausibly be caused by the changing bases of racial segregation, rising income sorting, and the damage to housing wealth done by subprime lending.

However, little research has attempted to understand how urban patterns of segregation and integration contribute to the dynamics that generate housing wealth, or to perform multilevel analyses to understand how national trends interact with regional patterns to produce inequality. Is homeownership a path to the middle class in some regions more so than others? Do nationwide policies like risk-based mortgage pricing amplify housing wealth inequality, and does that impact vary with income segregation? To answer these questions, I construct a dataset to measure the distribution of housing wealth within urban regions. With this dataset, I use spatial variation to analyze the relationship between racial and income segregation and housing wealth inequality. In this research, I investigate whether mortgage finance is a mechanism by which income based segregation impacts housing wealth inequality.

Literature Review

Income Segregation and Housing Wealth Inequality

This research examines the impact of income segregation on housing wealth inequality. Income segregation is rising in the United States (Ellen, Horn, & O'Regan, 2012). Watson (2009) finds that income sorting rose between 1970 and 1990, and has remained at 1990 levels for two decades. Against a backdrop of stable or declining racial segregation, other researchers have found rising isolation of poverty beginning in the 1970s, and in the 1980s onwards, rising isolation of wealth (Bischoff & Reardon, 2013; Fry & Taylor, 2012; Watson, 2009). Income sorting declined during the period of general affluence (and the rise of subprime lending) in the 1990s but rose again afterwards. However, Fry and Taylor (2012) note that income sorting remains less prevalent than racial segregation, and that segregation and sorting vary widely by city and region.

What is the cause of rising income sorting? One source may be a reduction of racial segregation, permitting greater neighborhood choice for well-to-do racial minorities (Bischoff & Reardon, 2013; Sharkey, 2013; Wilson, 2012). Another cause of increased income sorting is rising income inequality. Watson (2009) uses an innovative metric to measure income segregation and finds that income inequality almost completely explains rises in income sorting from 1970-2000. Bischoff and Reardon (2013) find that income inequality is highly correlated with the segregation of affluence, but not the segregation of poverty.

The geographic scale of sorting and segregation lend clues as to the causes of income sorting. Overall, contemporary income sorting does not follow a city vs. suburbs pattern.

Instead, segregation became higher within city centers and within the suburbs. Watson (2009) infers from this that income sorting may be driven by intensified competition for very fine grained local amenities (like parks, proximity to retail, or neighborhood status), but not public goods – like schools - provided at the local jurisdictional level. Similarly, Davidoff (2005) measures contemporary income sorting and attempts to differentiate between Tiebout sorting which occurs at the local jurisdictional level, and fine-grained amenity or Shelling-style sorting. Using 2000 census data on 279 metropolitan areas, Davidoff measures the variance in income segregation within and between jurisdictions, comparing zip codes on the borders of jurisdictions to control for variation in neighborhood composition and amenities. Focusing on the Boston MSA, he finds that jurisdictional boundaries account for only account for 2% of the variation in income, again suggesting that contemporary sorting is occurring around something more spatially fine grained than variation in taxation levels or school quality.

Another determinant of the rise of income sorting is density-based zoning. Watson (2009) and Davidoff (2005) find that income sorting likely occurs at the sub-jurisdictional level and is driven by income inequality, which they theorize to be evidence for amenity-based sorting or shelling-style sorting. Contradicting the findings of Watson (2009) and Davidoff (2005) is a set of research that finds that jurisdictional level factors are the primary driver of contemporary segregation. Most recently, Lens and Monkkonen (2016) study the relationship between density based zoning and income segregation in 95 cities nationwide. They find that density restrictions imposed at the jurisdictional level are powerful drivers of the segregation of affluence, but not the poor. State regulation is

associated with the isolation of poverty. J. T. Rothwell and Massey (2010) find a strong relationship between density zoning and income segregation in a study of US cities from 1990-2000, and with an instrumental variables approach, find this relationship is causal. In an earlier article on the changing bases of segregation, Massey et al. (2009) note the rise in segregation by income as well as class, as measured by educational attainment, ideology, and employment sector. Though the market allocates housing by price, in a perfect housing market there would be complete income sorting, they attribute the rise in income sorting not to the marketplace, but to density zoning.

How can we expect rising income segregation to affect housing wealth inequality? There is a broad literature that relates housing wealth and income, and empirical research has demonstrated that housing markets are often segmented by income and price, among other factors, so that in certain time periods and cities, home prices rise in ways that amplify existing economic inequality. Di and Liu (2007) and Krumm and Kelly (1989), study wealth accumulation during the 19909s. They find that high income families experience greater gains to homeownership than the low-income families in their sample. In a study of matched purchase and sales data in four cities, Belsky and Duda (2002) find that residential real estate at the bottom of the spectrum appreciates far faster than those in the middle or higher end of the spectrum. McMillen (2008) looks into why the percentage of expensive homes increased in Chicago between 1995 and 2005. He finds that increasing demand, rather than changes in housing stock explain the change. Boehm and Schlottmann (2008) also find that housing wealth increases with income. They estimate a dynamic model of family wealth accumulation using PSID's longitudinal data

on household wealth from 1984-1992. They observe that housing appreciation is roughly the same for their four socioeconomic groups, but even so, average annual housing wealth accumulation increases with socioeconomic status.

It is possible for this sort of housing market segmentation to occur without segregation – for instance, in integrated communities with mixed housing types and price levels. However, segregation may amplify housing segmentation dynamics. Because there are externalities to home prices, the degree of segregation may amplify the impact of income inequality on real estate values. Additionally, because home prices incorporate the value of local amenities, sorting and segregation may result in wide discrepancies in the local endowment schools, access to jobs, public transportation, and other public goods, which are then capitalized into price. The literature on income sorting is not always clear about whether uneven home price movements documented are simply due to segmentation of the market, or whether there are other forces such as externalities at play. At stake is whether and how home price dynamics amplify or echo growing income inequality. If home prices diverge because markets are segmented by income and incomes are diverging, this suggests that housing wealth will not lead to increasing returns to income inequality.

One way income segregation can generate inequality is if segregation lays the groundwork for gentrification (Jacobs, 1961). Glaeser, Gottlieb, and Tobio (2012) analyze within-city home price dynamics during the 2000s housing boom. They show that, on average, places with centralized poverty had stronger price appreciation in the city center than in the suburbs. In a series of zip code level regressions using MSA fixed

effects from 1996-2006, they ask whether a supply elasticity or a gentrification model best explains the pattern of home price appreciation during the boom, finding that a gentrification model best explains these patterns. In particular, they focus on the importance of local public transportation infrastructure as a driver of gentrification. A significant weakness of this study is that they do not evaluate the impact of subprime lending as a potential cause of home price booms in areas with centralized poverty.

Guerrieri, Hartley, and Hurst (2013) investigate whether "endogenous gentrification" generates within-city variation in home prices. They believe the distribution of home values within an urban region is driven by the income distribution and income sorting. They ask whether neighborhood home price growth relative to the MSA is linked with income growth relative to the MSA; and whether poor neighborhoods are more likely to gentrify when they neighbor rich neighborhoods. They find that home prices are strongly tied to income growth, and that strong home price increases in places with affordable home prices are much more likely in areas which neighbor high price areas. They interpret this result to be the effect of Shelling-style sorting, with residents demonstrating a preference for living adjacent to higher income neighborhoods. These two papers present explanations for uneven recovery that are fundamentally different than the idea of market segmentation, which relies heavily on the idea of segmented markets responding to mismatched changes in demand and supply.

As fine grained income segregation rises, what impact will this have on housing wealth inequality? In this research, I attempt to understand this connection, particularly as it pertains to mortgage finance practices like risk-based pricing.

Mortgage Finance and Housing Wealth Inequality

Several factors of mortgage finance impact the ability of borrowers to accumulate wealth. The cost of mortgage finance and amortization schedule directly affects the ability of homeowners to acquire home equity. Additionally, the riskiness of mortgage finance affects the ability of homeowners to weather economic downturns, and sell their homes at a time which will allow them to maximize capital gains, rather than at the low point of the market. Finally, mortgages have been found to be strong determinants of home prices. Mortgage market imperfections can have the impact of increasing or reducing home prices and can amplify sorting and segregation.

In the post-recession era, credit tightness and the impact of risk-based pricing policies may have the effect of amplifying housing wealth inequality. In the aftermath of the crisis, the GSEs instituted loan level pricing for insurance fees, and private sector mortgage securitizers have added overlays in response to concerns of having to repurchase loans which are found retrospectively to not conform to GSE standards (Immergluck, 2015a; Wachter, 2015). Past researchers have observed that credit sorting and an increase in the cost of mortgage debt and the returns to creditworthiness should increase credit sorting (Hanson, Schnier, & Turnbull, 2012; Walks, 2014). Wachter (2015) describes two ways in which credit tightness and risk-based pricing may exacerbate geographic inequality. First, if lenders price risk in response to geographically specific income shocks, this will amplify inequality. Pavlov, Wachter, and Zevelev (2014) model this phenomenon between two cities, but presumably it could occur between two neighborhoods within a city as well. Second, housing affordability has

declined, and at the same time, sorting between metropolitan areas has increased, with low skilled workers sorting into lower tier cities and high skilled workers sorting into high tiered cities. Under these conditions, risk-based pricing may work to amplify the tenure gap in highly desirable cities.

A final way in which mortgage credit can translate into housing wealth is by repairing nearby home prices. Recent evaluations of the Home Affordable Refinance Program (HARP) and of Quantitative Easing (QE) are relevant here. HARP was released on 2009 as a response to the financial crisis and sought to allow distressed homeowners refinance at historically low rates and lower their mortgage payments. The program was tweaked over the course of several years, with loan to value and credit score criteria slowly relaxed, and ultimately reached 3.4 million borrowers. QE is a monetary policy by which the central bank purchased US treasuries and other financial assets to meet a range of goals. In the second and third rounds of quantitative easing, the US central bank purchased over a trillion dollars of mortgage backed securities. This had the impact of increasing investor demand for mortgages, and lowering mortgage rates in the primary mortgage market, which prompted a boom in mortgage refinances. Both HARP and the second and third rounds of QE lowered mortgage pricing; and research into these programs has found that borrower savings translate into faster local home price appreciation. In the case of HARP, researchers find that reduced mortgage pricing significantly reduced the probability of foreclosure for many borrowers, improved home prices, and helped boost consumption and the local economy. Zhu et al (2015) find that a 10% reduction in mortgage payment corresponded to a 10% reduction in the default risk

for borrowers. Agarwal et al. (2015) measure the degree to which mortgage savings passed through to local economies. They find that regions with more HARP refinances corresponded with more durable spending, reduced foreclosure rates, and faster home price appreciation. In similar research on the effect of QE on home prices, Beraja et al. (2015) examine the regional impact of refinances in the first round of quantitative easing (QE). The authors ask whether QE refinance activity at lower rates amplified or diminished regional economic differences. They find that in regions with low income and low land prices, QE was less ineffective as a stimulus. Because of this differential effectiveness, this refinance activity exacerbated inequality between regions.

These studies suggest that mortgage savings not only help households directly, but also indirectly through local spillovers into home price appreciation. This suggests that risk-based pricing, by decreasing mortgage rates for more creditworthy and typically wealthier borrowers, and increasing the cost of debt for less creditworthy, typically less wealthy borrowers, may amplify housing wealth inequality not only through the differential cost of debt, but also because the spillovers of these savings can translate into more quickly rising home prices. Spillovers of course are stronger when their effects are clustered, so if borrowers are segregated by wealth or creditworthiness, this income segregation may amplify the effect of risk-based pricing.

In the next section I measure housing wealth inequality nationally and as it varies between and within CBSAs. I then describe how income sorting and risk-based pricing interact to generate housing wealth inequality at the CBSA level. Subprime lending in the 1990s and early 2000s was an egregious example of mortgage pricing which was

influenced by race and segregation with long lasting consequences for housing wealth. It would be difficult to separately estimate the impact of racial segregation and risk-based pricing prior to the collapse of the subprime mortgage market. The post-crisis period may be easier timeframe in which to measure the impact of income segregation and risk-based pricing on housing wealth, because almost all recent mortgage originations have been conforming, and the vast majority of new mortgages are either held by the GSEs or guaranteed by FHA/VA. For this reason, I estimate the impact of risk-based pricing and income segregation on the accumulation of housing wealth from 2010-2015, understanding that this period was one of moderate levels of risk-based pricing.

Methods and Data

To analyze the impact of mortgage pricing on housing wealth inequality independently of racial discrimination in pricing, I look at individual data on mortgages originated in 2010, during a period when many predatory mortgage originators had ceased doing business, but when credit sorting and mortgage pricing policies were in effect. The choice of timeframe should go a long way towards separating these two issues. I also use individual level data and controls in addition to census tract and MSA level characteristics.

The dataset for this analysis is obtained from credit record and mortgage data. The advantage of this over other sources of data on housing wealth like the American Housing Survey, the Survey of Consumer Finances, or PSID is that this data has large samples for each metropolitan area in the United States, permitting the construction of housing wealth inequality metrics within each city, and analysis of how processeswithin the metropolitan area affect housing wealth inequality. The other advantage of this

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dataset is it provides a longitudinal panel of administrative data on all sources of mortgage debt, as well as other kinds of debt and financial and demographic information. Disadvantages are that though coverage is good, home value information comes from mortgage servicer data, which is a convenience sample, though I am able to mitigate this problem by describing how the characteristics of the sample differ from the population. The other disadvantage is that I have no data on homeowners who own their homes outright, which the 2010-2014 ACS estimates as 34.4% of all homeowners. Due to this data limitation, this analysis of housing wealth inequality is restricted to mortgaged homeowners.

Credit record data is drawn from the FRBNY CCP. This panel randomly selects 5% of all individuals with a credit record by SSN. I obtained records for June of 2015. I then matched these records with the CRISM dataset. This dataset contained a convenience sample of mortgage servicer's administrative data with credit records obtained from Lender Processing Services (LPS). I limit the CRISM data to just those records which are contained in the randomly sampled FRBNY CCP dataset. It would be possible to use the larger convenience sample of homeowners in the CRISM dataset, but by restricting the sample to those which I can match with randomly selected credit records data, I am able to evaluate how the data in the mortgage sample varies from the population. After limiting the dataset to those in the FRBNY CCP random sample, I then exclude all borrowers under the age of 18 or over 100, and limited the sample to counties within CBSAs. This left 11.9M records, representing 238.2M adults.

The FRBNY CCP contains data on first mortgages, close end seconds (home equity loans) and home equity lines of credit. Both datasets show approximately 1.9M individuals with mortgage debt, which translates to a population of 38.8M-38.6 M., or 16% of all records in the dataset. Using census data to check these figures, I find approximately 49M mortgaged homes, which divided by the adult US population of 240M, is 20%.

As shown in Table 8, this dataset excludes homeowners with multiple properties. Sampled homeowners have higher home equity installment balances and fewer home equity lines of credit than the overall population. Sample homeowners' first mortgage balance is lower than average, with a mean balance of $162 compared to $200 thousand dollars. Sampled homeowners are the same age, and have been homeowners just as long as the average homeowner.

Table 8: Sampling Bias

	Number of First Mortgages	Home Equity Installment Balance	Home Equity Revolving Balance	First Mortgage Balance	Oldest Mortgage (Years)	Age (Years)
Not In Sample	1.14	1,832.54	9,186.99	199,708.09	10.37	51.67
In Sample	1.00	2,205.47	5,931.13	162,311.34	9.89	51.26
All Mortgagees	1.08	1,982.06	7,881.59	184,714.30	10.18	51.50

The sample varies slightly by geography, with coverage as low as 35-40% in rural states like VT, WV and MS, and as high as 65% in states like AZ, NV and MS. The breakdown

by property type in the sample is 80% single family residences, 14% condos, townhouses, or 2-4 unit residences, and the remainders are other or unknown.

I calculate housing wealth by taking the sale price or in the case of a refinance, the appraised home value from LPS. I estimate the current value of the home by multiplying the value at origination by CoreLogic's single family combined, zip-code-level home price index in the month of sale, and divide by the June 2015 HPI. I then subtract the total balances of all mortgage and home equity debt from current home value to estimate housing wealth.

Using the individual measures of housing wealth, I calculate aggregate housing wealth inequality within each CBSA and analyze whether housing wealth inequality varies more between or within urban region. Because housing wealth can take on negative and positive values, I use indices that can accommodate negative values; the Gini coefficient and GE(2), also referred to as half the squared coefficient of variation. GE(2) is one of the family of generalized entropy indices. The factor 2 indicating the weight used in this variant; generally, as this weight increases from 0 to 1 to 2, the index becomes more sensitive towards wealthier members in the distribution (Jenkins & Jäntti, 2005; Salverda, Nolan, & Smeeding, 2009). The formula for GE(2) is:

$$GE(2) = \frac{1}{2n\bar{y}^2} \sum_{i=1}^{n} (y_i - \bar{y})^2$$

Using the Gini coefficient and GE(2), I calculate housing wealth inequality for the over 300 metropolitan CBSAs nationwide.

After calculating descriptive statistics of how housing wealth varies by region across the nation, I investigate the dynamics generating inequality within urban regions. I look at whether mortgage pricing and income segregation increase housing wealth inequality, and if there is an interaction between the two factors. The effect of income segregation on housing wealth can vary non-linearly by household wealth. To understand how income segregation and mortgage pricing affect housing wealth inequality throughout the distribution, I perform a series of quantile regression analyses as depicted in equation 1.

Equation 1:

Housing Wealth$_{ijk\,2015}$ = + Mortgage Pricing$_{ijk2010}$ + Interaction Term + Income

Segregation $_{k2010}$ + Individual Characteristics$_{ijk\,2015}$ + Census Tract Characteristics$_{jk2010}$ + CBSA Characteristics$_{k2010}$ + $_i$

In this model, I estimate the impact of mortgage pricing and income segregation at origination on 2015 housing wealth.

Income segregation is measured using the Riordan and Bischoff's H index, a rank information theory index which measures income segregation independently of income inequality. The H index is constructed by ranking incomes in a region, calculating the distribution of ranks within each census tract, and aggregating those figures. The index varies between 0, in which case the distribution of ranks within each sub-area is

equivalent, and 1 in which case there is no variation within any sub-area (Reardon & Bischoff, 2011).

Summary statistics for this measure and for all variables are depicted in Table 9. Controls include borrower age, income, non-housing debt, starting home value, and loan-to-value at origination. At the neighborhood level, I control for 2010 census tract characteristics for percent Black, percent Hispanic, percent vacancy, percent owner occupied, median year built for residential homes, average commute times, the percent of adults over 25 with a bachelor's degree, the labor participation rate, and population density. Finally, I control for CBSA level characteristics: income segregation, the percentage of the Blacks in the metropolitan population, and the White-Black dissimilarity indices.

To test whether income segregation amplifies the impact of mortgage pricing on housing wealth inequality, I interact the measure of CBSA level income segregation with the individual measure of mortgage price.

Table 9: Data Sources Summary Statistics – 2010 Mortgage Originators

		Mean	Std. Dev.	Min	Max	
Individual	Income (000s)	61.18	22.50	0.00	238.00	Corelogic, Equifax Credit Risk Insight Servicing McDash Data, McDash Analytics, LLC, a wholly owned subsidiary of Black Knight Financial Services
	Income Squared (000s)	4248.84	3337.33	0.00	56644.00	
	Age (Years)	50.75	13.07	18.00	101.00	
	Sale Price ($)	$274,598	$350,956	$4,863	$100,000,000	
	Non-Housing Debt ($)	$22,992	$32,681	$0	$2,011,815	
	Fico Score	737.87	79.11	395.00	818.00	
	Mortgage Interest Rate	4.59	0.55	1.00	12.09	
	Interaction MIR * IS	64.40	16.87	7.40	196.76	
CBSA Level	Income Segregation (H)	14.01	3.27	4.50	21.30	US 2010
Census Tract	Population Density	3661.43	8333.69	0.00	484979.10	ACS 2010-2014
	% Black	8.91	14.74	0.00	100.00	
	% Hispanic	11.71	15.47	0.00	100.00	
	% Owner Occupied	74.53	17.75	0.00	100.00	
	% Percent Vacant	58.41	30.50	0.00	100.00	
	Median Year Built (Years)	1978	17	1939	2006	
	Average Commute Time (min)	26.37	6.29	8.00	79.00	
	% Over 25 with a B.A.	22.21	9.81	0.00	63.23	
	Adult Participation Rate	68.18	8.11	2.55	100.00	
CBSA Level	White-Black Dissimilarity Index	54.80	13.91	15.13	79.61	US 2010
	% Black Population	14.32	9.40	0.22	52.56	

Results

A snapshot of urban housing wealth in 2015 reveals that housing wealth is very unequal.
Within CBSA inequality is much higher than between city inequality. Housing wealth is
clustered around a peak of $25,000, with half the distribution falling between
approximately $12,000 and $141,000 in housing equity.
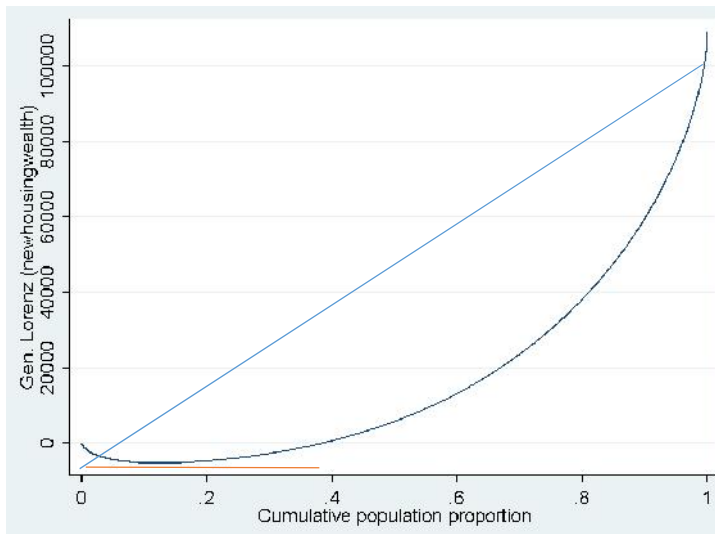
**Figure 7: Lorenz Curve of 2015 Housing Wealth Inequality, All Mortgaged
Homeowners.**

Source: Author Calculations, CoreLogic, Equifax Credit Risk Insight Servicing McDash dataset,
which includes a link to data from McDash Analytics, LLC, a wholly owned subsidiary of Black
Knight Financial Services, referred to hereon as (CRISM)

Figure 7 depicts the Lorenz curve for all homeowners in the sample. The overall Gini
coefficient is .683, far higher than the Gini coefficient for income in 2015, .4 (OECD,
2013), but lower than the overall wealth inequality, which was estimated in 2008 at .801.
Note that a portion of the Lorenz curve falls below zero, indicating substantial levels of

negative wealth. Broken down by urban region, this negative equity generates Gini coefficients higher than 1 in several areas.

In this dataset, the 90/50 ratio is around 4. By comparison, Mian and Sufi use PSID data and find that the ratio of housing wealth from the wealthiest 20% to the middle 20% has risen to 9. Using another metric of housing wealth inequality, half the square of the coefficient of variation, the overall GE(2) is 3.258. Decomposing the entropy index by CBSA shows that inequality is much higher within CBSAs at 3.127 than between CBSAs, at .132.

Figure 8 depicts the Gini coefficients by CBSA. Note that where mean wealth is negative, Gini indices are also below zero; and CBSAs with mean wealth close to zero create instability in both half the squared coefficient of variance and in the Gini index. This effect generates extremely high inequality indices which should be interpreted cautiously.
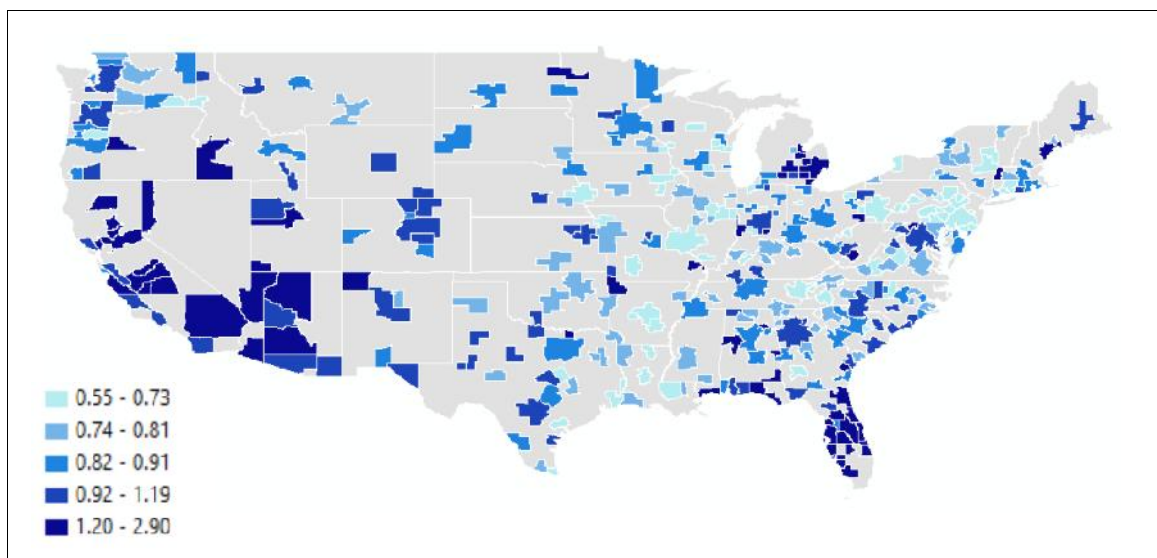

Figure 8: Gini Coefficients, Housing Wealth of Mortgaged Homes, by CBSA

The Gini coefficient can be interpreted as the predicted inequality between two randomly selected households. So, a Gini coefficient of .6 indicates that if one were to select at random two households, one will be 60% less than the other. In Figure 5, we see that areas shaded in darker blue Gini index above 1, indicating extremely high levels of negative equity. These high values are predominant in Florida, the Chicago area, and Southern California where home appreciation since the crisis has been strong, but pockets of negative equity remain. Overall this map demonstrates that there is a strong spatial component to housing wealth inequality, and the ability to use homeownership as an opportunity to build wealth is not evenly distributed across the country. Some places have higher risks than others.

The next analysis attempts to uncover one driver of regional housing wealth inequality. In the introduction, I discuss how income sorting is a likely cause of uneven housing wealth appreciation and can amplify inequities in mortgage pricing. Using a quantile regression, I investigate how and whether risk-based pricing interact with income segregation to increase inequality within a given metropolitan area.

In Figure 9 I show the results of a series of quantile regressions of housing wealth using just two regional factors: the isolation of poverty and wealth. We see that the isolation of poverty is correlated with higher housing wealth for all households, but most particularly the wealthy. Isolation of affluence, by contrast, decreases housing wealth of most households, but benefits those at the 75th percentile and above.

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	1st	10th	25th	50th	75th	90th	99th
Isolation of Poverty	$27,501	$19,814	$40,305	$71,020	$136,375	$234,291	$648,219
Isolation of Affluence	$(9,468)	$(16,813)	$(41,096)	$(57,412)	$(42,566)	$50,533	$754,529
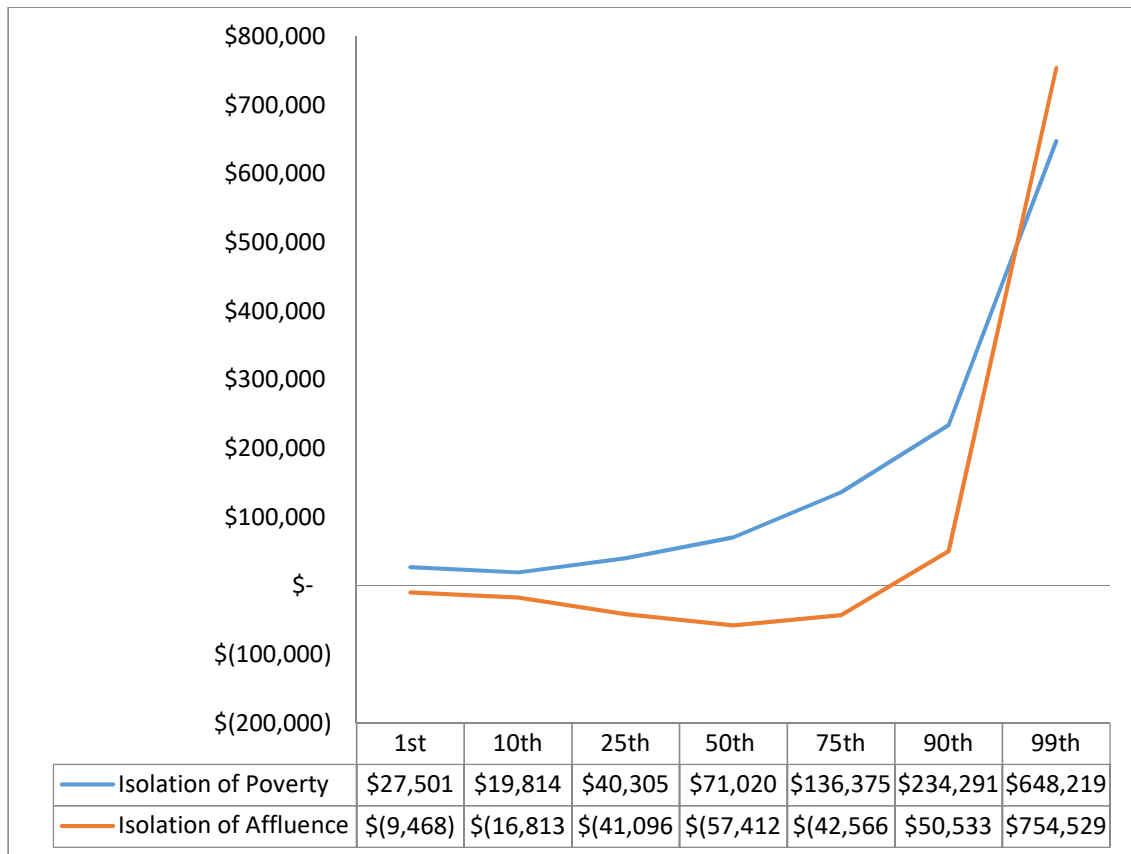
Figure 9: The Impact of Isolation of Poverty and Affluence on Housing Wealth

Table 10 uses the same dataset and displays a more extensive model. The table shows the coefficients obtained from quantile regressions at the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles. The R-squared ranges from .10 to .70, and the model appears to explain more variance at the higher than lower end of the housing wealth spectrum. Significance is calculated at the 95% level and all results that are significant at less than .05% are shaded beige.

The results show that typically, older home buyers have higher housing wealth, possibly because they have higher down payments. Sale price increases home equity overall, as expected. Non-housing debt is a tradeoff against home equity. At the lower end of the

spectrum, every dollar of debt reduces home equity by 9%. At the higher end, non-housing debt corresponds with higher home equity. Neighborhood population density, and higher minority populations have small but consistently negative coefficients, with each additional percent minority in a census tract reducing housing wealth by up to $121 over the 5 years of ownership. Measures of owner occupancy and vacancy perform have little impact at the neighborhood level, with coefficients that are small and insignificant. Neighborhoods with newer housing have lower housing wealth for homeowners at the bottom of the spectrum, with home equity declining by $47-$82 for each year, but increasing for homeowners in the top two percentiles by up to $100. This factor could be related to construction in the 2000s, which tended to be in exurban areas where home prices have not risen quickly; and in sunbelt cities that have not experienced the strong home price surges of supply constrained regions.

Table 10: Quantile Regression Results

Predicted: Housing Wealth, 2015		5th	10th	25th	Median	75%	90th	95th
Individual	Income (000s)	-1,628.79	-1,844.67	-2,503.43	-4,038.93	-6,272.32	-7,337.88	-6,583.82
	Income Squared (000s)	8.58	10.55	13.97	21.49	32.65	37.18	32.64
	Age (Years)	250.67	378.48	648.35	956.1	1,063.24	790.91	525.7
	Sale Price ($)	0.22	0.27	0.39	0.6	0.85	1.01	1.03
	Non-Housing Debt ($)	-0.09	-0.09	-0.11	-0.09	-0.01	0.09	0.15
	Fico Score	103.11	100.98	128.5	158.65	172.64	160.91	154.52
	Mortgage Interest Rate	-14,049.48	-15,682.98	-23,216.37	-28,261.86	-28,132.67	-15,498.90	-10,975.39
	Interaction: Mort. Interest Rate * Income Segregation	250.95	339.65	545.9	401.25	367.22	-5.21	75.31
CBSA Level	Income Segregation (H)	-1,020.40	-1,497.91	-2,429.31	-1,654.53	-1,189.23	866.17	962.07
Census Tract	Population Density	-0.19	-0.25	-0.32	-0.54	-0.41	-0.4	-0.3
	% Black	-47.91	-35.84	-52.91	-27.79	-31.23	-67.22	-53.12
	% Hispanic	-46	-67.48	-63.12	-28.1	-48.75	-76.56	-121.32
	% Owner Occupied	2.56	-0.01	13.59	6.11	-5.93	-18.38	-16.77
	% Percent Vacant	-5.68	-5.88	1.27	-8.15	-15.11	-5.59	-1.8
	Median Year Built (Years)	-22.95	-47	-68.44	-81.52	-75.12	51.86	100.8
	Average Commute Time (min)	-347.95	-301.18	-351.05	-268.66	64.28	108.71	156.26
	% Over 25 with a B.A.	183.42	144.67	228.98	359.19	561.81	655.74	717.58
	Adult Participation Rate	31.82	2.12	-33.86	-60.36	-22.66	53.04	-77.66
CBSA Level	White-Black Dissimilarity Index	206.22	179.84	224.75	309.92	373.84	316.81	182.02
	% Black Population	83.78	74.13	86.77	60.66	10.62	-33.54	-24.65
Constant	Constant	45,343.91	106,396.09	165,650.84	214,447.79	234,853.93	-15,866.78	-119,599.55
	N	70,465.00	70,465.00	70,465.00	70,465.00	70,465.00	70,465.00	70,465.00
	Pseudo R-squared	0.1	0.15	0.26	0.39	0.52	0.63	0.7
Predicted Housing Wealth at the Joint Means		$30,128	$43,326	$70,365	$111,740	$163,563	$207,948	$231,308

Commute times have a stronger impact, with each additional minute of commute time reducing housing wealth by as much as $351. This effect is stronger at the lower end of the spectrum and dissipates for those in the 75th percentile and above, for whom higher commute times are associated with increased equity.

Table 11 breaks out the impact of increases in mortgage pricing and/or income segregation on housing wealth inequality. The results for mortgage pricing show that the price of debt has a powerful effect on housing wealth. In a hypothetical city with no income segregation, a mortgage rate increase by .55 basis points, or one standard deviation, reduces housing wealth by between -$15,500 to -$6,000. At the bottom of the spectrum, this sort of increase costs homeowners -27% of housing wealth over the 5-year period, but at the top of the spectrum the impact is just -3%.

In a hypothetical city where the price of debt is zero, a rise in income segregation costs those with lower housing wealth -$3,333 or -4% at the 10th percentile and -$7,900 and -6% at the median, but increases housing wealth by 1%, or $2,800 and $3,100, for those in the 90th and 95th percentiles.

Table 11: Effect of joint increases in income segregation and risk-based pricing

	5th	10th	25th	50th	75th	90th	95th
Effect of an increase in mortgage rate with IS set to zero							
$	-$7,718	-$8,615	-$12,754	-$15,525	-$15,454	-$8,514	-$6,029
% of HW	-27%	-20%	-18%	-14%	-10%	-4%	-3%
Effect of an increase in income sorting with mortgage rates set to zero							
$	-$3,333	-$4,893	-$7,935	-$5,404	-$3,884	$2,829	$3,142
% of HW	-4%	-5%	-6%	-3%	-1%	1%	1%
Effect of an increase in mortgage rate and income sorting at joint means							
$	-$6,817	-$7,777	-$11,478	-$14,160	-$13,143	-$5,773	-$1,616
% of HW	-23%	-18%	-16%	-13%	-8%	-3%	-1%

The last two rows of Table 11 show the effect of increasing risk-based pricing and income segregation simultaneously. The interaction terms for mortgage pricing and income segregation are significant in the lower half of the spectrum, for regressions at the 10th through 50th percentiles. The combined effect of mortgage pricing and income segregation is to widen inequality – reducing housing wealth most for those who have less to begin with. I obtain these effects by predicting housing wealth for each set of coefficients at the joint means. I then find the impact of an increase by one standard deviation in both income segregation and risk-based pricing at joint means. The change is -$7,700 and -$11,000 for those in the 10th and 25th percentiles, respectively. But this downward effect decays for those with more housing wealth, so that those at the 90th percentile lose less – at the 95th percentile, just -$1,600 – from income segregation and the interaction with risk-based pricing. Expressed as a percent of housing wealth, the effects on inequality are clear. At the bottom of the spectrum, homeowners would have -23% less home equity over the 5-year period. At the top of the spectrum, homeowners lose just -1%.

The remaining results in Table 11 add to our understanding of the impact of race and racial segregation on housing wealth inequality. The coefficients for MSA level Black segregation and percent Black within a city are both positive, suggesting that home purchasers in 2010 across the spectrum benefited from racial segregation. Black segregation is associated with approximately $200-$300 higher accumulation of housing wealth across the 5-year period. Black segregation does not appear to benefit some borrowers more than others; as a percentage of wealth, Black segregation helps those in the lower percentiles more than those at the top. In all likelihood, this impact has to do with the composition of 2010 homebuyers and mortgage originators, who, due to credit tightness in 2010 and the ravages of subprime lending on minority home-owning communities, tended to be wealthier and Whiter than the general population. A suggestion for future analyses is to take advantage of HMDA data to understand the impact of racial segregation for mortgage originators of different races; or to examine the interaction between racial segregation and other factors such as census tract level demographics and income.

Similarly, percentage Black in an MSA seems to improve home equity for mortgage originators at the bottom of the spectrum, but has no effect, or a negative effect for those at the top. It is possible that this result reflects some gentrification during the period; in the few predominantly Black neighborhoods where low priced homes were purchased in 2010 may have been those that were gentrifying, and in those places, prices rose quickly between 2010 and 2015.

Conclusion

Wealth inequality has risen to levels not seen in the last century, and is linked to wider macroeconomic problem of secular stagnation. Housing wealth is the largest type of asset in the United States, and is the cornerstone of middle class wealth. Decentralized income segregation is rising in the United States, and current policy discussions around the disposition of the GSEs lean towards more privatized solutions with higher potential for steeper risk-based pricing. These results demonstrate that in combination, these rising factors will amplify housing wealth inequality.

These results quantify the monetary impacts of racial and income segregation, and point to how the institutional framework of homeownership in this country allocates housing wealth by place, race, and class. There are political ramifications to this work: if one group is systematically able to benefit from housing as an investment, while another is not, this uneven set of opportunities could pit the two groups against one another in a political competition for control of urban space. This work also shows how housing and mortgage markets contribute to the material basis for the formation of conflicting political interests (Aalbers, 2008; G. Dymski et al., 2013; Fox O'mahony & Overton, 2014; Thorns, 1981).

This research also makes it clear that the potential for wealth accumulation differs by urban region, with Southern California and Florida metro areas leading the nation in housing wealth inequality. These stark differences suggest that investigating spatial variation in housing wealth inequality can help us understand which policies will even the playing field. The impact of risk-based pricing on housing wealth inequality suggests

that housing finance reform should be evaluated on whether it will contribute to rising inequality. If mortgage policy then also interacts with rising income segregation, then inclusionary zoning and a commitment to creating mixed income communities may be key tools not only for promoting affordable housing, but for resolving larger macroeconomic issues by reducing housing wealth in the United States.

Chapter 5: Summary

American families' wealth is bound up in their housing, and we know from research at the national level that housing wealth is becoming more unequal. This research places widening housing wealth inequality in an urban context. Cities structure housing markets, from the production of new buildings to residential patterns to the provision of services and opportunities. The institutional arrangements that underpin mortgage markets vary by state and region as well, either because of activity in the private market, or because of the influence state chartering systems have on the banking system. In this research, for the first time, I calculate housing wealth inequality at the regional level and show that it varies widely by urban region, confirming that regional housing dynamics structure opportunities for homeowners to accumulate wealth.

Some theories suggest that income translates straightforwardly to housing wealth, leading to the prediction that housing wealth inequality would closely track income inequality. This research contradicts those theories. Instead, in the 2000-2005 era, I find that housing wealth does not have a strong link with income inequality. By contrast, segregation of the wealthy and Black isolation are associated with higher housing wealth inequality. Black isolation had a far stronger effect on housing wealth inequality than other forms of racial segregation, ethnic segregation, or economic segregation. This finding underscores the importance of Fair Housing law, and demonstrates that legislation to reduce exclusionary zoning, which other research has tied to racial segregation, will be a crucial aspect of

ensuring that housing wealth is a path to saving for the American middle class. This issue will be particularly pressing in an era of rising urban land prices and declining affordability.

The third chapter focuses on mortgage markets and segregation, examining the impact of subprime lending on housing wealth inequality between 2000 and 2015. This research is one of few analyses on the widening housing wealth gap over the last few years, and is the first study to frame this as an urban phenomenon. I find that overall housing wealth inequality changed dramatically over this time period, increasing by .11 Gini coefficients. In a regression analysis, I find that changes in income inequality predict changes in housing wealth inequality over the period, as well as changes in Black and Hispanic minority populations. This suggests that while the level of income inequality may have a slight relationship with housing wealth inequality, changes in income inequality are closely tied to changes in housing wealth inequality.

In this model, I had expected that the mortgage crisis would explain much of the association between Black segregation and housing wealth inequality. Contrary to my expectation, the incremental inclusion of metrics for subprime lending and post-crisis vacant homes does not deflate the effect of Black isolation, though it reduced the coefficient for Hispanic isolation as expected. These results suggest that there is something else about the crisis and recovery period other than subprime lending and the density of foreclosures which exacerbated housing wealth inequality in cities where Black isolation increased. One possibility is that the recovery period itself unfolded in ways that exacerbated racial inequality in housing wealth above and beyond the subprime

and foreclosure crises. Further research into the distribution of recovery policies and market responses such as REO-to-Rental, Quantitative Easing and HARP refinances are needed. The final analysis of this research examines the distributional impacts of risk-based pricing during the recovery period more closely.

In the fourth chapter, I examine housing wealth inequality in an individual-level analysis, focusing on interactions between risk-based mortgage pricing and income segregation during the housing market recovery period of 2010 to 2015. I find that both income segregation and mortgage pricing are significant, with large effects on widening housing wealth inequality. The interaction between the two factors is significant for regressions in the bottom half of the distribution. This interaction could be because risk-based pricing increases incentives for credit sorting and disparate home price appreciation; because it increases disposable incomes and economic health, and home prices in wealthier enclaves relative to other communities; or both. Further research is needed to disentangle these effects.

The results of Chapter 4 demonstrate that even in 2010, a period with slight levels of risk-based pricing, increases in mortgage rates have measurable and large effects on housing wealth inequality even absent the excesses of predatory practices. They also show that income segregation has a separate effect on inequality. This suggests that efforts to reduce spatial inequality are important, either by improving access to housing in good neighborhoods for low income families, or by increasing the equality of provision of public goods within a city. In addition to concerns about educational quality, access to services, access to employment, political polarization, and a host of other social ills, this

research adds rising wealth inequality to the list of negative impacts of increasing economic segregation.

These results reveal conflicting financial interests among borrowers and among neighborhoods with regard to segregation and sorting. Institutional theory places the potential to accumulate wealth at the center of class formation. If different groups, be they renters and owners or neighborhoods segregated by race, are differentially able to accumulate wealth through property ownership, this differential can frame political struggles within urban areas. That said, material concerns do not always translate predictably into political action. Other research has found that negative equity was a strong predictor of increased support for the GOP candidate in 2016 over 2012 (Raymond, 2017), even though the Republican candidate was far less likely to enact policies at the federal level to help repair home equity for underwater borrowers.

Taken as a whole, this research has clear ramifications for policies which impact socioeconomic and racial/ethnic segregation. Conventional zoning has many attributes that restrict density: mandatory parking, minimum lot sizes, specified housing type and density, and restrictions on infill development (Talen, 2013). This sort of density zoning corresponds with substantial increases in economic segregation, particularly the isolation of affluence (Lens & Monkkonen, 2016; J. T. Rothwell & Massey, 2010). One tool to combat the formation of local enclaves is inclusionary zoning, which offers developers density bonuses in exchange for increased numbers of affordable units, or can even require that new development include a certain percentage of affordable units.

The results of this research shows that wealthy homeowners have strong financial incentives to pursue exclusionary zoning in their neighborhood (Lens & Monkkonen, 2016; J. T. Rothwell & Massey, 2010). Lens and Monkkonen (2016) find that municipalities are often under considerable pressure to conform with the wishes of wealthy enclaves. For this reason, solutions which use incentives and are implemented at the municipal level may founder on political barriers. In this case, state legislatures can be particularly useful in pressuring cities to reduce income segregation, though obviously this only applies in places where there is an appetite for government support of affordable housing at the state level. Policies formulated at the state level that are also mandatory rather than voluntary hold promise. These tools include laws like the Massachusetts Comprehensive Permit Act, that grants developers the right to sidestep local zoning and other restrictions and obtain permits to develop affordable housing in localities that do not have a certain percentage of affordable housing (J. Rothwell, 2012).

In addition to ramifications for local zoning, this research has mortgage policy implications. There's been substantial research on the effect of predatory lending and risk-based pricing on equity during the financial crisis. The final empirical chapter of this research examines the impact of risk-based pricing during the recovery, a moment of low risk-based pricing. In Chapter 4, we find that not only does mortgage pricing affect housing wealth inequality, but there is a significant interaction with income segregation. This suggests that state and federal policies that reduce risk-based pricing overall, or by reducing mortgage interest rates for low income borrowers, may help slow widening housing wealth inequality.

The largest such program is the mortgage interest tax deduction. The mortgage interest tax deduction is a program which allows homeowners who itemize deductions to deduct their mortgage interest payments from their taxes. The second largest is the GSE's residential mortgage business, and after that, FHA/VA mortgage insurance. The federal government also supports mortgage revenue bonds issued at the state and municipal level, and is responsible for programs which are distributed at the state and local level like Community Development Blog Grant (CDBG), HOME Investment Partnerships Program (HOME), the Community Development Finance Institutions Fund (CDFI) and others (Collins, 2007).

There's a substantial body of research critiquing the distributional consequences of the mortgage interest tax deduction; this study doesn't specifically address tax benefits or add to that research strain. This research does find that slight increases in mortgage interest rates have a regressive effect. Because this research centers predominantly on the impact of mortgage interest rate pricing on wealth inequality, they shed light on mortgage revenue bonds, the GSEs, and other programs that reduce mortgage interest rates.

These results on the impact of mortgage pricing on housing wealth inequality have ramifications for housing finance reform. The GSEs have long subsidized the creation of low, fixed-rate mortgage loans, thereby increasing homeownership by lowering costs for most borrowers and reducing risk-based pricing and market segmentation in mortgage markets. This was accomplished by cross-subsidizing costs between borrowers of different incomes and risk tiers. Under conservatorship, the GSEs have moved away from providing one rate for most of the mortgage market towards slight risk-based pricing, but

significant cross-subsidization still occurs. The current administration has proposed to reduce regulation on mortgage markets and may seek to privatize or restructure the GSEs. Privatization proposals range from structures that would create competition among guarantors to a system in which shareholders invest in a highly regulated entity, among others (Parrott, Ranieri, Sperling, Zandi, & Zigas, 2016). Reform efforts seem very focused on attempting to limit the incentives of the GSEs to take on systemic risk, but may not be adequately addressing the impact on homeownership and mortgage pricing in the primary market. It is difficult to cross-subsidize risk in privatized models because competition leads to cherry-picking of low risk borrowers with cheaper prices and market segmentation as different firms serve different tiers of the market (Immergluck, 2015b). This research shows that increases in risk-based pricing have powerful distributional effects and are among the strongest factors in widening housing wealth inequality. These strong impacts of mortgage pricing on housing wealth inequality are obtained from a sample of mortgages issued in 2010, a moment of modest risk-based pricing. Some proposals for privatization of the GSEs would result in far higher levels of risk-based pricing and market segmentation.

The other ways in which privatization could affect mortgage markets is through state and local mortgage revenue bonds. Mortgage revenue bonds are financial instruments that are sold to investors to subsidize the finance of mortgage loans to low income borrowers. These bonds are targeted at Ginnie Mae and Freddie Mac securitize and provide credit enhancement to state and municipal mortgage revenue bonds, deepening investor interest, and invest directly in these products, guaranteeing a market for state and municipal debt

that is passed onto low income homeowners in the form of below market rate mortgages for low income borrowers. Preserving these functions during housing reform will allow states and municipalities to reduce risk-based pricing, and slow rising wealth inequality in the coming era. Finally, recent budgets have called for strong cuts or complete elimination of Community Development Blog Grants (CDBG) and HOME Investment Partnerships. These programs are used for an array of projects, among them the support of affordable homeownership. For this and other reasons, these programs should be preserved.

The challenge of providing safe, affordable residential mortgages with progressive or at least less regressive pricing may also be met at the state and local level. The importance of urban factors and urban policy on housing wealth inequality presents an opportunity for urban planners and policy makers, though it should be noted that states and cities have not always pursued equality of opportunity in the absence of federal protections. Even in the absence of federal support for affordable housing, decisions around zoning, affordable housing, and equality of opportunity made at the local level can generate a more equitable set of opportunities for homeowners.

States and municipalities should seek to extend mortgage bond revenue programs to combat wealth inequality at the local level. State and municipal housing finance agencies can increasingly fund mortgage revenue bond programs to prove a credit enhancement for borrowers. Local actors can also fund programs to provide down payment assistance, which would help reduce the mortgage interest rate borrowers qualify for in a private market. This funding has sometimes come from CDBG and HOME.

In addition to highlighting the need for progressive housing finance reform, and efforts to reduce urban segregation and sorting, this research casts wealth inequality not as a national or individual phenomenon, but in a spatial context. Housing wealth is the result of multiple trends at different levels of urban governance and structure. Income and racial segregation are the result of individual decisions as well as municipal and regional policy choices around provision of public goods, jurisdictional fragmentation, and urban form. From the excesses of predatory practices during the subprime lending crisis, to risk-based pricing, mortgage policy has powerful effects on housing wealth inequality, and is the result of a patchwork of state and federal laws and institutions interacting with the private financial institutions that help originate and invest in mortgages, from small banks to global financial conglomerates. In an era of rising income sorting and increasingly deregulated mortgage markets, I confirm that both factors independently increase housing wealth inequality and significantly interact with one another.

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Watson, T. (2009). Inequality and the measurement of residential segregation by income in American neighborhoods. Review of Income and Wealth, 55(3), 820-844.

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Wyly, E., Hammel, D., & Atia, M. (2004). Capital is the Landlord: Class-Monopoly Rent and New Geographies of Subprime and Predatory Mortgage Lending. Paper presented at the 34th Annual Meeting of the Urban Affairs Association.

Wyly, E., Moos, M., Hammel, D., & Kabahizi, E. (2009). Cartographies of race and class: mapping the class monopoly rents of American subprime mortgage capital. International Journal of Urban and Regional Research, 33(2), 332-354.

Yinger, J. (2015). Hedonic markets and sorting equilibria: Bid-function envelopes for public services and neighborhood amenities. Journal of Urban Economics, 86, 9-25.

Vita

EDUCATION

Georgia Institute of Technology, Atlanta, GA   PhD Urban Planning, Expected Spring 2017

Dissertation Title: A Comparison of Housing Wealth Inequality Between Urban Regions During the Recovery: the Impact of Racial Segregation, Income Sorting and Risk-based Mortgage Pricing

Committee: Professor Dan Immergluck, School of City and Regional Planning, Georgia Institute of Technology; Professor Roberto Quercia, Trudier Harris Distinguished Professor and Chair, Department of City and Regional Planning; Director, UNC Center for Community Capital; Professor Bruce Stiftel, Chair of the School of City and Regional Planning, Georgia Institute of Technology; Dr. Shatakshee Dhongde, Assistant Professor of Economics, Georgia Institute of Technology; Dr. Micheal Elliott, Associate Professor, School of City and Regional Planning, Georgia Institute of Technology

London School of Economics, London, UK   Year Abroad, 2001
Brown University, Providence, RI   B.A. History, 2002

AWARDS AND RECOGNITION

2017 Best Conference Paper Award, Urban Affairs Association
College of Architecture ADVANCE Woman of Excellence Award, 2014
Georgia Institute of Technology President's Fellowship, 2011-2015

SCHOLARSHIP AND RESEARCH

Peer Reviewed Journal Articles

Raymond, E. (2017). The Ongoing Housing Crisis and the Rust Belt Revolt for the GOP. *Metropolitiques.* URL: http://www.metropolitiques.eu/The-Ongoing-Housing-Crisis-and-the.html

Raymond, E. Duckworth, R. Miller, B. Lucas, M. Pokharel, S. (2016) New Corporate Landlords and Displacement: Evictions in Single Family Rentals in Atlanta, Georgia. *Federal Reserve Bank of Atlanta Community and Economic Development Discussion Paper Series.*

Peer Reviewed Journal Articles, continued

Raymond, E. (2016). Wholesale Funding and the Increase in Construction Bank-Owned Real Estate in the U.S. *Urban Geography.*

Raymond, E. (2016). Negative Equity in the Sixth Federal Reserve District. *Community and Economic Development Working Papers,* 2016-1. Federal Reserve Bank of Atlanta Research Department

Raymond, E. & Zaro-Moore, Jesse. (2016). Financial Innovation, Single Family Rentals, and the Uneven Housing Market Recovery in Atlanta. *Atlanta Studies.*

Raymond, E., Wang, K., & Immergluck, D. (2015). Race and Uneven Recovery: Neighborhood Home Value Trajectories in Atlanta Before and After the Housing Crisis. *Housing Studies*, 31(3), 1-16.

Manuscripts Under Review

Conditionally Accepted: Raymond, E. Uneven Recovery and Persistent Negative Equity in the Southeast.

Revise and Resubmit: Raymond, E., Dill, J. Millennial First Time Homebuyers: An Examination of the Impact of Credit Profile on Tenure and Location Choice among Millennials Before and After the Crisis.

Submitted: Raymond, E. Duckworth, R. Miller, B. Lucas, M. Pokharel, S. New Corporate Landlords and Displacement: Evictions in Single Family Rentals in Atlanta, Georgia.

Submitted: Raymond, E. The Impact of Income Sorting and Risk-based Mortgage Pricing on Housing Wealth Inequality: A Comparison between Urban Regions in the United States

Works in Progress

Raymond, E. Refinances and the Uneven Housing Market Recovery: The distribution of HARP Refinances in Atlanta, GA.

Raymond, E. Mortgaging the Commons: Financialization, the Asian Development Bank and Land Tenure Reform in Samoa.

Conference Presentations

"A Comparison of Housing Wealth Inequality Between Urban Regions During the Recovery: the Impact of Racial Segregation, Income Sorting and Risk-based Mortgage Pricing." Association of Collegiate Schools of Planning. Portland, OR. November, 2016.

Conference Presentations, *continued*

"Race and Uneven Recovery: Neighborhood Home Value Trajectories in Atlanta before and after the Housing Crisis." Urban Affairs Association. San Diego, CA. March, 2016.

"Race and Uneven Recovery: Neighborhood Home Value Trajectories in Atlanta before and after the Housing Crisis." Association of Collegiate Schools of Planning. Houston, TX. October, 2015.

Mortgaging the Commons: Financialization, the Asian Development Bank and Land Tenure Reform in Samoa. Association of European Schools of Planning. Utrecht, Netherlands. July 7, 2014.

Neighborhoods, Asset Prices or Free Markets? Atlanta's Vacant Homes and Fannie Mae's 2012 REO-to-Rental Pilot. Atlanta Studies Symposium, April 4, 2014.

Hot Money, Small Banks and the Makings of a Collapse: Wholesale Funding and the Increase in Bank-Owned Real Estate in the U.S. Financial Crisis. Urban Affairs Conference. San Antonio, TX. March 21, 2014.

Community Bank Failures, Atlanta Sprawl, and Bank Owned Real Estate in the 2007 Financial Crisis. Atlanta Studies Symposium. Atlanta, GA. April 26, 2013.

An Empirical Test of the Secondary Circuit of Capital: Hot Money and Real Estate Development in the 2007-2012 Financial Crisis. Association of Collegiate Schools of Planning. Cincinnati, OH. November, 2013.

Instants of Community: Bicycling, Risk, and Social Trust. Association of American Geographers, New York, NY, February, 2012.

Invited Talks

New Corporate Landlords and Displacement: Evictions in Single Family Rentals in Atlanta, Georgia. Housing Forum, Atlanta Regional Commission. March 14, 2017.

New Corporate Landlords and Displacement: Evictions in Single Family Rentals in Atlanta, Georgia. Enterprise Community Partners, the Georgia Department of Community Affairs, and Georgia ACT's Affordable Housing Preservation Challenge, Federal Reserve Bank of Atlanta. February 7, 2017.

Wholesale Funding and the Increase in Construction Bank-Owned Real Estate in the U.S. Planning, Design and the Built Environment Colloquium, Clemson University. April 15, 2016.

Hot Money, Small Banks and the Makings of a Collapse: Wholesale Funding and the Increase in Bank-Owned Real Estate in the U.S. Financial Crisis. Financialization Working Group, University of Leuven. June 23, 2014.

Teaching: Courses

Co-teacher, Principles of Real Estate Finance and Development, School of City and Regional Planning, Georgia Institute of Technology. Spring 2016. A graduate course in real estate and affordable housing and community development finance.

Teaching: Guest Lectures

Political Economy of Mortgage Finance. Conflict and Cooperation, Department of Political Science, Emory University, February 10 & 12, 2015.

Mortgaging the Commons: Financialization, the Asian Development Bank and Land Tenure Reform in Samoa. Masters in Sustainable Development Studio Course, Emory University. March 22, 2014

The Impact of Wholesale Funding on Zombie Subdivisions, Masters in Sustainable Development Studio Course, Emory University. April 2, 2013.

Analyzing Healthcare Data for Planning. Becoming Digital, Massachusetts Institute of Technology. February, 2010.

Selected Press/Media Coverage

Gopal, P. (2017, January 3). 'Wall Street, America's New Landlord, Kicks Tenants to the Curb.' *Bloomberg*. Retrieved 2017, from https://www.bloomberg.com/news/articles/2017-01-03/wall-street-america-s-new-landlord-kicks-tenants-to-the-curb

Stokes, S. (2017, January 11). 'Study: Investor Landlords More Likely To File Eviction Notices.' *WABE 90.1*. Retrieved from http://news.wabe.org/post/study-investor-landlords-more-likely-file-eviction-notices

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Selected Press/Media Coverage, continued

Research mentioned in NPRs *Marketplace*, the *Wall Street Journal*, the *Atlanta Journal Constitution, Investor's Business Daily, Real Estate Today Radio,* the *Samoa Journal,* and *Builder Magazine.*

Applied Research (peer reviewed)

Are Millennials Responsible for the Decline in First-Time Home Purchases? Part 2. July 1, 2015. Federal Reserve Bank of Atlanta, Real Estate Research
http://realestateresearch.frbatlanta.org/rer/2015/07/are-millennials-responsible-for-the-decline-in-first-time-home-purchases-part-2.html

Are Millennials Responsible for the Decline in First-Time Home Purchases? May 20, 2015. Federal Reserve Bank of Atlanta, Real Estate Research.
http://realestateresearch.frbatlanta.org/rer/2015/05/are-millennials-responsible-for-the-decline-in-first-time-home-purchases.html

Many Banks, Many Builders: Concentration in the Construction Industry. December 16, 2013. Federal Reserve Bank of Atlanta, Real Estate Research.
http://realestateresearch.frbatlanta.org/rer/2013/12/many-banks-many-builders-concentration-in-construction-industry.html

When Will the Housing Market Recovery Boost Retail Consumption? October 23, 2013. Federal Reserve Bank of Atlanta, Real Estate Research.
http://realestateresearch.frbatlanta.org/rer/2013/10/when-will-housing-market-recovery-boost-retail-consumption.html

Does Sprawl Really Cause Segregation? August 23, 2013. Federal Reserve Bank of Atlanta, Real Estate Research. http://realestateresearch.frbatlanta.org/rer/2013/08/does-sprawl-really-limit-income-mobility.html

Does the Mortgage Interest Tax Deduction Really Support Upward Mobility? September 20, 2013. Federal Reserve Bank of Atlanta, Real Estate Research.
http://realestateresearch.frbatlanta.org/rer/2013/09/does-the-mortgage-interest-tax-deduction-really-support-upward-mobility.html

The Shape of the Housing Recovery in Atlanta. July 24, 2013. Federal Reserve Bank of Atlanta, Real Estate Research. http://realestateresearch.frbatlanta.org/rer/2013/07/shape-of-housing-recovery-in-atlanta.html

EMPLOYMENT

Federal Reserve Bank of Atlanta.. Summer 2011-present
Graduate Research Assistant, Center for Real Estate Analytics

> Authored discussion paper on the causes and consequences of persistent negative equity in the Southeast.

> Authored research paper on the causes of urban bank failures and construction foreclosures during the financial crisis.

> Regularly contribute to Real Estate Research blog posts analyzing urban housing and mortgage markets with a focus on the uneven recovery during the great recession.

> Assist economics research and perform ad hoc data analytics using individual level longitudinal datasets including Lender Processing Services mortgage data, Equifax Credit Reports, and FFEIC Call Reports.

Shimberg Center for Housing..Summer 2010-Summer 2011

> Literature Review for Robert Wood Johnson Foundation grant application.

> Conduct survey on sustainable affordability in Low Income Housing Tax Credit projects.

Partners HealthCare Systems, Boston, MA .... Spring 2008 – Summer 2010
Research Project Manager, Business Planning and Market Development
Analyst, Business Planning and Market Development .... Summer 2007 – Spring 2008

Goizueta Business School, Atlanta, GA .... Fall 2003 – Spring 2007
Analyst, Research Computing

SERVICE
Peer Reviewer, Journal of Urban Affairs, 2017
Peer Reviewer, Federal Reserve Bank of San Francisco Community and Economic Development Discussion Paper Series, 2015.
Peer Reviewer, Journal of Planning Education and Research, 2015.
Coordinated Atlanta Studies Conference, 2014-2017.
Coordinated Urban Planning PhD Lecture Series, 2011-2012.