

Housing Affordability Primer

Executive Summary

The goal of this report is to identify the most common housing affordability metrics, describe their characteristics and limitations, and use them to analyze housing affordability over time. This report focuses on housing affordability from a perspective of whether or not households are able to afford their monthly housing costs based on their income levels.

We analyze five common housing affordability metrics and split them into two categories:

- Household-level measures are ratios of households' current housing costs to other household-level parameters. Metrics analyzed are:
 - o Housing cost-to-income ratios
 - o Residual income approaches

- Market-level measures gauge the extent to which potential homeowners are able to afford the recurring monthly costs associated with current mortgage rates and house prices. Metrics analyzed are:
 - o National Association of Realtors' Housing Affordability Index (NAR HAI)
 - o California Association of Realtors' Variant Housing Affordability Index (CAR Variant HAI)
 - o National Association of Home Builders/Wells Fargo Housing Opportunity Index (NAHB/Wells Fargo HOI)

The prominent concern with household-level metrics pertains to housing consumption levels being a choice that is made based on information that is not available to the analyst. For market-level metrics, concerns arise due to differences between general population median attributes, used to construct the metrics, and those of potential homebuyers. The report further presents alternative metrics that have been proposed to address issues with these common metrics.

According to these metrics, housing affordability trends show that renter cost burden levels are consistently higher than those for homeowners; different household-level metrics show markedly different cost burden levels, with relative differences across metrics more pronounced for homeowners; and household- and market-level metrics elicit distinct conclusions regarding affordability concerns.

This analysis highlights the importance of understanding the key features of affordability metrics in order to obtain a more comprehensive understanding of housing affordability. Focusing on a single type of metric will provide only a partial view of affordability concerns. Nonetheless, this report recommends the following be used to address certain aspects of affordability:

- Housing cost burdens of current homeowners and renters (household-level metrics)
 - o Residual income approaches for lower-income households
- Home purchase affordability (market-level metrics)
 - o Goldman Sachs (GS) Marginal Homebuyer Index for potential entrants into homeownership

- Renter affordability across geographic areas (National Low Income Housing Coalition's Housing Wage metric)
- Housing supply constraints' impact on affordability (mismatch measures)

Introduction

Housing affordability has typically been hard to define. One reason for this is highlighted by Quigley and Raphael (2004), who describe how affordability encompasses issues related to the distribution of housing prices and quality; the distribution of income; housing policies affecting market conditions; households' ability to borrow in order to finance home purchases; the supply of new and refurbished housing; and ultimately the choices that families make regarding whether to own or rent. The confluence of all these issues into the broad category of housing affordability has led to the emergence of a series of housing affordability metrics.

This report analyzes the various metrics that are used to gauge the affordability of housing for both homeowners and renters. The goals are to identify the most common housing affordability metrics, describe their characteristics, identify their limitations, and show what they indicate regarding trends in housing affordability. The report focuses on measures that pertain to households' ability to cover housing costs given their income levels. The initial step in doing so is to lay out the theoretical background for measuring housing costs. Specifically, the report details how one can directly compare the costs of owner-occupied and renter-occupied housing.

The focus on households' ability to cover housing costs distinguishes this report's concept of affordability from other dimensions of the housing affordability question. One important distinction to bear in mind throughout is the difference between housing affordability measured in this manner and housing or mortgage credit availability and accessibility. This view of housing affordability may indicate that an area is affordable because the housing costs and incomes in the area are seen to be within certain parameters. However, it may be that there simply aren't enough housing units available for lower-income households to purchase or rent. Consequently, this makes housing availability concerns for these groups trump affordability concerns. Mortgage credit accessibility can similarly impact overall housing affordability. Affordability indicators focusing on housing costs and income can fail to take into account the inability of certain households to access credit that would enable them to become homeowners.

Theoretical Background for Measuring Housing Costs

In order to obtain a picture of affordability that encompasses both the affordability of rental housing and homeownership, researchers have had to develop a method that makes the cost of these two housing options comparable. Poterba's (1984, 1992) work is the foundation for much of the research on the "user cost" of housing, which employs an asset market approach to model the flow of services generated from owning a home.

As with any utility maximizing problem, in equilibrium individuals will consume housing services up to the point where the marginal value of housing services (the flow of services) equals the cost of these services (the imputed rent). Under this approach, we can obtain an expression for the imputed rent of owner occupied housing by setting the equilibrium condition. Appendix A details how one obtains an expression for the imputed rent for owner-occupied housing, which accounts for foregone interest, mortgage payments, property taxes, depreciation, maintenance, and house price growth.¹ Having obtained this imputed rent for owner-occupied homes, one can create a

¹ The imputed rent expression obtained in Appendix A is: $R = (1 - \tau)[(1 - L)i_0 + Li_b + t_p] + d + m - g) P$

single distribution of housing services supply that includes both rental and owner-occupied properties.

No housing affordability metric factors all of the components that go into the creation of imputed-rent for owner-occupied housing into its determination of whether housing is affordable. Nonetheless, establishing the theoretical foundation for what should be included in the imputed rent for owner-occupied housing will enable a clear analysis of what the current affordability metrics may be lacking. Note that comparable rent levels for renter-occupied housing are simply contract rent values, which do not include utilities.

One salient difference between user-cost theory and common affordability metrics is that the foregone interest on the capital that is invested in housing is never factored into the calculation of common affordability metrics, but it is included in user-cost theory. This foregone interest represents an opportunity cost of owning a home, not an explicit cost, which is the likely explanation for its omission from affordability metrics. It is also worth mentioning at this junction that the user cost of housing theory doesn't consider the cost of utilities as a user cost of owning a home. This marks a clear departure from the approach used in household-level measures of housing affordability, detailed in the next section.

Common Affordability Metrics

Affordability metrics used in the housing industry fall into two broad categories: household-level and market-level. Household-level measures are ratios of housing costs to other household-level parameters. Market-level measures typically gauge the extent to which potential homeowners entering the owner-occupied housing market would be able to afford the recurring monthly costs associated with holding a mortgage loan on their homes. One exception to this homeowner-centric approach for market-level measures is the National Low Income Housing Coalition's (NLIHC) Housing Wage metric (see Table 4 for more details).

Table 1 - Common Household-Level Metrics

Measure	Definition	Values	Data Needed
Housing Cost-to-Income Ratios e.g., HUD Guideline	If annual housing costs exceed 30% of gross money income, then a household is considered Cost Burdened (Severely Cost Burdened if they exceed 50%). Renter housing cost is gross rent (rent + utilities). Owner housing costs include any payments on mortgages or other debts on the properties, real estate taxes, insurance (fire, hazard, and flood), utilities, and condominium fees.	0-100 (% of households burdened)	Information on housing costs and income
Residual Income Approaches e.g., Stone (1993), Kutty (2005), VA Home Loans	Households have affordability problems if they cannot afford a base level of non-housing consumption after covering their housing costs. These base levels vary by household size and type.	0-100 (% of households w/ problem)	Information on housing costs, income, and household attributes

The definition that a cost burden occurs if housing costs account for 30% or more of income evolved from the National Housing Act. It was formally set at 25% in 1969 and raised to 30% in

1981. Schwartz and Wilson (2008) point out that this is simply based on a rule of thumb that a week's wage should cover a month's housing expenditures. Pelletiere (2008) further details that the 25/30% rule was likely created to reflect conclusions from empirical research on family budgets conducted around the turn of the 20th century. Note that the 30% U.S. Department of Housing and Urban Development (HUD) Guideline (see Table 1) uses household gross monthly income (or pre-tax income) as the denominator in the ratio.² This leads to distortions regarding what percentage of actual income available to families is spent on housing due to differences in taxation levels and tax credits (e.g., EITC) across income groups.

All three residual income approaches in Table 1 follow the same principle that there exists a minimum level of non-housing consumption that households must achieve so as not to have an affordability problem. The differences arise in what particular level is chosen, which therefore impacts the picture of affordability that is portrayed by different measures. Stone's (1993) "Shelter Poverty" uses the Bureau of Labor Statistics (BLS) Lower Budgets (discontinued in 2008) to define non-housing consumption requirements. Kutty (2005) defines minimum non-housing consumption as two-thirds of the U.S. Census Bureau's poverty threshold, thus assuming one-third of the poverty threshold level can be spent on housing. Housing costs under these two residual income approaches are measured in a manner similar to that described in Table 1 for the housing cost-to-income ratio. However, income definitions differ: Kutty's (2005) approach uses the same pre-tax definition as the 30% ratio approach, while Stone's (1993) method uses disposable (after-tax) income. The VA home loan program calculates the residual income left over after covering all monthly debt (both housing and non-housing debt), obligations (taxes and Social Security), and shelter costs and compares it to non-housing consumption levels that vary based on family size, loan amount, and census region. This factor is used in determining whether a particular loan will be too burdensome for potential borrowers (VA Pamphlet 26-7, Chp.4).

Common market-level affordability measures relate household income levels to some qualifying level of income needed to afford a mortgage on a home. The National Association of Realtors' (NAR) Housing Affordability Index (HAI) assumes a 20% down payment, a 25% qualifying ratio (i.e., that monthly mortgage and interest payments are 25% of income), and uses the "effective mortgage rates" for previously occupied homes reported by the Federal Housing Finance Agency (FHFA).³ The NAR HAI doesn't explicitly calculate property taxes and insurance costs, but uses a 25% qualifying ratio, instead of the traditional 28%, to account for these added costs. The California Association of Realtors' (CAR) Variant HAI assumes a down payment of 20%, a qualifying ratio of 30%, and uses the same effective mortgage rates described above. In addition, this measure accounts for property taxes and insurance costs, with an annual cost estimated as 1% and 0.38% of median home price, respectively.⁴ The National Association of Home Builders (NAHB)/Wells Fargo Housing Opportunity Index (HOI) assumes a 10% down payment, 28% qualifying ratio, and uses a weighted average of the FHFA interest rates for fixed- and adjustable-rate mortgages for the quarter. This index also accounts for the estimated cost of property taxes and property insurance.⁵

² HUD household income includes reported income from all sources for household members over age 18 (Steffen *et al*, 2015). Possible sources: wages or salaries, self-employment income, Social Security or railroad retirement income, public assistance or welfare payments, interest, dividend, rental income, and any other money income.

³ See: <http://www.realtor.org/topics/housing-affordability-index/methodology>

⁴ The California Association of Realtors (CAR) publishes this Variant HAI for California. The median price measure is obtained from the CAR's monthly existing home sales survey based on single-family homes. See: <http://www.car.org/marketdata/data/haimethodology/>

⁵ See: <http://www.nahb.org/en/research/housing-economics/housing-indexes/housing-opportunity-index.aspx>

Table 2 - Common Market-Level Metrics

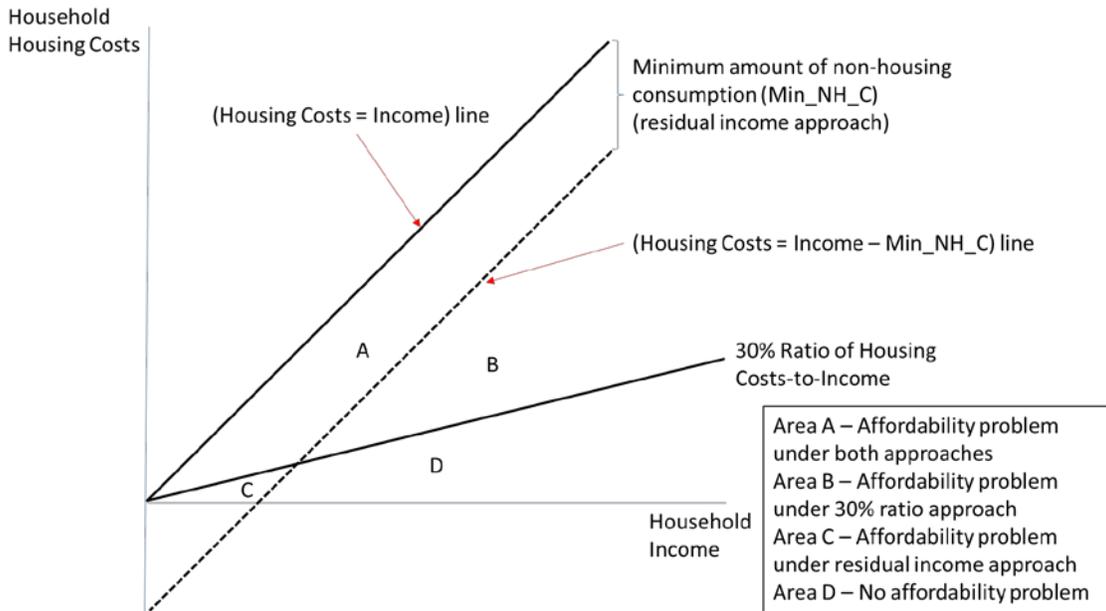
Measure	Definition	Values	Data Needed
NAR HAI	NAR HAI is the ratio of the national median family income to the income required to qualify for a mortgage-loan on a national median-priced existing single-family home. An index value above 100 indicates that the median-income family can afford the median-priced home given prevailing interest rates and mortgage qualification assumptions.	> 0	Median income, median home price, and interest rates (FHFA)
CAR Variant HAI	This measure assesses what percentage of family incomes in a given area is above the qualifying income requirement for a median-priced existing single-family home.	0-100	Distribution of income, median home prices, and interest rates (FHFA)
NAHB/Wells Fargo HOI	The NAHB/Wells Fargo HOI is the percentage of new and existing home sales of any structure type in a given area for which the monthly mortgage, property taxes, and insurance costs are less than or equal to 28% of the median pre-tax income for that area.	0-100	Median income, distribution of home prices, and interest rates (FHFA)

Household-Level Metrics: Housing Cost-to-Income Ratio vs. Residual Income Approach

Figure 1 details how households are differentially labeled as having an affordability problem based on their income and housing costs according to two different household-level metrics. One measure used is the 30% housing cost-to-income ratio. The second measure is a residual income approach. Note that Figure 1 assumes a constant household structure across income groups so the level of non-housing consumption needs is the same throughout the income distribution.

As shown in Figure 1, relative to the residual income approach, the designation of affordability based on the 30% housing cost-to-income ratio will tend to overstate affordability problems for households higher up the income distribution (area B) and understate such problems for lower-income households (area C). One can argue that for those in the bottom end of the income distribution, residual income approaches are likely to be more reliable measures of housing affordability. For such households, the probability that they do, indeed, fail to meet minimum non-housing consumption standards is larger due to income constraints. For those higher up the income distribution, this is likely not such a large concern given that their nominal income leaves them a greater margin of security before a higher share of housing expenditures limits their ability to pay for a basic level of food, clothing, and other household necessities.

Figure 1 - Affordability Problem Labeling Under Two Household-Level Metrics



Concerns with Common Affordability Metrics

By their nature, metrics can only touch on a few dimensions of something as complex as housing affordability. Therefore, Table 3 lists additional issues to keep in mind when drawing inferences from these metrics. Although concerns are separated by affordability metric type, these are merely expositional distinctions given the majority of these issues apply across the gamut of affordability metrics.

Table 3 - Concerns with Common Affordability Metrics

Concerns with Household-Level Metrics	Concerns with Market-Level Metrics
Housing consumption level is a choice. Projected future income vs. current income. Family formation decisions. Impact of expected house price changes. Non-housing consumption varies with income. Income elasticity is less than one. Depreciation and maintenance expenditures.	Median attributes vs. potential homeowners. Credit scores and underwriting criteria. Wealth constraints. Missing other housing expenditures. No seasonal adjustment. New vs. existing homes.
Concern with Both Types of Metrics	
Housing quality and amenity differences across areas.	

Concerns with Common Household-Level Metrics

Housing consumption level is a choice. Affordability measures cannot take into account all the information available to households when making their housing consumption choice. As a result, they may erroneously classify households as being cost burdened when in fact their level of housing cost-to-income is a logical utility-maximizing decision. Incorrect affordability classifications arise due to differences between the information available to a household when making a choice and the information available to an analyst or policy-maker during an evaluation



of that choice. The chance of an erroneous identification of an affordability issue using these metrics will diminish further down the income distribution as choices become more limited and tradeoffs bite more quickly into the necessities of life.

Households base their housing consumption choice on projected future income. Housing consumption decisions are likely made by taking into account projected future incomes.⁶ This means that households may be labeled as having a cost burden when in fact their future income will remove such affordability concerns. This is an issue that is especially likely to lead to the mislabeling of younger households as having an affordability problem since they are in the upward trajectory portion of their earnings profile.

Family formation decisions affect housing consumption. Households can decide to consume higher levels of housing that induce a transient affordability concern simply due to expected increases in family size.

Expected house price changes impact housing consumption levels. This can mean that households expecting the price of their home to increase will be more willing to spend a higher amount on current housing consumption. This is because they expect that price increases will compensate for their higher current costs at the time of sale or mortgage refinancing. This can lead to a household being in a cost burdened position, which simply reflects their personal choice, making it unclear whether this should be a concern or not.

Non-housing consumption needs vary with income, unlike residual income approach. The majority of consumption goods are normal goods, so one expects that households' bundle of consumption goods will increase in value with income. Yet the residual income approach assumes that the minimum consumption requirement for particular household types is the same across income levels.

Income elasticity of housing demand is lower than a value of 1 assumed with 30% ratio. The 30% housing cost-to-income ratio implicitly assumes that the income elasticity of housing demand is the same across the income distribution at a value of 1. This value is larger than literature estimates that place income elasticity of housing demand below 1, sometimes well below.⁷ Furthermore, Mayo (1981) and Zabel (2004) both stress that elasticities will vary across income levels and other demographic characteristics. This single ratio (hence single-income elasticity) approach is therefore a limitation of this affordability metric.

Depreciation and maintenance expenditures are not included in metrics. As presented in the theoretical background section, the inclusion of depreciation could provide a more accurate view of homeowner yearly user cost. However, this would involve making assumptions regarding the rate of housing depreciation, which may be troublesome. Likewise, maintenance expenditures incurred to stave off depreciation should be factored into affordability designations. Yet difficulties in distinguishing what maintenance would be of a solely precautionary nature versus what would lead to housing quality increases make the inclusion of this component challenging.

Concern with Both Metric Types

Housing quality and amenity level differences impact prices and cost burden levels. Preferences may dictate that the level of housing consumed will be considered “burdensome” from a cost perspective, but they simply reflect a preference for better quality housing (Bogdon and Can, 1997) or for higher amenity levels. Such differences in quality and amenities are a concern for market-level affordability measures because they will be reflected in prices and rents

⁶ Furthermore, current income may suffer from under-reporting bias in survey data. Hurst, Li and Pugsley (2011) show this tends to be the case for self-employed individuals; thus leading to over-estimates of affordability concerns.

⁷ Estimates of income elasticity of housing demand vary significantly across modeling assumptions, data aggregation levels, and differences in measurement of income and house prices. Nonetheless, permanent income housing demand elasticity estimates, which provide a more accurate estimation of elasticity, range between 0.36 and 0.87, with the majority of estimates in the 0.5 to 0.7 range (Mayo, 1981). More recent studies show lower estimates, in the 0.35 to 0.4 range (Goodman, 1988; and Zabel, 2004).



in a given area. This means that, all else being equal, higher quality or amenity level areas will more likely be labeled as having an affordability problem, but it is unclear whether this should be the case.

Concerns with Common Market-Level Metrics

Focus on median incomes and house prices is a limitation. Common market-level metrics tend to focus on the median values of either income or house prices in a given area. Several authors (Gan and Hill, 2009; Jewkes and Delgadillo, 2010) have stressed that affordability concerns may be more pronounced at the lower end of both the income and housing price distributions.

Wealth constraints can make metrics' down payment assumptions infeasible. Wealth constraints, particularly those related to a household's ability to accumulate enough savings for a mortgage down payment and other up-front costs of home purchase, have a large impact on the ability to become a homeowner (Linneman and Wachter, 1989). Both the NAR HAI and NAHB/Wells Fargo HOI assume that households have the ability to make the down payment requirements of 20% and 10%, respectively, and cover other up-front costs. However, this may be an unrealistic expectation for a number of households.

Omitted credit scores and underwriting criteria affect credit accessibility and costs. Credit scores are conspicuously missing from common market-level measures. Yet they have a first-order impact not only on households' ability to secure a mortgage, which is more a credit availability issue, but also on what the monthly costs associated with that mortgage would be. Likewise, changes in underwriting criteria over time will differentially affect the ability of certain population subgroups to access credit and obtain favorable mortgage rates.

Multiple expenses associated with homeownership are excluded. Common market-level measures give an incomplete view of the true housing costs since they fail to account for estimated utility costs (Dacquist and Rodda, 2006) or depreciation and maintenance costs.

Non-seasonally adjusted house prices impact affordability. Himmelberg *et al.* (2014) highlight how the NAR HAI does not carry out any seasonal adjustment of house prices, leading to fluctuations in perceived area affordability throughout the year that simply reflect the seasonality in house prices.

Omission of new homes for sale provides incomplete picture. The NAR HAI and CAR Variant HAI indices obtain their measure of the local median house price from the sales of existing homes. This is a concern since newly built homes are likely to factor into the determination of whether a market has an affordability problem.

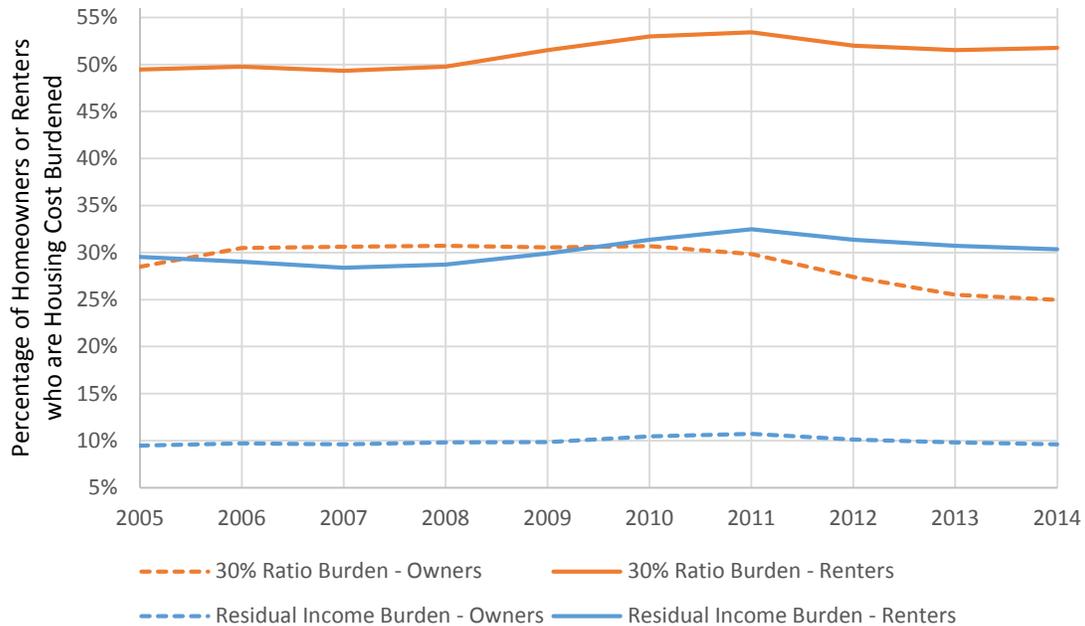
Trends in Housing Affordability Based on Common Household-Level Metrics

Figure 2 displays how the two common household-level affordability metrics have performed from 2005 to 2014, estimated using yearly American Community Survey (ACS) Summary File Tables for the 30% ratio method and Public Use Microdata Sample (PUMS) data for the residual income approach.⁸ Households deemed cost burdened under the 30% ratio approach are those whose annual housing costs exceed 30% of annual gross household income (pre-tax), as detailed in Table 1. Note that the residual income approach used is that presented by Kutty (2005). As such, the minimum levels of residual income (i.e., income remaining after covering housing expenses) are set at two-thirds the Poverty Threshold values produced by the U.S. Census Bureau and vary

⁸ For details on ACS PUMS see: <https://www.census.gov/programs-surveys/acs/technical-documentation/pums.html>

based on household head age and the number of individuals and number of children under age 18 in the household.⁹

Figure 2 - Household-Level Affordability Metrics (2005-2014)



Source: American Community Survey (ACS).

A salient feature of Figure 2 is that housing cost burden levels according to this residual income approach are lower than those based on the 30% cost-to-income. This is simply a function of the particularly low level of minimum residual income that Kutty's (2005) approach uses.¹⁰ Poverty thresholds represent a subsistence level of consumption, therefore it is unsurprising that fewer households are considered cost burdened according to this metric than under the 30% ratio approach. The difference in the percentage of households categorized as burdened across the two measures hovers around 20 percentage points, which represents a larger relative difference for homeowners than renters. This contrasts with Stone's (1993) approach, which uses higher residual income levels, and yields cost burden levels closer to those estimated using the 30% ratio approach.

Another salient feature of Figure 2 is that renter cost burden levels are higher than those for homeowners, which is in line with historical trends. The higher incidence of renter cost burdens reflects differences in average household attributes such as age (renters are younger) and income levels (renters have lower incomes) across housing tenures. Income differences across tenure status are most likely to affect cost burden levels for the residual income approach because the minimum residual income levels are not a function of household income. This is reflected in Figure 2, which shows that the percentage of renter households that are cost burdened is about three times larger than the equivalent percentage for homeowners by residual income, but only about double the size by the 30% ratio. This difference in the relative magnitudes of burden levels for

⁹ Computations are based on a sample which excludes individuals living in institutions, college dormitories, and other group quarters. In addition, households for which household income is zero or negative, and those renters with no cash rent, are also excluded from the analysis sample.

¹⁰ Kutty's (2005, Table 5) estimates using 1999 American Housing Survey data show similarly lower cost burden levels under the residual income approach (referred to as "housing-induced poverty") relative to the 30% rule.



renters versus owners across the two household-level measures of affordability emphasizes how different measures provide very different pictures regarding affordability concerns.

Analyzing affordability for all renters or owners in one single measure masks important differences in how the two types of household-level metrics may portray affordability status across household socio-demographic dimensions. While the general result that the residual income metric produces lower cost burden levels than the 30% ratio method holds, Appendix Tables B2 to B9 show other nuances worth highlighting.

Tables B2 to B5 present cost burden levels by householder age. These tables show affordability concerns are greater for the youngest (15 to 24) and oldest (65 and over) age groups. However, while for renters both metrics agree regarding the relative levels and trends of cost burden across age groups, for homeowners they do not. According to the residual income approach, burden levels are consistently higher for those over 65 than those within the 25 to 34 age group. Conversely, under the 30% ratio approach the opposite is true for homeowners, with burden levels for the younger group being higher for most of the decade, although they decrease to a level below the 65 and over group after 2012. Generally, the 30% ratio approach shows younger homeowner cost burdens have been falling for most of the decade, but have remained stable according to the residual income approach.

Results in Tables B6 to B9, displaying cost burden levels by household income group, further emphasize differences across the two household-level affordability metrics.¹¹ The relative difference in cost burden levels across income groups is significantly greater for the residual income approach (note the separate, right-hand side, scale in Tables B7 and B9 for the three highest income groups). This is unsurprising given that, as previously mentioned, the minimum residual income requirements are not a function of income. The general conclusions regarding the evolution of affordability concerns since 2005 are mostly the same across metrics. Homeowner cost burdens for the lowest income group increased or held steady throughout, while, for the remainder of homeowners, they peaked between 2008 and 2011 and have decreased or held around that level since. For renters, cost burden levels exhibited modest increases throughout the 2005-2014 period.

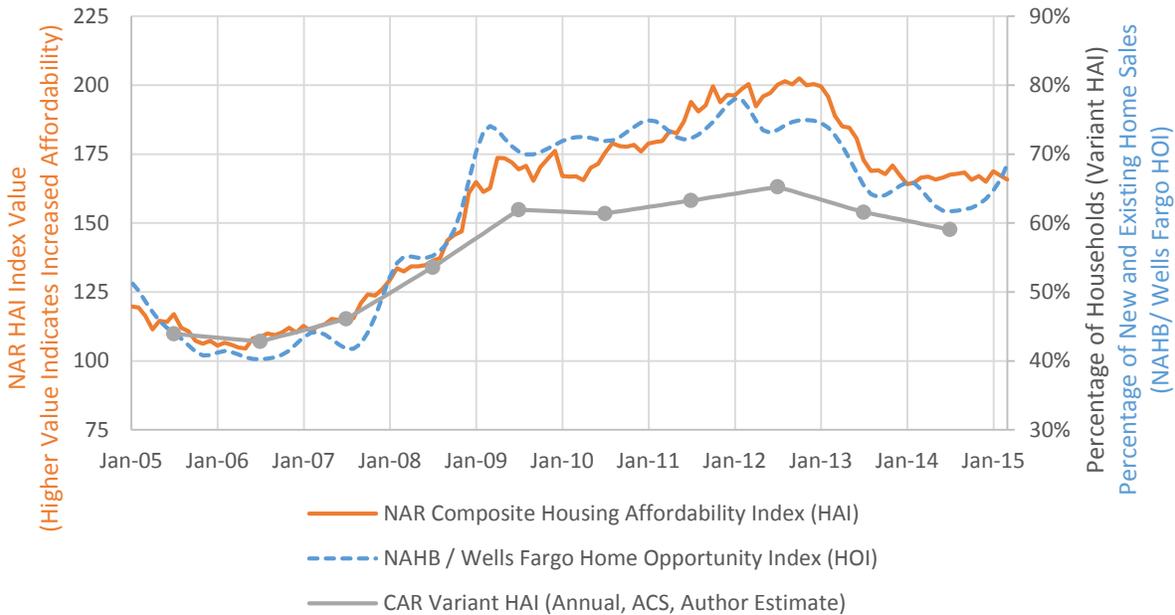
Trends in Housing Affordability Based on Common Market-Level Metrics

Figure 3 shows that all three common market-level metrics elicit similar conclusions regarding the evolution of home purchase affordability over the last decade. Note that the NAR HAI and NAHB/Wells Fargo HOI are monthly measures reported by their respective institutions, whereas the CAR Variant HAI is an annual estimate computed using yearly ACS PUMS data according to the California Association of Realtors' definition.¹² Were it not for differences in the computations and integral components of the different indices, the percentage values for the HOI and CAR Variant HAI should equal 50% when the NAR HAI index equals 100. The particular differences are due to the HOI accounting for newly built homes and assuming a 10% down payment and 28% qualifying ratio, relative to NAR HAI assumptions of 20% and 25%, respectively, and the CAR Variant HAI also assuming a different qualifying ratio (30% instead of 25%).

¹¹ Income groups in tables B6 to B9 are in year 2014 dollars; adjusted for inflation using the Consumer Price Index for All Urban Consumers.

¹² Note that the NAR HAI reported in Figure 3 is the Composite version of the index, including adjustable and fixed rate mortgage interest rates, as opposed to the Fixed version which only includes fixed rate mortgage interest rates.

Figure 3 - Monthly HAI, HOI and Annual Variant HAI



Sources: National Association of Realtors, National Association of Home Builders, American Community Survey (ACS).

Figures B10 and B11 depict how the component pieces of market-level home purchase affordability metrics have evolved over the same time period. Analyzing how median income, median home sales prices, and mortgage interest rates performed during this period sheds light on the patterns for market-level measures presented in Figure 3. All indicators in Figure 3 show that housing affordability shot up in 2009 aided by falling house prices and favorable mortgage rates. Conversely, the increase in mortgage rates in the beginning of 2013 had a negative impact on affordability, as reflected in the pronounced drop in these metrics at that time. However, even with this drop at the start of 2013, housing affordability remains at high levels when compared to the pre-2008 period.

These market-level measures seem to be particularly sensitive to fluctuations in mortgage rates. This sensitivity is clearly visible by comparing Figures 3 and B11. In doing so one sees how the movements in affordability metrics are almost the exact opposite of what happens to mortgage rates. Median income displays less variability than the other two components of the HAI and HOI, appearing to have contributed less to changes in these measures over this period.

In contrasting what household-level and market-level metrics show regarding trends in housing affordability during this period, it is interesting to note how disparate the trends are across metric types. Whereas market-level metrics clearly show a rising trend in affordability during the Jan. 2006 to Jan. 2013 period, household-level metrics do not. Household-level metrics show that homeowner affordability problems were in general either at a high level (according to the 30% ratio) or steadily increasing (according to residual income) until 2010/2011 – the decrease since then likely reflecting increased homeowner refinancing behavior to take advantage of low mortgage interest rates. For household-level metrics only, young homeowner (under 34 years old) affordability – as measured by the 30% ratio approach – seems to match up with this trend of increased affordability during the Jan. 2006 to Jan. 2013 period that is visible in market-level metrics. Note that these market-level metrics do not gauge the affordability of renter housing. This

comparison further highlights the perils of drawing conclusions on housing affordability based on a single measure or single type of measure.

Alternative Affordability Measures

In response to some of the concerns regarding common affordability metrics, several different affordability measures have been proposed. Table 4 presents some of the alternative measures that have stemmed from academic research and other research initiatives.

Table 4 - Alternative Affordability Measures

Measure	Definition	Data Needed
Amenity-Based Affordability Indices	These indices seek to include certain amenity levels in housing costs estimates. Simple measures calculate the ratio of the sum of both housing and transportation costs to income, e.g., HUD and Dept. of Transportation's (DOT) Location Affordability Index and the Center for Neighborhood Technology's Housing and Transport Affordability Index. ¹³ Fisher <i>et al.</i> (2009) propose a measure that further includes school quality and crime as well as transportation costs in affordability. ¹⁴	Housing costs, income, transportation costs, and amenities information (e.g., school quality, crime statistics)
Mismatch Measure	The ratio of housing units affordable to households in an income group (assuming no more than 30% of income goes to housing costs) to the number of households in that income group. This is estimated separately for different income cutoffs across areas. ¹⁵	Distribution of house prices and incomes
NLIHC's Housing Wage	The National Low Income Housing Coalition (NLIHC) calculates the level of household hourly wages required to afford the gross rent (rent + utilities) for different housing units based on HUD's fair market rent, assuming 30% of income goes to housing costs. ¹⁶	Fair Market Rents or rents and utility costs for a given area
First-Time or Marginal Homebuyer Indices	Both the NAR and CAR produce first-time homebuyer indices based on their HAI and Variant HAI metrics, respectively. Goldman Sachs's Marginal Homebuyer Index assesses how many marginal buyers (younger households with lower credit scores) can qualify for low down payment mortgages. ¹⁷	Median income and home prices, interest rates

Amenity-based measures address the concern regarding how different amenity levels will be captured in house prices, thus affecting affordability designations in common metrics. Mismatch measures move away from the focus on median incomes and median house prices to look at affordability for different segments of the population and the balance between housing supply and demand for these segments. The NLIHC's housing wage measure seeks to overcome the

¹³ See: CNT (2006), and HUD-DT (2015).

¹⁴ These authors also account for how income tax deductions of mortgage payments and property taxes factor into obtaining a more accurate measure of the true costs of being a homeowner.

¹⁵ See Bogdon and Can (1994) or Steffen *et al* (2015) for applications of this measure.

¹⁶ Fair Market Rent as determined by the U.S. Department of Housing and Urban Development is typically the 40th percentile of the rent distribution for specific metropolitan or rural areas. See Fair Market Rent Overview, for more information, URL: www.huduser.org/portal/datasets/fmr/fmrover_071707R2.doc

¹⁷ This index uses expected future income of 30 to 40 year-olds, constant-quality seasonally-adjusted home prices for those purchased by 30 to 40 year-olds, a 5 percent down payment and FHA mortgage insurance premium. See Himmelberg *et al* (2014).



homeowner-focused nature of market-level affordability metrics. First-time or marginal buyer indices are focused on households with more financial constraints to homeownership.¹⁸

As previously indicated, a salient criticism of common market-level metrics is the focus on population median house prices or incomes. As such, the institutions producing two of the common metrics identified in Table 2 have created alternate indices focusing on home purchasing conditions for first-time homebuyers. Appendix Figures B12 and B13 contrast the main indices, NAR HAI and CAR Variant HAI, with their respective first-time homebuyer alternatives.

Figure B12 shows that the NAR First-Time Homebuyer HAI is merely a scaled-down version of the Composite HAI measure (the first-time index value is around 34% smaller). This is because the first-time homebuyer index simply reduces the assumed house price (0.85 of median home price), income (0.65 of median income), and down payment (to 10% from 20%) relative to the general index and adds the corresponding primary mortgage insurance premium to the effective mortgage rate. By contrast, the First-Time Homebuyer Variant HAI is markedly different from the general index. In addition to the differences in home price and down payment assumptions described above, this index assumes an adjustable- rather than fixed-rate mortgage with accompanying points and fees and increases the qualifying income ratio (to 40% from 30%). As a result, Figure B13 shows the First-Time Homebuyer Variant HAI is consistently higher than the general index and that this new index is not simply a scaled-down version of the general index, as evident from the fluctuation in the difference between the two. Note, however, the logical inconsistency in this index's assumption of a 10% down payment without accounting for the added cost of a mortgage insurance premium, while the other first-time/marginal homebuyer indices do account for mortgage insurance.

It is interesting to note that the two first-time homebuyer indices described in the previous paragraph have opposite views on first-time versus general homebuyer affordability. This is evident in the NAR HAI version being below the general index but the opposite occurring for the CAR Variant HAI indices. Figure B14 compares both of these first-time homebuyer indices with the Goldman Sachs' Marginal Homebuyer Index.¹⁹ All three indices show similar trends in home purchase affordability for potential new homebuyers. The Goldman Sachs index displays less variability because it uses constant-quality seasonally adjusted house prices. This feature may make it a preferable affordability metric, over the other two, for this population subgroup.

Conclusion

This report has highlighted the most commonly used metrics for assessing housing affordability. Metrics were categorized as being either household-level or market-level measures of affordability. The most commonly referenced household-level metrics are housing-cost-to-income ratios and residual-income approaches. Market-level metrics tend to be more widely reported in the industry. Among these, the most commonly used metrics are the NAR HAI, the CAR Variant HAI, and the NAHB/Wells Fargo HOI. Nonetheless, the housing cost-to-income ratio is used in determining rent levels a family must pay in a number of assisted housing programs including Public Housing, Section 8, and Housing Choice Vouchers. As noted by Pelletiere (2008), due to

¹⁸ The Mortgage Bankers Association also publishes a housing affordability indicator. Their Mortgage Credit Availability Index has a specific focus on credit availability, which differs from this report's focus on affordability from a housing costs-to-income perspective, hence it is not included in Table 4. See: <https://www.mba.org/news-research-and-resources/forecasts-data-and-reports/single-family-research/mortgage-credit-availability-index>

¹⁹ The Goldman Sachs Index reported in Figure B14 is an author computation based on the methodological description in Himmelberg *et al* (2014).



the manner in which gross income in these programs is adjusted for a series of deductions, the effective cost-to-income ratio that is used will typically be below 30%.²⁰

The report further details issues that arise when using these measures for assessing affordability problems across population groups as well as analyzing trends in housing affordability over the last decade. The most salient concern with household-level affordability metrics pertains to the fact that housing consumption levels are a choice that is presumably made so as to maximize households' expected utility. Therefore, conceptually, it is unclear whether once a household has chosen this optimal level we can label them as having an affordability problem, when we do not have the same information that was available to them when making this decision. This is particularly relevant for those households higher up in the income distribution, for whom this is a more obvious choice. As such, housing affordability metrics will more accurately reflect true affordability concerns for households further down the income distribution. For lower-income households, residual income approaches can be particularly useful given that a ratio approach will likely underestimate the amount of income required to secure minimum non-housing consumption needs. However, as highlighted in looking at housing affordability trends based on these metrics, the particular minimum non-housing consumption levels that are used in computing each residual income metric significantly impact conclusions regarding housing affordability for different populations.

Concerns with market-level metrics arise due to the disconnect that exists between median population characteristics and behaviors, used to construct the metrics, and those same attributes of potential homebuyers. In addition, as the trends in housing affordability according to these metrics show, market-level metrics are particularly sensitive to interest rate fluctuations. This may lead to erroneous conclusions regarding affordability concerns because they do not truly reflect the extent to which homeowners are able to afford their monthly mortgage payments. In particular, interest rate increases will lead to a deterioration in housing affordability according to this measure but may actually not have an impact on affordability for current homeowners holding a fixed-rate mortgage. Since market-level metrics focus on affordability for potential entrants into the housing market, they do not capture the extent to which current homeowners or renters can afford their levels of housing consumption, and thus provide only a partial view of the affordability picture.

The analysis of housing affordability trends over the last decade shows that renter cost burden levels are consistently higher than those for homeowners. In addition, contrasting household- and market-level affordability measures elicits different conclusions regarding the evolution of affordability concerns over the last decade. Specifically, market-level metrics indicate that potential homeowner housing affordability exhibited a steady increase from 2006 to 2011 and slightly decreased since. On the other hand, household-level metrics show housing affordability problems for homeowners were highest during that same period but have since improved.

The last section of the report presents alternative affordability metrics that have been proposed to address issues with common affordability measures. These measures attempt to either capture some component of affordability that is missing from common metrics or target different segments of the population for whom common metrics do not accurately measure affordability.

This report's recommendations regarding which metric to use for particular affordability concerns are:

²⁰ HUD mandatory deductions from gross income account for: the number of household members under 18 or who are students; number of elderly or disabled family members; unreimbursed medical or attendant care expenditures; and childcare expenditures (Pelletiere, 2008).

- Household-level measures to assess cost burden levels of current homeowners and renters, residual income approaches for burden levels of lower-income households
- Market-level measures to analyze home purchase affordability, specifically the Goldman Sachs Marginal Homebuyer Index for affordability of potential entrants into homeownership
- The NLIHC Housing Wage metric to obtain a clearer picture of renter affordability across geographic areas
- Mismatch measures of affordability to gain insights into how market constraints influence affordability across areas

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References

- Bogdon, Amy and Ayse Can. 1997. "Indicators of Local Housing Affordability: Comparative and Spatial Approaches." *Real Estate Economics*, 25(1): 43-80.
- CNT, Center for Transit-Oriented Development and Center for Neighborhood Technology. 2006. "The Affordability Index: A New Tool for Measuring the True Affordability of a Housing Choice." *Brookings Institution*, Urban Markets Initiative, Market Innovation Brief, January.
- Dacquisto, David and David Rodda. 2006. "Housing Impact Analysis." *U.S. Department of Housing and Urban Development*, Office of Policy Development and Research, Report, January.
- Fisher, Lynn, Henry Pollakowski, and Jeffrey Zabel. 2009. "Amenity-Based Housing Affordability Indexes." *Real Estate Economics*, 37(4): 705-746.
- Gan, Quan and Robert Hill. 2009. "Measuring housing affordability: Looking beyond the median." *Journal of Housing Economics*, 18(2): 115-125.
- Goodman, Allen. 1988. "An econometric model of housing price, permanent income, tenure choice, and housing demand." *Journal of Urban Economics*, 23(3): 327-353.
- Himmelberg, Charles, Marty Young, Hui Shan, Chris Henson and Spencer Rogers. 2014. "Housing is not as affordable as it looks." *The Mortgage Analyst*. May 12, 2014. Goldman Sachs Group, Credit Strategy Research.
- HUD-DT, U.S. Department of Housing and Urban Development and Department of Transportation. 2015. "Data and Methodology: Location Affordability Index, Version 2.0." < <http://www.locationaffordability.info/LAPMethodsV2.pdf> >.
- Hurst, Erik, Geng Li, and Benjamin Pugsley. 2011. "Are Household Surveys Like Tax Forms: Evidence from Income Underreporting of the Self-Employed." *Finance and Economic Discussion Series*, 2011-06. Washington, DC: Federal Reserve Board.
- Jewkes, Melanie and Lucy Delgadillo. 2010. "Weaknesses of Housing Affordability Indices Used by Practitioners." *Journal of Financial Counseling and Planning*, 21(1): 43-52.

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- Kutty, Nandinee. 2005. "A new measure of housing affordability: Estimates and analytical results." *Housing Policy Debate*, 16(1): 113-142.
- Linneman, Peter and Susan Wachter. 1989. "The Impacts of Borrowing Constraints on Homeownership." *AREUEA Journal*, 17(1): 389-402.
- Mayo, Stephen. 1981. "Theory and estimation in the economics of housing demand." *Journal of Urban Economics*, 10(1): 95-116.
- Pelletiere, Danilo. 2008. "Getting to the Heart of Housing's Fundamental Question: How Much Can a Family Afford? A Primer on Housing Affordability Standards in U.S. Housing Policy." *National Low Income Housing Coalition*, February.
- Poterba, James. 1984. "Tax Subsidies to Owner-Occupied Housing: An Asset Market Approach." *Quarterly Journal of Economics*, 99(4): 729-752.
- Poterba, James. 1992. "Taxation and Housing: Old Questions, New Answers." *American Economic Review*, 82(2): 237-242.
- Quigley, John, and Steven Raphael. 2004. "Is Housing Unaffordable? Why isn't it More Affordable?" *Journal of Economic Perspectives*, 18(1): 129-152.
- Schwartz, Mary and Ellen Wilson. 2008. "Who can afford to live in a home? A look at data from the 2006 American Community Survey." *US Census Bureau*.
- Steffen, Barry, George Carter, Marge Martin, Danilo Pelletiere, David Vandenbroucke, and Yunn-Gan Yao. 2015. "Worst Case Housing Needs, 2015 Report to Congress." *U.S. Department of Housing and Urban Development*, April.
- Stone, Michael. 1993. *Shelter Poverty: New Ideas on Housing Affordability*. Philadelphia: Temple University Press.
- Stone, Michael. 2006. "What is housing affordability? The case for the residual income approach." *Housing Policy Debate*, 17(1): 151-184.
- Zabel, Jeffrey. 2004. "The demand for housing services." *Journal of Housing Economics*, 13(1): 16-35.

Appendix A – User Cost of Housing

This appendix details the elements included in the computation of imputed rent for owner-occupied housing according to user cost theory.

$$R = i P \quad (1)$$

Equation (1) displays the housing market individual equilibrium condition whereby the imputed rent (R) is equal to the opportunity cost of using the capital in housing of value P (house price), *i.e.* the foregone interest ($i * P$). This simple equation fails to account for house price growth (g), which decreases the user cost of owning a home; nor does it account for other factors that increase user costs: the depreciation (d) that the house experiences, normal wear and tear; any maintenance or improvements to the home (m) which may stave off depreciation or improve housing quality; and property taxes (t_p) incurred during that period. Equation (2) incorporates all of the above:

$$R = (i + t_p + d + m - g) P \quad (2)$$

Equation (2) assumes that the opportunity cost of borrowing is the same as that of holding the capital in housing; *i.e.* the general interest rate is the same as the interest rate on mortgage borrowing. If we were to drop this assumption, then the loan-to-value ratio (L) will factor into the user cost of housing. Equation (3) shows the updated equilibrium condition that distinguishes between the general interest rate (i_0) and the interest rate on mortgage borrowing (i_b).

$$R = ((1 - L) i_0 + L i_b + t_p + d + m - g) P \quad (3)$$

Lastly, the imputed rent for owner occupied homes needs to take into account the favorable tax treatment of housing. Mortgage payments and real estate taxes can be deducted from annual income tax thus reducing the user cost. The model assumes that households face a marginal tax rate (τ) and therefore incorporates this into the new equation:

$$R = ((1 - \tau) [(1 - L) i_0 + L i_b + t_p] + d + m - g) P \quad (4)$$

Equation (4) now incorporates all of the parameters that have been identified as factoring into the user cost of owning a home. Having this in place now allows one to see that certain factors have an obviously positive (depreciation and maintenance) or negative (house price growth) impact on the value of imputed rent for owner occupied housing. The effect of taxes on user cost is more nuanced. If taxes increase via property tax hikes, then user cost increases; conversely, if that tax increase occurs solely through increasing the marginal tax rate, then user cost decreases. The last component that can have an effect on user cost is the loan-to-value ratio. If the loan-to-value ratio decreases, as would occur with loan principal payments, then the user cost would decrease as well, so long as the general interest rate is lower than that on mortgage loans (*i.e.* $i_0 < i_b$).

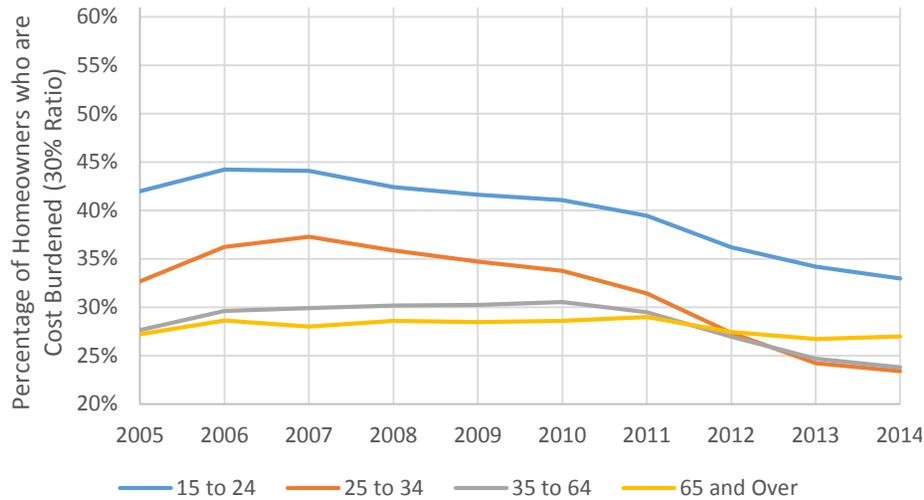
Appendix B - Supplementary Tables and Figures

Table B1 - Alphabetic List of Metrics Presented in Report

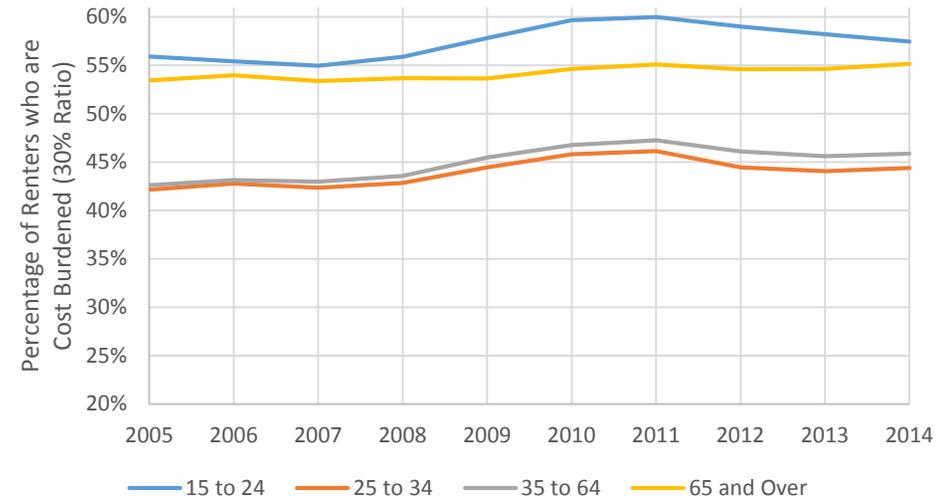
Measure	Description
Amenity-Based Affordability Indices	These indices seek to include certain amenity levels in housing costs estimates. Simple measures calculate the ratio of the sum of both housing and transportation costs to income, e.g. HUD and DOT's Location Affordability Index and the Center for Neighborhood Technology's Housing and Transport Affordability Index. Fisher <i>et al</i> (2009) propose a measure that further includes school quality and crime as well as transportation costs in affordability.
First-Time or Marginal Homebuyer Indices	Both the NAR and CAR produce first-time homebuyer indices based on their HAI and Variant HAI metrics, respectively. Goldman Sachs's Marginal Homebuyer Index assesses how many marginal buyers (younger households with lower credit scores) can qualify for low down payment mortgages.
Housing Cost-to-Income Ratios e.g. HUD Guideline	If annual housing costs exceed 30% of gross money income then a household is considered Cost Burdened (Severely Cost Burdened if costs exceed 50% of income). Renter housing cost is gross rent (rent + utilities). Owner housing costs include any payments on mortgages or other debts on the properties, real estate taxes, insurance (fire, hazard, and flood), utilities, and condominium fees.
Mismatch Measure	Is the ratio of housing units affordable to households in an income group (assuming no more than 30% of income goes to housing costs) to the number of households in that income group. This is estimated separately for different income cutoffs across areas.
NAHB / Wells Fargo HOI	The NAHB / Wells Fargo HOI is the percentage of new and existing home sales of any home structure type in a given area for which the monthly mortgage cost is less than or equal to 28% of the median income for that area.
NAR HAI	The NAR HAI is the ratio of the national median family income to the income required to qualify for a mortgage-loan on a national median priced existing single-family home. An index value above 100 indicates that the median income family can afford the median priced home given prevailing interest rates and mortgage qualification assumptions.
NLIHC's Housing Wage	The NLIHC calculates the level of household hourly wages required to afford the gross rent (rent + utilities) for different housing units based on HUD's Fair Market Rent (assuming 30% of income used for housing costs)
Residual Income Approaches	A household has an affordability problem if they cannot afford a base level of non-housing consumption after covering their housing costs. Non-housing consumption requirements vary by household size and type.
CAR Variant HAI	This measure assesses what percentage of family incomes in a given area are above the qualifying income requirement for a median priced existing single-family home.

Appendix B - Figures B2 to B5 - Housing Cost Burden Levels by Household Head Age Group

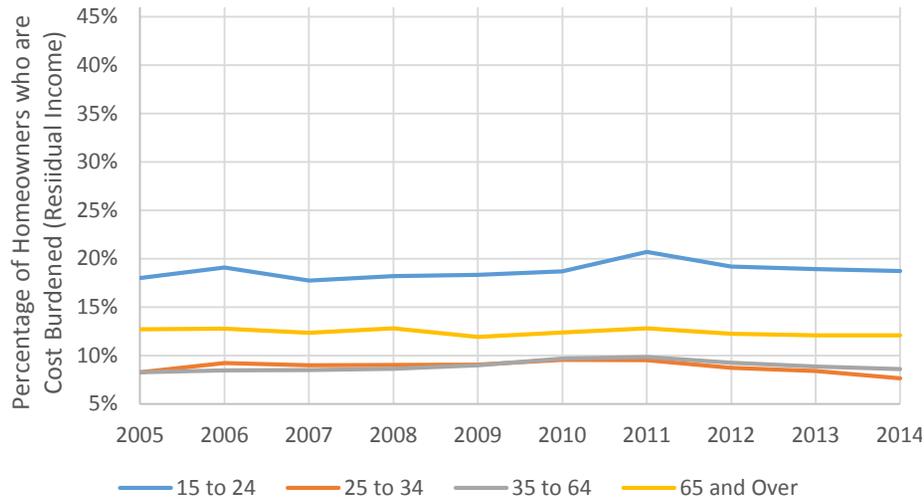
**Table B2 - Burdened Homeowners by Age Group
30% Ratio Method**



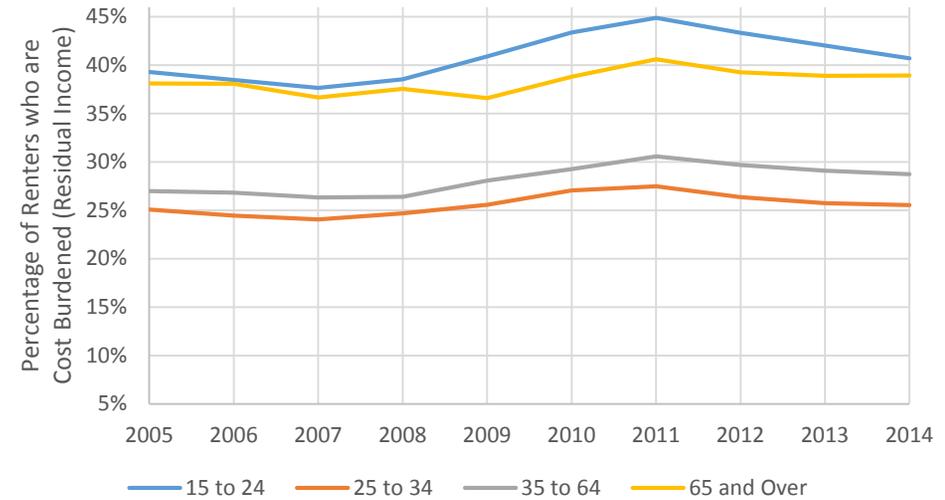
**Table B4 - Burdened Renters by Age Group
30% Ratio Method**



**Table B3 - Burdened Homeowners by Age Group
Residual Income Method**

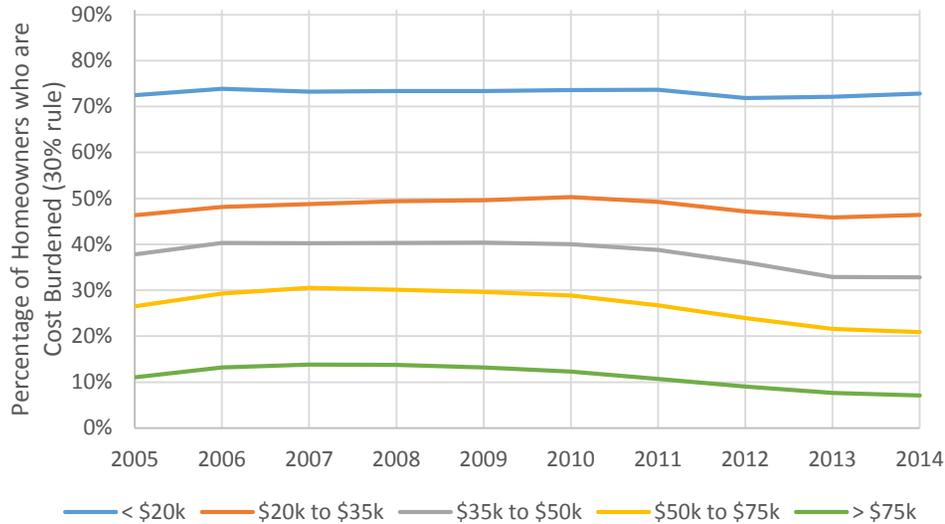


**Table B5 - Burdened Renters by Age Group
Residual Income Method**

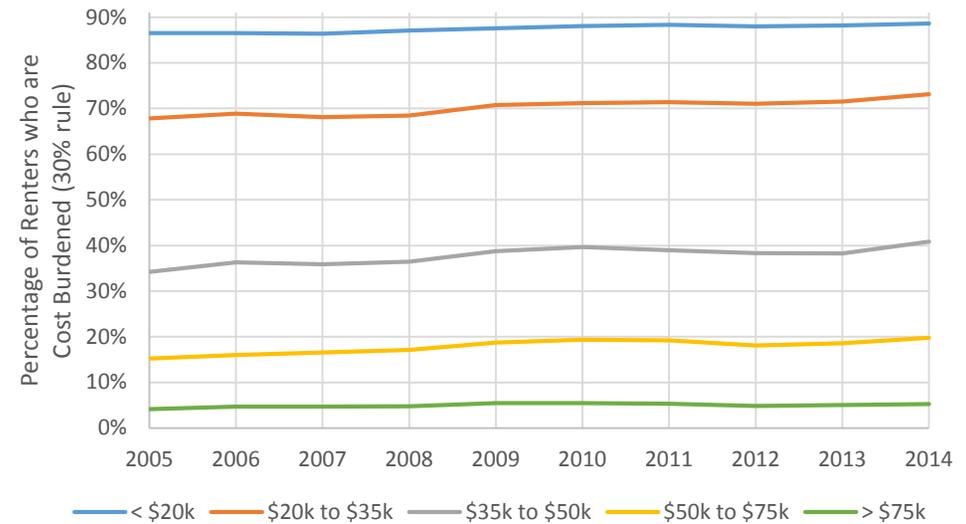


Appendix B - Figures B6 to B9 - Housing Cost Burden Levels by Household Income Group

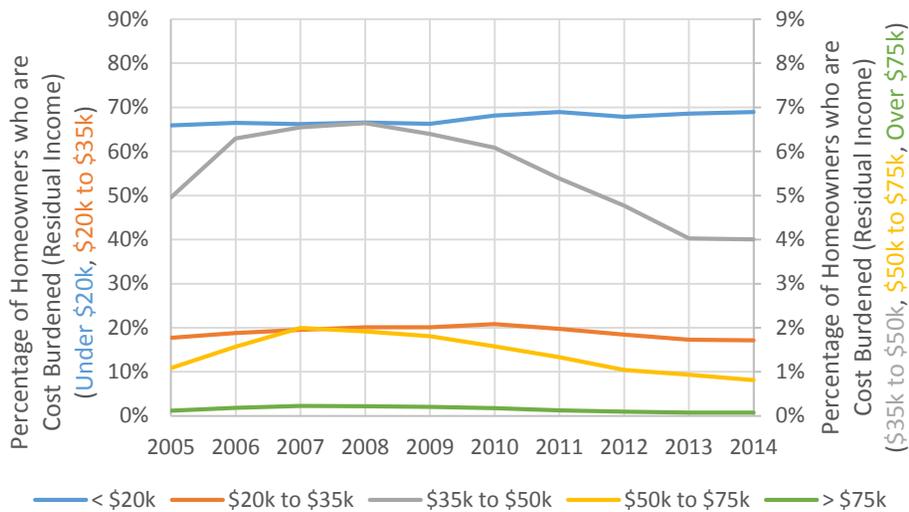
**Table B6 - Burdened Homeowners by Income Group (2014\$)
30% Ratio Method**



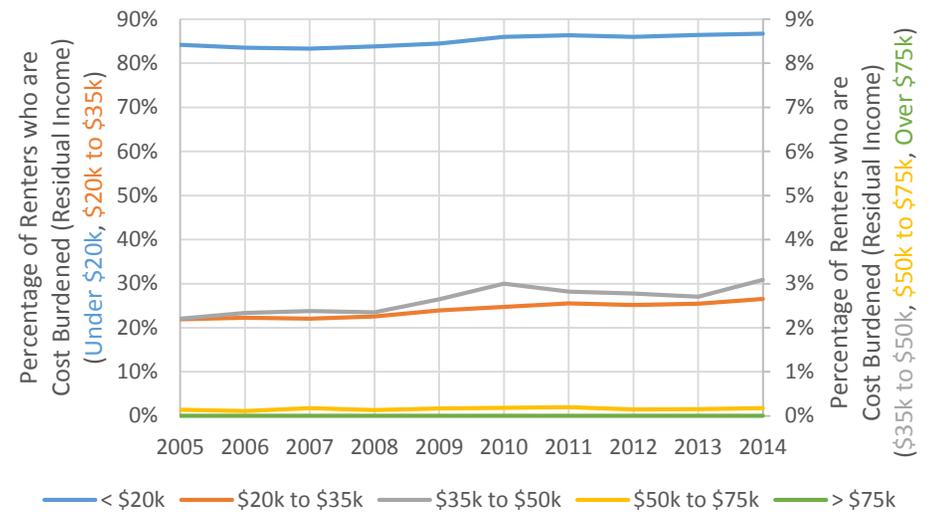
**Table B8 - Burdened Renters by Income Group (2014\$)
30% Ratio Method**



**Table B7 - Burdened Homeowners by Income Group (2014\$)
Residual Income Method**

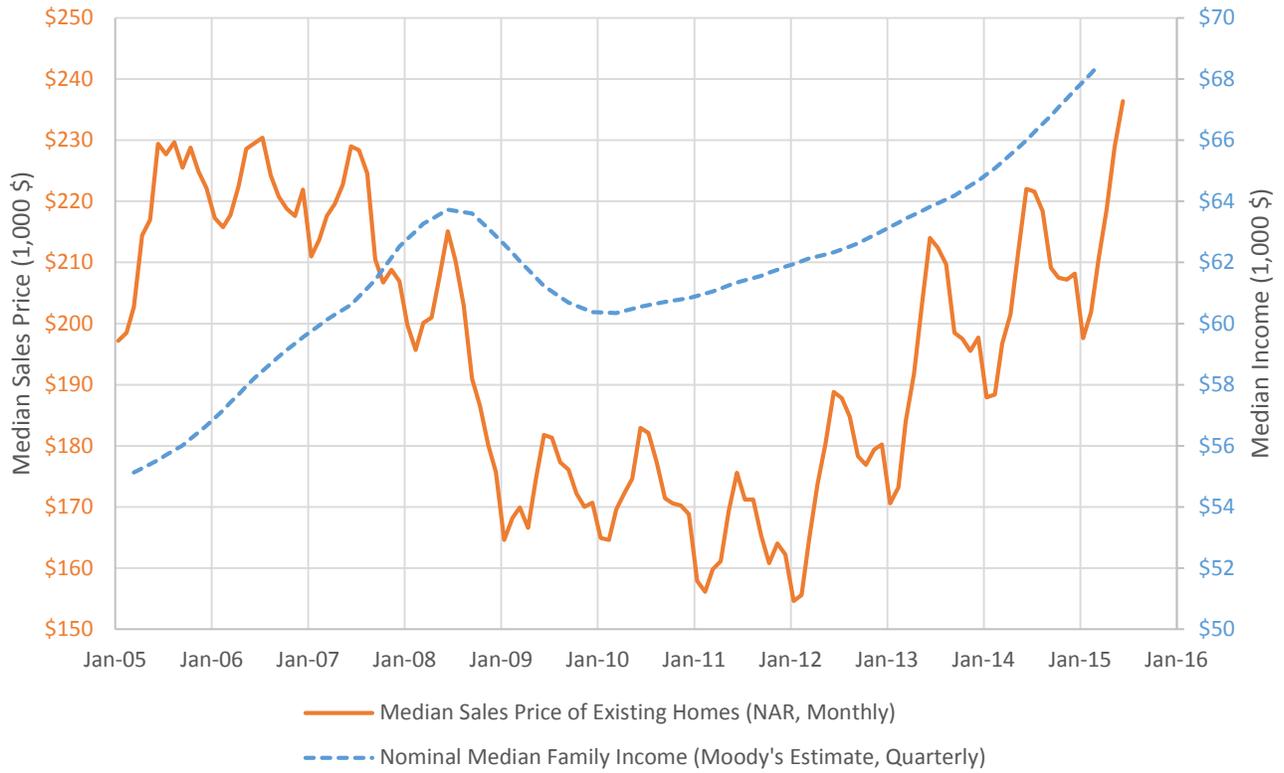


**Table B9 - Burdened Renters by Income Group (2014\$)
Residual Income Method**



**Appendix B - Figures B10 and B11 -
Components of Market-Level Affordability Metrics**

Figure B10 - Median Home Sales Price and Income



Sources: National Association of Realtors (NAR), Moody's Analytics.

Figure B11 - Monthly Mortgage Rates



Source: Federal Housing Finance Agency (FHFA).

Appendix B - Figures B12 to B14 - Comparison of First-Time and Marginal Homebuyer Indices

Figure B12 - NAR Composite HAI vs. First-Time Homebuyer HAI

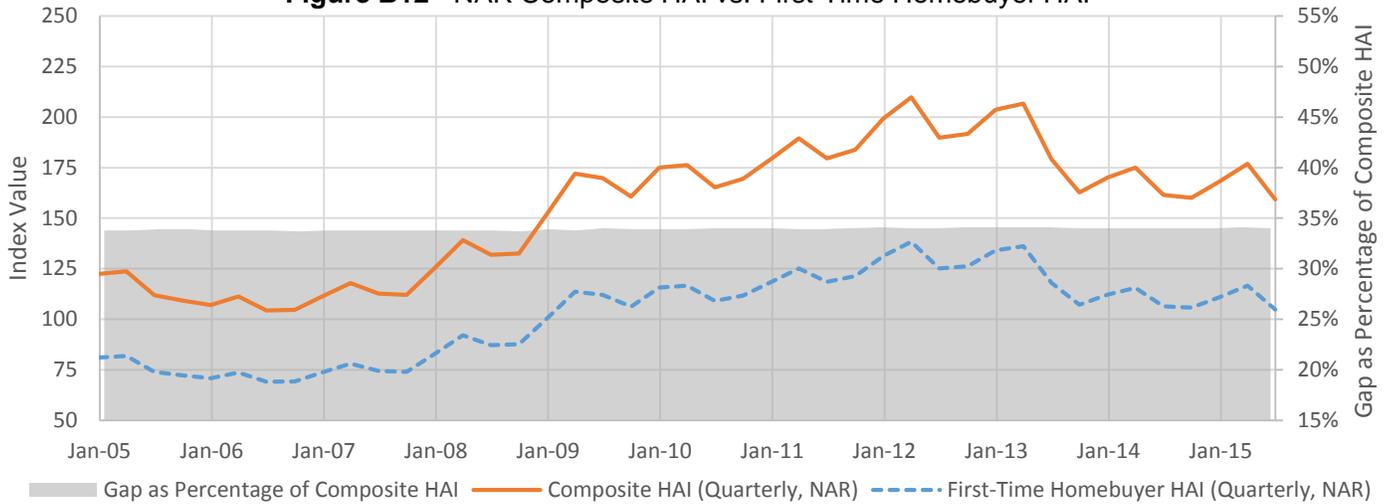


Figure B13 - Variant HAI vs First-Time Homebuyer Variant HAI

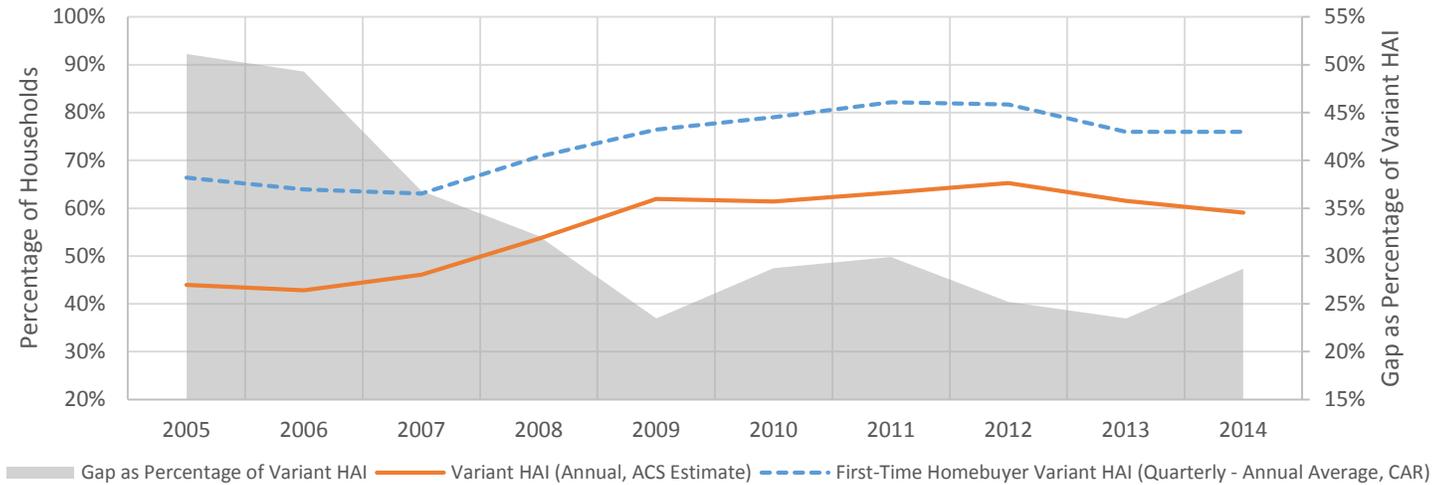
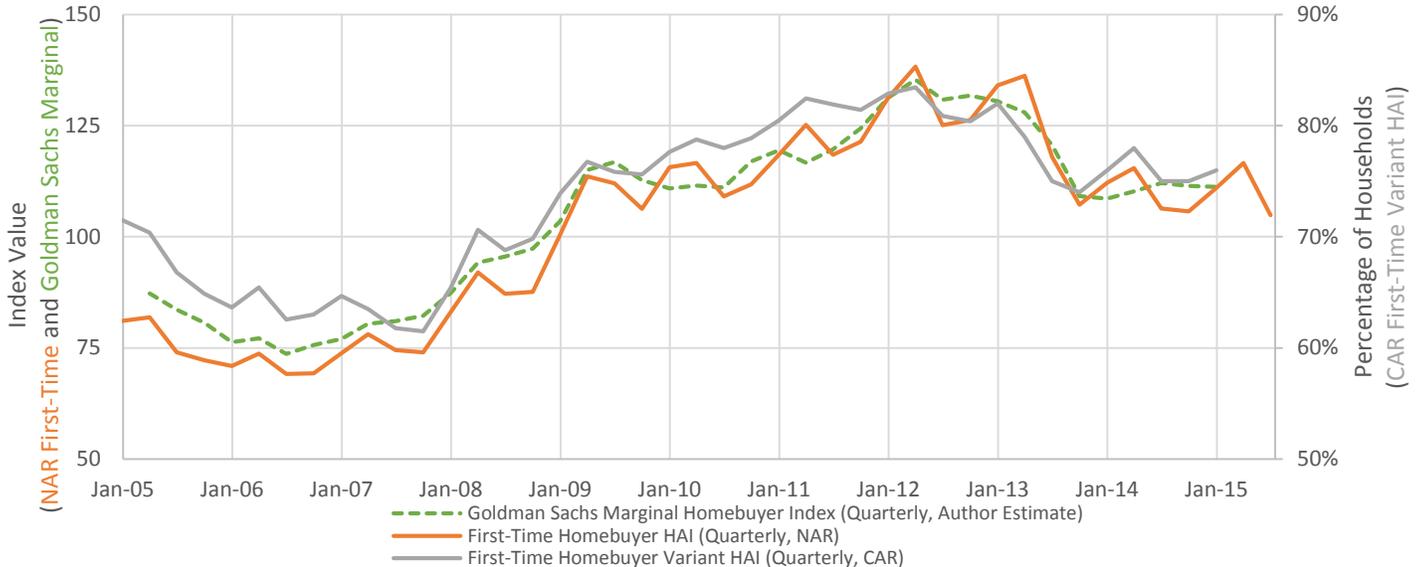


Figure B14 - First-Time Homebuyer Indices vs Marginal Homebuyer Index



Sources: California Association of Realtors (CAR), Goldman Sachs Group, National Association of Realtors (NAR).