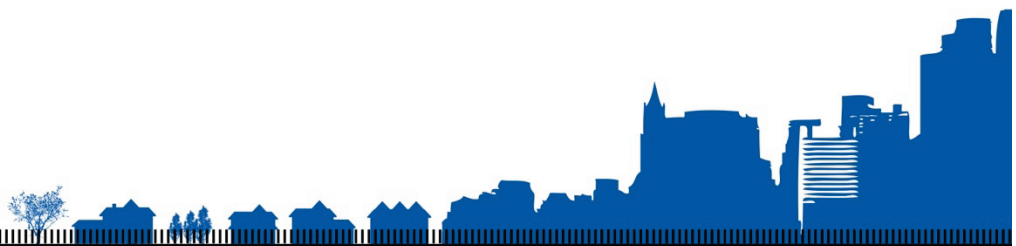


American Housing Survey

Components of Inventory Change & Rental Dynamics: Detroit 2015–2017



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American Housing Survey

Components of Inventory Change & Rental Dynamics: Detroit 2015–2017

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Foreword

The U.S. Department of Housing & Urban Development is pleased to present this report, which provides picture of the changing housing conditions in the Detroit-Warren-Dearborn metropolitan area, based on comparing the status of the housing units in 2015 and 2017. This picture has two parts. The first is Components of Inventory Change (CINCH), an analysis of the entire housing stock. The second is Rental Dynamics, which concentrates on changes in the rental stock, with special emphasis on affordability. The source for both is the American Housing Survey (AHS), which is administered by HUD and implemented by the U.S. Census Bureau. AHS has a longitudinal sample design, which means that sample units stay in the survey and are interviewed in each round (every 2 years). Thus, the AHS can detect changes in the characteristics of housing units, including the points at which they enter and leave the housing stock. Although the AHS is a national survey, it includes oversamples of 15 metropolitan areas, including Detroit. This report is based on the approximately 2,000 sample cases that the AHS surveyed in each of 2015 and 2017.

The Detroit metropolitan area's housing stock grew from 1,910,700 in 2015 to 1,936,900 in 2017. However, this net increase of 26,200 units masks the fact that the gross flows of units leaving and being added to the stock were almost as large in either direction. The AHS can trace these flows and identify how the characteristics of lost units differ from added units. It can also detect changes in the characteristics of units that stayed in the stock. The tables in this report divide the stock into 96 overlapping categories, and the text comments on which of these exhibited unusual volatility.

The Rental Dynamics section of this report zooms in on the metropolitan area's rental housing stock. The AHS can track how rental housing units become more or less affordable (in this report called "filtering" and "gentrifying," respectively). It also tracks changes in the total size of the rental stock, through new construction, physical losses, and conversion to and from owner-occupied housing. This analysis finds that the gross flows into and out of the rental stock of approximately 100,000 units in each direction left a net decrease of 16,000 units. The most affordable units, those available to households earning 50 percent of the area median income, experienced a net decline of 22,000 units (9 percent). Most of this change was the result of more units gentrifying out of the category than filtering into it.

This report demonstrates the ability of the AHS to provide detailed information on a metropolitan area. The flows of housing units into, out of, and within the stock are complex, with large gross changes resulting in relatively small net outcomes. It particularly highlights the role of gentrification and filtering in determining the size of the affordable rental stock.



Seth D. Appleton
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Executive Summary

The Detroit-Warren-Dearborn metropolitan statistical area is the 14th largest in the country, containing 1,723,300 households and 1,936,900 housing units in 2017, but the City of Detroit has become “the poster child for urban decay.” In 1950, “Detroit built one of every two cars produced in the world”; in 2013, the city filed for bankruptcy under Chapter 9.

Detroit’s decline began in the 1960s, when the “Big Three” car manufacturers began to locate new plants outside the city. The riots of 1967 further contributed to dramatic population outmigration. In the 1970s that has continued, though at lower levels, until today. At the metropolitan level, population has held relatively steady since 1980, but the net migration has not been positive since before 2000.

More recently, the metropolitan area experienced 10 consecutive years of job losses from 2000 to 2010, and 11 automotive and automotive parts plants closed between 2005 and 2011. This decline turned around in 2011, however, with good growth in jobs from 2011 to 2013 followed by slower growth through 2018.

The housing market background is particularly relevant. The 1967 riots had a devastating effect on land use in the City of Detroit: Damage occurred in a ring around downtown, and today, that ring consists of mostly vacant or partially developed census tracts. Data on year-built show that virtually none of the homes in Detroit were constructed after 1975.

The Detroit housing stock grew from 1,910,700 in 2015 to 1,936,900 in 2017. This change involved three factors: the loss of 22,700 units from the housing stock, the addition of 29,700 units, and an unexplained increase of another 19,300 units achieved by adjusting survey weights. This last factor is an unavoidable feature of Components of Inventory Change (CINCH) analysis; it means that the American Housing Survey (AHS) does not have sufficient information to identify and measure, in this case, all the additions.

The AHS divides the losses into two groups: 13,800 were temporary losses, or units that might return to the housing stock after 2017, and 9,000 were permanent losses, or units that cannot return to the stock with the same characteristics. Examples of temporary losses include the 5,000 residential units in disrepair, with interiors open to the elements, and 2,600 mobile homes that were moved out of mobile home sites. The permanent losses include 2,800 units that were demolished or destroyed due to fire or natural disaster, while another 4,600 permanent losses fell into undefined “other” categories.

Meanwhile, Detroit’s 29,700 “new units” included 19,700 that were recovered from units classified as temporary losses in 2015; new construction provided only 9,400 new units. This growth pattern is consistent with Detroit’s history.

The overall loss rate for Detroit was 1.2 percent, and the overall rate of additions was 1.5 percent, indicating a low rate of turnover in the Detroit housing stock.

This report divides the Detroit housing market into 96 overlapping segments to determine the extent to which losses and additions vary across those segments. The most notable findings are:

- Vacant units and seasonal units have substantially higher loss rates and higher addition rates. For example, the loss rate for vacant units was 4.6 percent, and the addition rate for vacant units was 6.8 percent.
- The report uses two measures of unit quality: the long-standing AHS adequacy measure, and a simple count of how many problems (from a list of 20) a unit has. For both measures, the loss rate rose as unit quality dropped; four of the six loss rates were marginally significant.
- Change rates—the percentage of a market segment in a given survey year that is still in the stock but in a different segment in the other survey year—also showed interesting results with respect to these quality measures. For both measures, change rates were low (approximately 6 percent) for better-quality units, meaning that good units tended to stay good. But change rates were high for lower-quality units under both measures, suggesting that when very bad units remain in the stock, they move to a better category in the next survey.
- Addition rates were low for households with children and those with Black householders.

This report also examines the rental market in Detroit. Counting vacant units for rent, the Detroit rental stock grew from 576,000 units in 2015 to 591,000 in 2017. The report applies rental dynamics techniques to describe how rental housing in Detroit changed during this period, with particular attention to the availability of affordable rental housing; although the Detroit rental stock grew by 15,000 from 2015 to 2017, the affordable rent category declined by 22,000 units.

There were large flows—approximately 100,000 in each direction—out of and into the rental stock from owner and seasonal stocks as well as from losses and additions to the housing stock, but the net outflow from the rental stock was only 16,000. The biggest contributor to the growth of the rental stock was a weight adjustment of 31,000.

Using a dataset created by the U.S. Department of Housing and Urban Development (HUD), the report divides the Detroit rental stock into three affordability categories: affordable rent, moderate rent, and high rent. Affordability is a simple concept; it is the relationship between the gross rent (rent plus utilities and other related costs) and household income. If a unit's gross rent is less than 30 percent of income for a particular household, then the unit is said to be affordable for that household. In 2015, the median family income in Detroit was \$67,700; a family earning 50 percent of median family income would be able to afford a unit renting for approximately \$850 ($(\$67,700/12) \cdot 0.5 \cdot 0.3$), and a family earning 80 percent of median family income would be able to afford a unit renting for approximately \$1,350 ($(\$67,700/12) \cdot 0.8 \cdot 0.3$). The actual classification in the HUD data of units by affordability is complicated because it simultaneously takes household size and number of bedrooms into account.

Although net flows into and out of the rental stock were relatively small between 2015 and 2017, within the stock there were large flows among these three affordability categories, which had the effect of reducing affordable rental housing. The following are the experiences of each category:

- **Affordable rent:** This group includes HUD-assisted and no-cash-rent units as well as all units with gross rents at or below the highest rent that a household earning 50 percent of the local median family income could afford. This category declined from 256,000 to

234,000 units. The net of gentrification over filtration accounted for 17,000 of the 22,000-unit decrease, as 62,000 units gentrified out of the most affordable category while 45,000 filtered into it.

- **Moderate rent:** This group includes all units with gross rents higher than the affordable rent cap but at or below the highest rent that a household earning 80 percent of the local median family income could afford. The moderate rent category gained 20,000 units. This rent category is the only one where filtration and gentrification can occur in both directions. Although 8,000 more units filtered out of this category to the affordable category than filtered into it from the high rent category, the moderate rent category gained units from gentrification when 22,000 more units gentrified up into it than gentrified out of it. The net of these inter-category flows was 14,000 units, accounting for most of the 20,000-unit gain.
- **High rent:** This group includes all units with gross rents higher than the moderate rent cap. The high rent category gained 17,000 units. It gained 32,000 units from gentrification while losing 21,000 units to filtration, for a net inter-category flow of 11,000.

Components of Inventory Change & Rental Dynamics: Detroit 2015–2017

Section 1: Introduction

The U.S. Department of Housing and Urban Development (HUD) and U.S. Census Bureau conduct a large-scale survey of the housing stock, called the American Housing Survey (AHS), in 2-year cycles. In addition to the approximately 50,000 units in the national survey, the AHS oversamples units in the 15 largest metropolitan areas, and a separate metropolitan AHS draws samples in 20 of the 16th through 50th largest metropolitan areas. The samples from the 15 largest areas are collected every 2 years, whereas samples from the other 20 areas are collected every 4 years—10 in one survey cycle and 10 in the next. As a result, HUD and the U.S. Census Bureau are able to produce detailed portraits of housing units and the households who inhabit them for 25 metropolitan areas every 2 years.

The AHS survey is longitudinal, which means that the same housing units are interviewed in each 2-year cycle. This special feature allows researchers to observe changes at the unit level. HUD has exploited this feature in two series of studies: Components of Inventory Change (CINCH), which explores how the national housing stock evolves between surveys, and Rental Dynamics Analyses, which focuses on the evolution of the rental stock, particularly the affordable rental stock.

HUD seeks to use longitudinality to examine how the housing stock evolves at the metropolitan level. This report, sponsored by HUD, uses CINCH and rental dynamics techniques to explain changes in the Detroit housing market between 2015 and 2017. The AHS samples from Detroit are large enough to furnish reliable information on housing conditions in the Detroit metropolitan area; the 2015 sample contained 2,141 interviewed cases, and the 2017 sample contained 2,164 interviewed cases. Flows into and out of the Detroit housing market, however, are small; losses to the 2015 housing market are represented by only 15 interviewed cases, and additions are represented by only 38 interviewed cases. Therefore, the level of detail in the report and its precision are necessarily less than those found in corresponding studies at the national level.

Section 1.1: Related Studies

Three related studies demonstrate the power of CINCH and rental dynamics analysis at the national level. Of particular importance, they contain relevant methodological background for this study of Detroit.

- *Components of Inventory Change: 2015–2017* assesses changes in the U. S. housing market. Section 2.3: Units in Both Housing Stocks explains how CINCH is composed of two separate analyses: one that looks forward from 2015 to 2017 and one that looks back from 2017 to 2015. Appendix A explains how to read the classic forward-looking and backward-looking CINCH tables.
- *Rental Market Dynamics: 2015–2017* tracks changes in the U.S. rental market. Section 3: The Fundamental Structure of Rental Dynamics Analysis explains how the basic rental dynamics tables are constructed.

- *WEIGHTING FOR CINCH AND RENTAL DYNAMICS* explains how the weights used in CINCH and rental dynamics analysis are constructed. The Research Goals and Methodological Issues section explains the methodology involved in CINCH analysis. Appendix B documents the weights used in this study.

All three reports are available online.¹

Section 1.2: Organization

This report is organized as follows:

- Section 2 explains how the Detroit housing stock grew from 2015 to 2017.
- Section 3 examines segments of the Detroit housing market that underwent noteworthy changes.
- Section 4 shows how the Detroit rental market changed.

There are three appendices:

- Appendix A contains the classic forward-looking and backward-looking CINCH tables for Detroit.
- Appendix B contains loss rate, addition rates, t-statistics, and change rates for 96 overlapping segments of the Detroit housing market.
- Appendix C presents the fundamental forward-looking and backward-looking rental dynamics tables for Detroit.

¹HUD. *Components of Inventory Change (CINCH) Reports*. Retrieved from <https://www.huduser.gov/portal/datasets/cinch.html>.

Section 2: Detroit Housing Stock: 2015–2017

Section 2.1: Background²

The Detroit-Warren-Dearborn metropolitan statistical area is the 14th largest in the country, containing 1,723,300 households and 1,936,900 housing units in 2017. In 1950, however, the City of Detroit was the 5th largest in the United States. Now only the 23rd largest city, it has become “the poster child for urban decay.” In 1950, “Detroit built one of every two cars produced in the world”; in 2013, the city filed for bankruptcy under Chapter 9.

Detroit’s decline began in the 1960s, when the “Big Three” car manufacturers began to locate new plants outside the city. The riots of 1967 further contributed to dramatic population outmigration in the 1970s, and outmigration has continued at lower levels until today. Although population at the metropolitan area level has held relatively steady since 1980, net migration has not been positive since before 2000.

More recently, the metropolitan area experienced 10 consecutive years of job losses from 2000 to 2010, and 11 automotive and automotive parts plants closed between 2005 and 2011. This decline turned around in 2011, however, with good growth in jobs from 2011 to 2013 followed by slower growth through 2018.

The housing market background is particularly relevant. The 1967 riots had a devastating effect on land use in the City of Detroit. While Detroit’s population fell by 10 percent and 9 percent in the 1950s and 1960s, it fell 20 percent in the 1970s. Fire damage occurred in a ring around downtown that contained housing built in the 1930s; today, that ring consists of mostly vacant or partially developed census tracts, and year-built data show that virtually none of the homes in Detroit were constructed after 1975. What new development there is in the city is concentrated downtown, along the riverfront, and in the area around Wayne State University. In Wayne County, the sales market in 2018 was considered soft but the rental market was judged balanced. Both the sales and rental markets outside Wayne County are considered balanced.

²This background section draws heavily from three documents:

Owens, R., Rossi-Hansberg, E., & Sarte, P-D. (2020). Rethinking Detroit. *American Economic Journal: Economic Policy*, 12(2), pp 258–305. This article focuses on the City of Detroit and provides an excellent overview of deep-seated problems that have plagued Detroit since the late 1960s.

HUD. (2018, October 1). *Comprehensive Housing Market Analysis Detroit-Warren-Dearborn, Michigan*. <https://www.huduser.gov/portal/publications/pdf/DetroitWarrenDearbornMI-CHMA-18.pdf>.

HUD. (2016, July 1). *Comprehensive Housing Market Analysis Detroit-Warren-Dearborn, Michigan*. <https://www.huduser.gov/portal/publications/pdf/DetroitMI-comp-16.pdf>. These HUD documents focus on the recent history and current prospects of the entire Detroit metropolitan area but include separate analysis of Wayne County.

This subsection uses information from all three documents without specific attribution.

Section 2.2: Growth in the Housing Stock, 2015–2017

Exhibit 2-1 identifies the basic mechanisms in Detroit’s housing stock growth. One contribution of CINCH analysis is to measure losses from the stock and additions to the stock. There is no other published information on losses, and the information on additions involve only new construction, not all additions.

Exhibit 2-1. Basic Mechanism in Detroit’s Housing Stock Growth

2015 Housing Stock	1,910,700
Losses From the Stock	22,700
2015 Units to 2017	1,887,900
Weight Adjustment	19,300
2017 Units From 2015	1,907,200
Additions to the Stock	29,700
2017 Housing Stock	1,936,900

CINCH uses different weights for forward-looking and backward-looking analyses; the fourth row in exhibit 2-1 is an adjustment based on the switch in CINCH weights.³ This adjustment is interpreted as the “error” in CINCH’s attempt to track the evolution of the stock from 2015 to 2017.⁴ It means, in this case, that the AHS does not have sufficient information to identify and measure all additions.

Another contribution of CINCH is to identify and measure the different ways in which a unit can leave the stock. The AHS classifies losses as either temporary, which means the lost unit can return to the stock, or permanent, which means the lost unit cannot return to the stock with the same characteristics.⁵ Exhibit 2-2 lists nine types of temporary losses and seven types of permanent losses and provides estimates for each. An estimate of “0” does not mean that the Detroit area experienced no losses of that type; instead, it most likely means that the sample (15 cases) was too small or that the follow-up to “not classified above” losses was incomplete.

Of the losses, 61 percent were temporary and only 39 percent were considered permanent. The temporary designation does not mean that the unit will return to the stock, only that it could potentially return, and many temporary losses eventually become permanent. Given Detroit’s history, it is interesting that over one-third of temporary losses were units with an “interior exposed to the elements.”

³CINCH weights have to measure losses accurately and sum to the 2015 stock and also measure additions accurately and sum to the 2017 stock; one set of weights cannot do both. The AHS also uses different weights to portray the 2015 and 2017 housing stock. If this analysis had used the AHS weights, the difference between 2015 and 2017 for these same 2,259 cases would have been 124,800.

⁴“Error” is appropriate in the sense that the needed adjustment would be close to zero if the original sample selection and weighting had been perfect and non-response introduced no biases, and if the sample added in 2017 accurately reflected all additions to the stock and was appropriated weighted.

⁵For example, when a unit is split in two, there are now two units in the stock but neither is the same as the original unit. The U.S. Census Bureau considers this case to be the loss of a unit and the addition of two units.

Over one-third of the permanent losses (2,800 out of 9,000) involved the physical destruction of the unit. The movement of a mobile home is considered a loss because it involves the separation of the capital and the land that composed the original unit. A significant number of permanent losses occurred in the two “other” categories (1,400 and 3,200, respectively).

Exhibit 2-2. Losses From the Detroit Housing Stock, 2015–2017

Temporary Losses	Number
Permit granted, construction not started	0
Under construction, not ready	3,200
Permanent or temporary business or commercial storage	1,600
Unoccupied site for mobile home or tent	2,600
Other unit including non-staff, or converted to institutional unit	0
Occupancy prohibited	0
Interior exposed to the elements	5,000
Not classified above, structure type is not boat, RV, tent, cave, or railroad car	1,400
Not classified above, structure type is boat, RV, tent, cave, or railroad car	0
Subtotal	13,800
Permanent Losses	
Demolished or disaster loss	2,800
House or mobile home moved	1,600
Unit eliminated in structural conversion	0
Merged, not in current sample	0
Permit abandoned	0
Not classified above	1,400
Unit does not exist or unit is out of scope	3,200
Subtotal	9,000
Total losses	22,800

CINCH also identifies the various ways that units can enter the housing stock, but measurement is not precise even with larger samples. CINCH separates units that enter the stock into three groups. First, it counts units that were considered residential when sampled but were found in the 2015 survey to be out of the stock temporarily for one of the reasons listed in the top panel of exhibit 2-2. If these units are in the 2017 housing stock, they are considered additions; if a unit had not started construction or construction was not completed in 2015, CINCH labels them new construction in 2017. Second, every year, the U.S. Census Bureau adds units to the AHS sample from new entries in its Master Address File. All of these new addresses are considered new additions; if a newly sampled unit was built in 2010 or later, CINCH lists it as new construction.⁶ Third, if a newly sampled unit was built before 2010, CINCH lists it as “other additions” without clarifying how it was added. There are many possibilities, including an older mobile home being

⁶The AHS does not have a variable that identifies new construction, and CINCH has to use year built to identify such units. Unfortunately, concerns about protecting confidentiality caused the Census Bureau to group year-built into categories, the most recent being “2010 and later.”

moved to a new location, a new unit being created by splitting an older unit or merging two older units, or a warehouse being converted into residential units.

Exhibit 2-3 contains all three groups and, where possible, breaks the groups down into components. As in exhibit 2-2, a “0” means the sample was probably too small to include examples of this type of addition, or that follow-up was not complete enough to move a case out of the “not classified above” groups.

Exhibit 2-3. Additions to the Detroit Housing Stock, 2015-2017

Additions by Source	Number
New construction	9,400
Newly sampled units built 2010 or later	9,400
Uncompleted units in 2015	0
Recovered units temporarily lost in 2015	19,700
Permanent or temporary business or commercial storage	1,800
Unoccupied site for mobile home or tent	900
Other unit including non-staff, or converted to institutional unit	1,700
Occupancy prohibited	1,900
Interior exposed to the elements	7,400
Not classified above, structure type is not boat, RV, tent, cave, or railroad car	6,000
Not classified above, structure type is boat, RV, tent, cave, or railroad car	0
Other additions	800
Newly sampled units built before 2010	800
Total additions	29,800

Exhibit 2-3 shows 29,800 additions, which is slightly higher, because of rounding, than the most reliable CINCH estimate of 29,700 in exhibit 2-1. New construction accounted for only 9,400 additions, all of which came from newly sampled cases; none were units that were unfinished in 2015. The CINCH report covering the entire Nation found that the CINCH estimate of new construction probably overestimates new construction by roughly 25 percent at the expense of “other additions.”

There were 19,700 recovered units that had been temporary losses in 2015, constituting two-thirds of all additions. The largest number (7,400) were units with interiors exposed to the elements in 2015. Finally, there were only 800 other additions, or newly sampled units built before 2017.

Given the small number of sampled cases (15 for losses and 38 for additions), the detail presented in exhibits 2-2 and 2-3 represent, in many cases, only one or two sample cases.

Section 3: Detroit Housing Market Segments with Noteworthy Loss or Addition Rates or Changes in Characteristics

CINCH analysis typically looks at changes not only in the overall housing stock but also in interesting subsets of the housing market. Appendix A contains four forward-looking tables and four backward-looking tables that decompose the housing market in 96 overlapping segments. These segments are defined by unit characteristics such as structure type and size; by unit quality; by householder and household characteristics such as age, race, and household composition; and by tenure, housing costs, and household income.

This section looks across all 96 segments to see if any differed in noteworthy ways from the general housing stock in terms of rate of loss, rate of new additions, or the extent to which members of the segment adhered (between the 2015 and 2017 surveys) to the characteristics that define the segment. Appendix B contains loss rates, addition rates, and change rates for all the segments.

To avoid calling attention to numbers based on small sample sizes, the analysis uses a statistical test to compare the loss and addition rates of each segment to an overall rate, such as the loss rate for all units.⁷ Exhibit 3-1 gives the loss rate and addition rates of the comparison groups.

Exhibit 3-1. Loss and Addition Rates of Comparison Segments

Segment	Loss Rate (%)	Addition Rate (%)
All housing units	1.2	1.5
All occupied units	0.7	1.0
All renter-occupied units	1.0	1.7
All owner-occupied units	0.5	0.6

For the 2015 Detroit stock, 1.2 percent of all units, 0.7 percent of occupied units, 1.0 percent of renter-occupied units, and 0.5 percent of owner-occupied units were lost by 2017. Only the rate for occupied units differed significantly from any of the others; in this case, from the loss rate for all units. With respect to additions, 1.5 percent of the 2017 housing stock, 1.0 of the occupied stock, 1.7 percent of the renter-occupied stock, and 0.6 percent of the owner-occupied stock were additions. None of these rates differed significantly from one another.

Change rates are the percentage of a market segment in a given survey year that is still in the stock but in a different segment in the other survey year. Change rates can reveal insights into how the housing market operates, but one must interpret them cautiously. Not having the same characteristic may mean many things; for example, not being renter-occupied can mean the unit is owner-occupied, vacant, or seasonal. In addition, the information on characteristics comes from interviews, and respondents can make mistakes.

⁷The test used is a comparison of percentages. For various reasons, this is not the preferred test, but it is convenient and serves the purpose of differentiating among segments.

Section 3.1: Housing Characteristics

Occupied units have both a lower loss rate and a lower addition rate than all housing units, whereas vacant units and seasonal units have substantially higher loss rates and higher addition rates, as shown in exhibit 3-2. The seasonal sector includes second homes—in AHS terminology, UREs (usual residence elsewhere). The vacant sector has high change rates (over 50 percent), suggesting that vacant units move quickly out of that status. The seasonal sector consisted of 10 sample cases in 2015 and 9 in 2017.

Exhibit 3-2. Loss and Addition Rates for Vacant and Seasonal Units

Segment	Loss Rate (%)	Addition Rate (%)
Occupied	0.7*	1.0*
Vacant	4.6***	6.8***
Seasonal	38.0**	11.3

* Significant at 0.10 level. ** Significant at 0.05. *** Significant at 0.01.

Although loss and addition rates vary with the type of structure and size of unit, the sample sizes are too small to draw conclusions, with some exceptions. Regarding structure type, single-family detached units had a low addition rate (0.9 percent), whereas units in buildings containing 20 or more units had a high addition rate (6.0 percent). For unit size, units with no or one bedroom had a high addition rate (5.3 percent), and units with three bedrooms had a low addition rate (0.7 percent).

Section 3.2: Unit Quality

Small sample sizes are a particular problem with respect to unit quality. This report uses two measures of unit quality: the long-standing AHS adequacy measure, and a simple count of how many problems (from a list of 20) a unit has. In general, unit quality is high in Detroit, with only 23 sample cases earning the worst AHS adequacy score, 9 of which became losses. Similarly, only 47 sample cases had 4 or more of the 20 problems, 10 of which left the stock. For both measures, the loss rate rose as unit quality dropped, and four of six results were considered significant at the 0.05 level.

Change rates are interesting with respect to the quality measures. For both measures, change rates were low (approximately 6 percent) for better-quality units, meaning that good units tended to stay good. But change rates were high for lower-quality units under both measures—59 percent for the count measure and 74 percent for the AHS measure—suggesting that when very bad units remain in the stock, they move to a better category in the next survey.

Section 3.3: Householder and Household Characteristics

In CINCH analysis of the national stock, the report concluded that there was no evidence that losses occur at higher rates among any groups defined by policy-sensitive characteristics such as age, race, ethnicity, or the presence or absence of children.

For Detroit, there were only two statistically sound and potentially policy-relevant findings. Among households with children, only 0.3 percent of the 2017 stock were new additions, whereas among units with Black householders, only 0.2 percent were new additions. This compares to 1.0 percent for all occupied units.

Section 3.4: Tenure, Housing Costs, and Household Income

There are no notable findings in this category, which corresponds to Table D (forward- and backward-looking) in Appendix A. Detroit's sales and rental markets have markedly low turnover, with only the addition rate for renter-occupied units exceeding 1 percent.

Section 4: Detroit Rental Housing: 2015–2017

The U.S. Census Bureau’s Table Creator tool indicates that renter-occupied housing units in Detroit grew from 520,000 in 2015 to 527,300 in 2017, an increase of only 7,300.⁸ At the same time, the median cash rent increased by 4.8 percent, from \$832 to \$872. This section applies rental dynamics techniques to explain how rental housing in Detroit changed from 2015 to 2017, with particular attention to the availability of affordable rental housing.

For this purpose, the report makes use of the Housing Affordability Data System (HADS), a component of the redesigned AHS created by HUD using AHS data. HADS has two advantages. First, it includes vacant for-rent units in the rental stock and imputes a total housing cost estimate to these units. Total housing costs equal the sum of rent, utilities, and related costs; this is also sometimes called gross rent. Second, HADS classifies all rental units into one of eight affordability categories. Because of limited sample size, this report compresses the eight categories into three. Counting vacant units for rent, the Detroit rental housing stock grew from 576,000 units in 2015 to 591,000 in 2017.

Section 4.1: Flows at the Rental Stock Level

Exhibit 4-1 tracks the flow of units out of and into the rental stock. Although the net flows were small, the gross flows were large relative to the 15,000 increase in the housing stock. Over 100,000 units left the 2015 rental stock, whereas just under 100,000 units entered the 2017 stock either from the 2015 owner and seasonal stocks or from additions. The net inflow of rental units was -16,000.

Exhibit 4-1. Flows Into and Out of the Detroit Rental Stock, 2015–2017

Rental units in 2015	
2015 rental units to owner or seasonal stock in 2017	576,000
2015 rental units lost to the stock by 2017	114,000
2015 rentals to 2017 rentals	462,000
<i>Forward-looking weights above</i>	
Weight adjustment	31,000
<i>Backward-looking weights below</i>	
2017 rentals from 2015	493,000
2015 owner or seasonal stock to rental in 2017	85,000
Rental units added by 2017	13,000
Rental units in 2017	591,000
Gross flow into and out of rental stock (excludes weight adjustment)	212,000
Net inflow from owner or seasonal stock	-16,000

Note: Totals do not equal the sum of components due to rounding.

As explained earlier, different weights are used in the forward-looking and backward-looking analyses. A large percentage of the 2015 rental stock remained rental in 2017. The forward-looking

⁸Table Creator allows users to access prepared tables bases on AHS data; it can be found at <https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html>.

weights estimate these units at 462,000 in 2015, whereas the backward-looking weights estimate these same units at 493,000 in 2017—a (rounded) difference of 31,000.

Section 4.2: Flows Within the Rental Stock

Using a dataset created by HUD, the report divides the Detroit rental stock into three affordability categories: affordable rent, moderate rent, and high rent. Affordability is a simple concept; it is the relationship between the gross rent (rent plus utilities and other related costs) and household income. If a unit’s gross rent is less than 30 percent of income for a particular household, then the unit is said to be affordable for that household. In 2015, the median family income in Detroit was \$67,700; a family earning 50 percent of median family income would be able to afford a unit renting for approximately \$850 $(\$67,700/12)*0.5*0.3$ and a family earning 80 percent of median family income would be able to afford a unit renting for approximately \$1,350 $(\$67,700/12)*0.8*0.3$. The actual classification in HADS of units by affordability is complicated because it simultaneously takes household size into account when considering income and number of bedrooms when considering gross rent.

- **Affordable rent:** This group includes HUD-assisted and no-cash-rent units as well as all units with gross rents at or below the highest rent that a household earning 50 percent of the local median family income could afford.
- **Moderate rent:** This group includes all units with gross rents higher than the affordable rent cap but at or below the highest rent that a household earning 80 percent of the local median family income could afford.
- **High rent:** This group includes all units with gross rents higher than the moderate rent cap. The high rent category gained 17,000 units.

Although net flows into and out of the rental stock were relatively small between 2015 and 2017, within the stock there were large flows among these three affordability categories, which had the effect of reducing affordable rental housing. Exhibit 4-2 measures the flows among these three categories between 2015 and 2017.

Exhibit 4-2. Flows Among Affordable Categories⁹

<i>Forward-looking analysis—2015 to 2017</i>	<i>Number</i>
Flows to more affordable categories	53,000
Same category in 2017	325,000
Flows to less affordable categories	84,000
Net flows to more affordable categories	-31,000
<i>Backward-looking analysis—2017 from 2015</i>	
Flows from less affordable categories	59,000
Same category in 2015	348,000
Flows from more affordable categories	86,000
Net flows from less affordable categories	-27,000

⁹The weight adjustment is smaller in exhibit 4-3 than in exhibit 4-2 because it applies only to the units that remained in the same categories.

Forward-looking gross flows	137,000
Weight adjustment	8,000
Backward-looking gross flows	145,000

Whether measured using forward-looking (31,000) or backward-looking (27,000) weights, internal flows resulted in there being more rental units in less affordable categories in 2017 than in 2015; that is, the 2017 rental stock was less affordable than the 2015 rental stock due to net gentrification.

Section 4.3: Changes in Rental Stock at the Affordable Category Level

Exhibit 4-3 combines data on internal and external flows to explain the growth or decline of each affordability category and by summation, the entire Detroit rental stock. With only three categories makes it easier to understand what is going on with respect to filtration (flows down to a more affordable category) and gentrification (flows up to a less affordable category). Only the moderate rent category can experience filtration and gentrification in two directions; that is, moderate rent units can filter down to the affordable rent categories, and high rent units can filter down to the moderate rent category. For this category, therefore, net filtration can be either positive or negative. Filtration can be only positive for the affordable rent category and can be only negative for the high rent category.

The bottom two rows of exhibit 4-3 draw attention to how much activity took place within the rental stock despite the marginal overall growth in rental housing.

Exhibit 4-3. Changes From 2015 to 2017, by Affordability Category

	Affordable Rent	Moderate Rent	High Rent	Rental Stock
Rental units in 2015	256,000	234,000	86,000	576,000
Flows among affordable categories	-17,000	14,000	11,000	8,000*
From less to more (filtration)	45,000	-8,000	-21,000	16,000
From more to less (gentrification)	-62,000	22,000	32,000	-8,000
Net owner or seasonal to rental plus net additions minus losses	-13,000	-6,000	3,000	-16,000
Change in weight	8,000	12,000	3,000	23,000*
Rental units in 2017	234,000	254,000	103,000	591,000
2015–2017 change	-22,000	20,000	17,000	15,000
Absolute value of inflows and outflows (excludes weight changes)	208,000	202,000	84,000	494,000
Flows as percent of 2017 units	88.9%	79.5%	81.6%	83.6%

*The flows within the categories should cancel out to zero. The 8,000 is the weight adjustment from exhibit 4-2. The 31,000-unit weight adjustment from exhibit 4-1 is split in exhibit 4-3 into a 8,000 and 23,000 adjustment.

Here are the experiences of each of the three affordability categories:

- **Affordable Rent:** This category declined from 256,000 to 234,000 units. Gentrification was the primary reason the affordable rent category declined. The net of gentrification over filtration accounted for 17,000 of the 22,000-unit decrease, as 62,000 units gentrified out of the most affordable category while 45,000 filtered into it. the category also lost 13,000 units to the owner and seasonal sectors and to physical losses exceeding additions.

- **Moderate Rent:** The moderate rent category gained 20,000 units. This rent category is the only one where filtration and gentrification can occur in both directions. Although 8,000 more units filtered out of this category to the affordable category than filtered into it from the high rent category, the moderate rent category gained units from gentrification when 22,000 more units gentrified up into it than gentrified out of it. The net of these inter-category flows was 14,000 units, accounting for most of the 20,000-unit gain. The net outflow loss to the owner or seasonal sectors and to physical losses exceeding additions was 6,000.
- **High Rent:** This group gained 32,000 units from gentrification while losing 21,000 units to filtration, for a net inter-category flow of 11,000. Net flows from the owner and seasonal sectors and additions exceeding losses represented a gain of 3,000 units.

Although the overall rental stock grew by 15,000, the “affordable rent” category declined by 22,000 units. The Detroit rental stock was less affordable in 2017. HUD’s report to Congress on worst case housing needs provides a good discussion of how reduced affordability affects lower-income households.¹⁰

¹⁰See the *Worst Case Housing Needs: 2019 Report To Congress* at <https://www.huduser.gov/portal/publications/worst-case-housing-needs-2020.html>.

Appendix A: CINCH Tables

Since 2000, CINCH studies have produced eight tables: four forward-looking tables and four backward-looking tables. Each set of four tables cover (A) housing characteristics, (B) housing quality, (C) householder and householder characteristics, and (D) tenure, housing costs, and household income.

When CINCH analysis is applied at the metropolitan level, the smaller sample sizes necessitate reducing the number of columns that explain where units go or where they come from and collapsing the categories (rows) that describe various unit and household characteristics.

CINCH does not allow some characteristics, such as structure type, year built, or stories, to change between survey years.

Appendix A in *CINCH: 2015–2017* explains how these tables are constructed and how to read them.

Forward-Looking Table A—Housing Characteristics (Rounded to Hundreds of Housing Units)

	A	B	C	D	E
Row	Characteristics	Present in 2015	Present in 2017 With Same Characteristics	Present in 2017 With Different Characteristics	Temporary or Permanent Loss in 2017
1	Housing Stock	1,910,700	1,887,900	0	
	Occupancy Status	22,700			
2	Occupied				
3	Vacant	1,720,300	1,584,500	124,200	11,600
4	Seasonal	183,400	74,900	100,000	8,500
	Structure Type	6,900	0	4,300	2,600
5	Single-family, detached				
6	Single-family, attached	1,355,100	1,342,800	NA	12,300
7	2- to 9-unit building	173,500	169,600	NA	3,900
8	10- to 19-unit building	159,900	156,300	NA	3,500
9	20-or-more-unit building	64,100	64,100	NA	0
10	Mobile home/manufactured/other	103,500	102,800	NA	700
	Year Built	54,600	52,300	NA	2,300
11	2010 or later				
12	2000–2009	21,800	21,800	NA	0
13	1990–1999	164,700	163,900	NA	800
14	1980–1989	229,900	229,200	NA	700
15	1970–1979	172,500	169,700	NA	2,900
16	1950–1969	273,400	271,700	NA	1,800
17	1949 or earlier	584,800	580,200	NA	4,600
	Number of Rooms	463,500	451,400	NA	12,000
18	3 or fewer rooms				
19	4 rooms	141,100	2,600	137,000	1,500
20	5 rooms	270,800	146,500	119,300	4,900
21	6 rooms	458,900	246,200	205,000	7,700
22	7 rooms	476,700	253,700	217,300	5,800
23	8 or more rooms	274,900	102,800	171,300	800
	Number of Bedrooms	288,300	107,900	178,300	2,100
24	None or 1 bedroom				
25	2 bedrooms	192,000	4,900	184,200	2,900
26	3 bedrooms	442,000	356,700	75,100	10,100
27	4 or more bedrooms	863,800	756,200	100,700	6,900
28	Multiunit structures	413,000	340,600	69,500	2,900
29	Stories: 1 or 2				
30	Stories: 3 or more	327,500	323,200	NA	4,300

Forward-Looking Table B—Housing Condition (Rounded to Hundreds of Housing Units)

	A	B	C	D	E
Row	Characteristics	Present in 2015	Present in 2017 With Same Characteristics	Present in 2017 With Different Characteristics	Temporary or Permanent Loss by 2015
1	Housing Stock	1,910,700	1,887,900	0	22,700
	AHS Adequacy Measure				
2	Adequate	1,710,900	1,604,900	95,900	10,100
3	Moderately inadequate	124,000	26,100	91,200	6,700
4	Severely inadequate	75,900	18,400	51,400	6,000
	Possible Unit Problems				
5	Unit cold for 24 hours at least once last winter	244,300	63,600	178,800	1,800
6	No working toilet at least once in last 3 months	32,400	1,800	30,600	0
7	Unit without running water at least once in last 3 months	62,100	3,800	58,300	0
8	Unit has no hot and cold running water	36,100	13,700	17,400	5,000
9	Unit had sewer breakdown at least once in last 3 months	44,500	1,800	42,700	0
10	Signs of rodents in last 12 months	165,300	43,300	119,500	2,500
11	Foundation has cracks or is crumbling	124,700	30,100	92,200	2,400
12	Holes in roof	36,100	9,100	24,300	2,700
13	Roof sags or is uneven	43,200	6,000	35,900	1,400
14	Outside walls missing siding or bricks	77,400	24,700	47,300	5,400
15	Outside wall leans, slopes, or buckles	28,500	4,800	20,400	3,300
16	Window(s) boarded up	50,200	15,500	30,000	4,700
17	Holes in floors	40,300	4,100	34,100	2,000
18	Water leak from outside in last 12 months	232,200	61,600	169,000	1,700
19	Water leak from inside in last 12 months	175,500	31,300	143,300	900
20	Mold present in last 12 months	70,100	9,400	60,800	0
21	Unit has no stove or range with oven	83,500	36,500	39,800	7,100
22	Unit has no working refrigerator	103,300	38,600	55,400	9,400
23	Unit has no kitchen sink	34,700	9,500	20,900	4,300
24	Unit does not have exclusive use of kitchen	8,400	900	7,400	0
	Count of Problems				
25	Two or fewer problems	1,705,100	1,584,500	106,200	14,400
26	Three problems	102,700	12,700	88,300	1,700
27	Four or more problems	102,800	39,500	56,700	6,700
	Water Source				
28	Public/private water	1,712,500	1,683,300	8,600	20,600
29	Well	194,900	185,700	7,000	2,200
30	Other water source	3,400	0	3,400	0

	A	B	C	D	E
Row	Characteristics	Present in 2015	Present in 2017 With Same Characteristics	Present in 2017 With Different Characteristics	Temporary or Permanent Loss by 2015
	Sewerage Treatment				
31	Public sewer	1,692,600	1,672,700	0	19,900
32	Septic tank/cesspool	203,200	174,900	26,100	2,200
33	Other, none, or no response	15,000	700	13,500	700

Forward-Looking Table C—Householder and Household Characteristics (Rounded to Hundreds of Housing Units)

	A	B	C	D	E
Row	Characteristics	Present in 2015	Present in 2017 With Same Characteristics	Present in 2017 With Different Characteristics	Temporary or Permanent Loss by 2015
1	Occupied Units	1,720,300	1,584,500	124,200	11,600
	Age of Householder				
2	Under 65	1,318,800	1,209,500	100,000	9,300
3	65–74	233,800	168,000	65,200	700
4	75 or older	167,700	123,100	43,100	1,600
	Children in Household				
5	Children: Some	473,000	336,300	134,100	2,600
6	Children: None	1,247,300	1,126,600	111,700	9,000
	Race of Householder				
7	White alone	1,223,100	1,097,600	117,600	7,900
8	Black alone	399,300	321,900	73,600	3,700
9	Two or more races	98,000	74,600	23,400	0
	Ethnicity of Householder				
10	Hispanics	52,000	37,200	14,800	0
	Household Composition				
11	Married couple	748,600	618,200	128,700	1,700
12	Other family: Male householder, no wife	83,500	48,100	33,700	1,600
13	Other family: Female householder, no husband	244,000	143,600	95,200	5,300
14	Nonfamily: Male householder, living alone	263,000	161,800	98,800	2,300
15	Nonfamily: Male householder, not living alone	57,600	19,800	37,800	0
16	Nonfamily: Female householder, living alone	284,400	190,300	93,300	700
17	Nonfamily: Female householder, not living alone	39,300	17,000	22,300	0

**Forward-Looking Table D—Tenure, Housing Cost, and Household Income
(Rounded to Hundreds of Housing Units)**

	A	B	C	D	E
Row	Characteristics	Present in 2015	Present in 2017 With Same Characteristics	Present in 2017 With Different Characteristics	Temporary or Permanent Loss by 2015
1	Occupied Units	1,720,300	1,584,500	124,200	11,600
	Tenure of Unit				
2	Owner occupied	1,183,600	1,083,300	94,000	6,300
3	Renter occupied	536,800	401,200	130,300	5,300
	Renter Monthly Housing Costs				
4	No-cash rent or HUD assisted	97,000	52,800	42,500	1,700
5	Less than \$800	174,400	95,100	76,500	2,800
6	\$800–\$1,249	183,600	99,000	84,600	0
7	\$1,250 or more	81,700	47,500	33,400	800
	Renter Household Income				
8	Less than \$30,000	260,400	131,800	124,100	4,500
9	\$50,000 or more	109,400	27,400	81,200	800
10	\$80,000 or more	166,900	73,100	93,900	0
	Owner Housing Costs				
11	Less than \$800	506,300	318,400	183,300	4,600
12	\$800–\$1,249	262,600	108,000	154,600	0
13	\$1,250 or more	414,700	300,300	112,700	1,600
	Owner Household Income				
14	Less than \$59,999	573,200	354,100	213,600	5,500
15	\$60,000–\$99,999	271,500	103,100	167,600	700
16	\$100,000 or more	338,900	229,300	109,600	0

Backward-Looking Table A—Housing Characteristics (Rounded to Hundreds of Housing Units)

	A	B	C	D	E
Row	Characteristics	Present in 2017	Present in 2015 With Same Characteristics	Present in 2015 With Different Characteristics	Added by 2017
1	Housing Stock	1,936,900	1,907,200	0	29,700
	Occupancy Status				
2	Occupied	1,751,600	1,609,600	125,300	16,700
3	Vacant	179,100	71,900	95,000	12,200
4	Seasonal	6,100	0	5,400	700
	Structure Type				
5	Single-family, detached	1,357,900	1,346,300	NA	11,600
6	Single-family, attached	185,500	180,800	NA	4,700
7	2- to 9-unit building	158,500	154,300	NA	4,200
8	10- to 19-unit building	65,900	64,300	NA	1,600
9	20-or-more-unit building	111,700	105,000	NA	6,700
10	Mobile home/ manufactured/other	57,400	56,500	NA	900
	Year Built				
11	2010 or later	43,100	33,400	NA	9,800
12	2000–2009	162,600	162,600	NA	0
13	1990–1999	233,500	232,600	NA	800
14	1980–1989	176,400	174,700	NA	1,700
15	1970–1979	265,800	262,400	NA	3,400
16	1950–1969	602,400	598,100	NA	4,400
17	1949 or earlier	453,100	443,500	NA	9,600
	Number of Rooms				
18	3 or fewer rooms	157,900	1,900	146,100	9,900
19	4 rooms	255,400	146,000	107,000	2,400
20	5 rooms	454,600	246,800	198,900	8,900
21	6 rooms	480,200	258,000	219,100	3,100
22	7 rooms	277,900	104,800	170,100	2,900
23	8 or more rooms	310,900	117,000	191,400	2,500
	Number of Bedrooms				
24	None or 1 bedroom	200,700	7,400	182,600	10,700
25	2 bedrooms	436,400	356,700	72,300	7,400
26	3 bedrooms	878,300	765,500	106,700	6,100
27	4 or more bedrooms	421,500	348,700	67,300	5,500
28	Multiunit structures	336,100	323,600	NA	12,500
29	Stories: 1 or 2	150,300	144,300	NA	6,000
30	Stories: 3 or more	185,800	179,200	NA	6,500

Backward-Looking Table B—Housing Conditions (Rounded to Hundreds of Housing Units)

	A	B	C	D	E
Row	Characteristics	Present in 2015	Present in 2015 With Same Characteristics	Present in 2015 With Different Characteristics	Added by 2017
1	Housing Stock	1,936,900	1,907,200	0	29,700
	AHS Adequacy Measure				
2	Adequate	1,766,600	1,624,200	125,000	17,300
3	Moderately inadequate	92,600	26,500	63,900	2,200
4	Severely inadequate	77,700	17,600	50,000	10,100
	Possible Unit Problems				
5	Unit cold for 24 hours at least once last winter	257,400	64,900	190,800	1,700
6	No working toilet at least once in last 3 months	25,000	1,800	23,100	0
7	Unit without running water at least once in last 3 months	43,000	3,700	39,300	0
8	Unit has no hot and cold running water	55,500	13,200	33,100	9,300
9	Unit had sewer breakdown at least once in last 3 months	35,600	2,000	33,600	0
10	Signs of rodents in last 12 months	162,400	44,000	118,400	0
11	Foundation has cracks or is crumbling	131,700	30,700	98,100	2,900
12	Holes in roof	43,500	8,800	33,200	1,400
13	Roof sags or is uneven	37,700	5,800	31,300	700
14	Outside walls missing siding or bricks	77,200	24,800	51,000	1,400
15	Outside wall leans, slopes, or buckles	29,500	4,800	24,100	700
16	Window(s) boarded up	49,000	15,000	29,700	4,300
17	Holes in floors	42,600	4,000	33,500	5,000
18	Water leak from outside in last 12 months	211,800	61,900	149,900	0
19	Water leak from inside in last 12 months	150,800	32,000	117,900	900
20	Mold present in last 12 months	48,400	9,000	39,400	0
21	Unit has no stove or range with oven	80,800	35,000	34,300	11,600
22	Unit has no working refrigerator	89,900	36,800	42,200	10,800
23	Unit has no kitchen sink	36,100	9,400	19,400	7,300
24	Unit does not have exclusive use of kitchen	3,900	1,000	3,000	0
	Count of Problems				
25	Two or fewer problems	1,740,300	1,604,400	117,900	18,100
26	Three problems	86,600	13,200	69,700	3,700
27	Four or more problems	109,900	38,700	63,400	7,800
	Water Source				
28	Public/private water	1,736,400	1,700,000	9,400	27,100
29	Well	196,800	189,200	5,700	1,800
30	Other water source	3,700	0	2,900	700

	A	B	C	D	E
Row	Characteristics	Present in 2015	Present in 2015 With Same Characteristics	Present in 2015 With Different Characteristics	Added by 2017
	Sewerage Treatment				
31	Public sewer	1,747,800	1,687,400	37,000	23,400
32	Septic tank/cesspool	181,200	178,400	900	1,800
33	Other, none, or no response	7,900	700	2,800	4,400

**Backward-Looking Table C—Householder and Household Characteristics
(Rounded to Hundreds of Housing Units)**

	A	B	C	D	E
Row	Characteristics	Present in 2015	Present in 2015 With Same Characteristics	Present in 2015 With Different Characteristics	Added by 2017
1	Occupied Units	1,751,600	1,609,600	125,300	16,700
	Age of Householder				
2	Under 65	1,297,800	1,230,200	57,100	10,400
3	65–74	279,400	173,400	103,700	2,300
4	75 or older	174,400	126,600	43,800	4,000
	Children in Household				
5	Children: Some	496,500	340,000	154,800	1,700
6	Children: None	1,255,100	1,135,600	104,500	15,100
	Race of Householder				
7	White alone	1,231,100	1,113,700	103,200	14,200
8	Black alone	415,600	328,100	86,500	1,000
9	Two or more races	104,900	74,600	28,700	1,600
	Ethnicity of Householder				
10	Hispanics	48,600	37,000	11,600	0
	Household composition				
11	Married couple	742,600	629,500	109,200	4,000
12	Other family: Male householder, no wife	103,000	48,800	53,300	900
13	Other family: Female householder, no husband	248,600	145,600	103,000	0
14	Nonfamily: Male householder, living alone	258,200	163,900	90,100	4,300
15	Nonfamily: Male householder, not living alone	58,400	20,000	37,600	800
16	Nonfamily: Female householder, living alone	293,200	193,200	93,300	6,800
17	Nonfamily: Female householder, not living alone	47,500	17,100	30,400	0

**Backward-Looking Table D—Tenure, Housing Costs, and Household Income—
Continued (Rounded to Hundreds of Housing Units)**

	A	B	C	D	E
Row	Characteristics	Present in 2015	Present in 2017 With Same Characteristics	Present in 2017 With Different Characteristics	Added in 2017
1	Occupied Units	1,751,600	1,609,600	125,300	16,700
	Tenure of Unit				
2	Owner occupied	1,236,700	1,102,700	126,000	8,000
3	Renter occupied	514,900	404,900	101,300	8,800
	Renter Monthly Housing Costs				
4	No-cash rent or HUD assisted	87,100	52,700	33,400	1,000
5	Less than \$800	155,900	96,800	56,400	2,700
6	\$800–\$1,249	185,700	99,800	84,200	1,700
7	\$1,250 or more	86,200	47,900	35,100	3,300
	Renter Household Income				
8	Less than \$30,000	245,600	132,300	109,800	3,500
9	\$50,000 or more	102,200	27,800	73,600	800
10	\$80,000 or more	167,000	73,300	89,300	4,400
	Owner Housing Costs				
11	Less than \$800	481,200	322,200	155,900	3,100
12	\$800–\$1,249	295,300	110,700	183,800	800
13	\$1,250 or more	460,100	306,100	150,000	4,000
	Owner Household Income				
14	Less than \$59,999	540,200	359,400	175,900	4,900
15	\$60,000–\$99,999	295,600	105,100	189,900	700
16	\$100,000 or more	400,900	233,600	164,900	2,400

Appendix B: Loss Rates, Addition Rates, t-Statistics, and Change in Characteristics Rate

The loss rates reported here were computed from the forward-looking tables in Appendix A, the additional rates were computed from the backward-looking tables in Appendix A, and the change rates were computed from all the tables in Appendix A.

The t-statistics were computed using the data from unweighted and weighted versions of the tables in Appendix A. The t-statistics are computed from a test of the difference of two percentages. The comparison percentages were for unit characteristics and unit quality, the percentages for all housing; for household and householder characteristics and for tenure, the percentages for all occupied units; and for housing costs and household income, the percentages for all renter-occupied units and for all owner-occupied units. The test of differences is not the preferred test because of the interrelationship because segments and for other reasons. However, this test does help sort through the data for the more meaningful findings.

CINCH does not allow some characteristics, such as structure type or year built, to change between AHS surveys.

Exhibit B-1. Loss Rates, Addition Rates, t-Statistics, and Rates of Change in Characteristics

Row	Market Segment	Forward-Looking			Backward-Looking		
		Loss Rate	t-statistic	2015 Unit, Different in 2017	Addition Rate	t-statistic	2017 Unit, Different in 2015
	Housing Characteristics						
1	Housing Stock	1.2%	0.000	0.0%	1.5%	0.000	0.0%
	Occupancy Status						
2	Occupied	0.7%	-1.726	7.3%	1.0%	-1.669	7.2%
3	Vacant	4.7%	2.566	57.2%	6.8%	3.299	56.9%
4	Seasonal	38.0%	2.396	100.0%	11.3%	0.927	100.0%
	Structure Type						
5	Single-family, detached	0.9%	-0.840	NA	0.9%	-1.903	NA
6	Single-family, attached	2.2%	0.964	NA	2.5%	0.915	NA
7	2- to 9-unit building	2.2%	0.914	NA	2.7%	0.902	NA
8	10- to 19-unit building	0.0%	-5.098	NA	2.4%	0.477	NA
9	20-or-more-unit building	0.7%	-0.632	NA	6.0%	2.190	NA
10	Mobile home/manufactured/other	4.2%	1.207	NA	1.5%	-0.029	NA
	Year Built						
11	2010 or later	0.0%	-5.098	NA	22.6%	3.376	NA
12	2000–2009	0.5%	-1.226	NA	0.0%	-5.802	NA
13	1990–1999	0.3%	-2.171	NA	0.4%	-2.580	NA
14	1980–1989	1.7%	0.510	NA	1.0%	-0.748	NA
15	1970–1979	0.6%	-1.084	NA	1.3%	-0.355	NA

Row	Market Segment	Forward-Looking			Backward-Looking		
		Loss Rate	t-statistic	2015 Unit, Different in 2017	Addition Rate	t-statistic	2017 Unit, Different in 2015
16	1950–1969	0.8%	-0.981	NA	0.7%	-1.928	NA
17	1949 or earlier	2.6%	1.917	NA	2.1%	0.855	NA
	Number of Rooms						
18	3 or fewer rooms	1.1%	-0.126	98.2%	6.3%	2.662	98.7%
19	4 rooms	1.8%	0.787	44.9%	0.9%	-0.962	42.3%
20	5 rooms	1.7%	0.787	45.4%	2.0%	0.640	44.6%
21	6 rooms	1.2%	0.030	46.1%	0.7%	-2.006	45.9%
22	7 rooms	0.3%	-2.279	62.5%	1.0%	-0.767	61.9%
23	8 or more rooms	0.7%	-0.895	62.3%	0.8%	-1.335	62.1%
	Number of Bedrooms						
24	None or 1 bedroom	1.5%	0.360	97.4%	5.3%	2.557	96.1%
25	2 bedrooms	2.3%	1.558	17.4%	1.7%	0.251	16.9%
26	3 bedrooms	0.8%	-1.079	11.8%	0.7%	-2.223	12.2%
27	4 or more bedrooms	0.7%	-1.075	17.0%	1.3%	-0.397	16.2%
28	Multiunit structures	1.3%	0.183	NA	3.7%	2.182	NA
29	Stories: 1 or 2	1.4%	0.257	NA	4.0%	1.580	NA
30	Stories: 3 or more	1.2%	0.019	NA	3.5%	1.557	NA
	Housing Conditions						
	AHS Adequacy Measure						
2	Adequate	0.6%	-2.068	5.6%	1.0%	-1.592	7.1%
3	Moderately inadequate	5.4%	2.259	77.7%	2.4%	0.570	70.7%
4	Severely inadequate	8.0%	2.379	73.7%	13.0%	3.389	73.9%
	Possible Unit Problems						
5	Unit cold for 24 hours at least once last winter	0.8%	-0.743	73.8%	0.6%	-1.607	74.6%
6	No working toilet at least once in last 3 months	0.0%	-5.098	94.4%	0.0%	-5.802	92.7%
7	Unit without running water at least once in last 3 months	0.0%	-5.098	93.8%	0.0%	-5.802	91.4%
8	Unit has no hot and cold running water	13.9%	2.596	56.0%	16.7%	3.543	71.6%
9	Unit had sewer breakdown at least once in last 3 months	0.0%	-5.098	95.9%	0.0%	-5.802	94.3%
10	Signs of rodents in last 12 months	1.5%	0.352	73.4%	0.0%	-5.802	72.9%
11	Foundation has cracks or is crumbling	1.9%	0.620	75.4%	2.2%	0.535	76.2%
12	Holes in roof	7.4%	1.519	72.9%	3.3%	0.689	79.0%
13	Roof sags or is uneven	3.1%	0.787	85.7%	1.8%	0.158	84.4%
14	Outside walls missing siding or bricks	6.9%	2.120	65.7%	1.8%	0.205	67.3%

Row	Market Segment	Forward-Looking			Backward-Looking		
		Loss Rate	t-statistic	2015 Unit, Different in 2017	Addition Rate	t-statistic	2017 Unit, Different in 2015
15	Outside wall leans, slopes, or buckles	11.6%	1.894	81.1%	2.4%	0.332	83.5%
16	Window(s) boarded up	9.4%	2.209	65.9%	8.8%	2.004	66.5%
17	Holes in floors	5.0%	1.212	89.2%	11.8%	2.363	89.3%
18	Water leak from outside in last 12 months	0.7%	-0.790	73.3%	0.0%	-5.802	70.8%
19	Water leak from inside in last 12 months	0.5%	-1.243	82.1%	0.6%	-1.475	78.6%
20	Mold present in last 12 months	0.0%	-5.098	86.6%	0.0%	-5.802	81.4%
21	Unit has no stove or range with oven	8.5%	2.794	52.2%	14.4%	3.858	49.5%
22	Unit has no working refrigerator	9.1%	3.225	58.9%	12.1%	3.587	53.4%
23	Unit has no kitchen sink	12.5%	2.292	68.7%	20.1%	3.242	67.4%
24	Unit does not have exclusive use of kitchen	0.0%	-5.098	88.9%	0.0%	-5.802	75.7%
	Count of Problems						
25	Two or fewer problems	0.8%	-1.109	6.3%	1.0%	-1.405	6.8%
26	Three problems	1.6%	0.372	87.4%	4.3%	1.305	84.1%
27	Four or more problems	6.5%	2.366	58.9%	7.1%	2.500	62.1%
	Water Source						
28	Public/private water	1.2%	0.033	0.5%	1.6%	0.072	0.5%
29	Well	1.1%	-0.107	3.6%	0.9%	-0.840	2.9%
30	Other water source	0.0%	-5.098	100.0%	20.1%	1.035	100.0%
	Sewerage Treatment						
31	Public sewer	1.2%	-0.044	0.0%	1.3%	-0.519	2.1%
32	Septic tank/cesspool	1.1%	-0.174	13.0%	1.0%	-0.674	0.5%
33	Other, none, or no response	4.6%	0.685	94.8%	55.8%	3.621	78.7%
	Household Characteristics						
	Age of Householder						
2	Under 65	0.7%	0.112	7.6%	0.8%	-0.460	4.4%
3	65–74	0.3%	-0.976	28.0%	0.8%	-0.244	37.4%
4	75 or older	0.9%	0.371	25.9%	2.3%	1.275	25.7%
	Children in Household						
5	Children: Some	0.6%	-0.310	28.5%	0.3%	-1.853	31.3%
6	Children: None	0.7%	0.151	9.0%	1.2%	0.666	8.4%
	Race of Householder						
7	White alone	0.6%	-0.101	9.7%	1.2%	0.541	8.5%
8	Black alone	0.9%	0.500	18.6%	0.2%	-2.223	20.9%
9	Other & two or more races	0.0%	-3.585	23.9%	1.5%	0.465	27.8%
	Ethnicity of Householder						
10	Hispanics	0.0%	-3.585	28.4%	0.0%	-4.282	23.9%

Row	Market Segment	Forward-Looking			Backward-Looking		
		Loss Rate	t-statistic	2015 Unit, Different in 2017	Addition Rate	t-statistic	2017 Unit, Different in 2015
	Household composition'						
11	Married couple	0.2%	-1.802	17.2%	0.5%	-1.238	14.8%
12	Other family: Male householder, no wife	1.9%	0.853	41.2%	0.8%	-0.140	52.2%
13	Other family: Female householder, no husband	2.2%	1.635	39.9%	0.0%	-4.282	41.4%
14	Nonfamily: Male householder, living alone	0.9%	0.373	37.9%	1.7%	0.884	35.5%
15	Nonfamily: Male householder, not living alone	0.0%	-3.585	65.6%	1.4%	0.299	65.3%
16	Nonfamily: Female householder, living alone	0.3%	-1.251	32.9%	2.3%	1.593	32.6%
17	Nonfamily: Female householder, not living alone	0.0%	-3.585	56.8%	0.0%	-4.282	64.0%
	Tenure, Costs & Income						
	Tenure of Unit						
2	Owner occupied	0.5%	-0.527	8.0%	0.6%	-0.991	10.3%
3	Renter occupied	1.0%	0.718	24.5%	1.7%	1.272	20.0%
	Renter Monthly Housing Costs						
4	No-cash rent or HUD assisted	1.7%	0.966	44.6%	1.2%	0.222	38.8%
5	Less than \$800	1.6%	0.987	44.6%	1.8%	0.739	36.8%
6	\$800–\$1,249	0.0%	-3.585	46.1%	0.9%	-0.054	45.8%
7	\$1,250 or more	1.0%	0.289	41.3%	3.8%	1.410	42.3%
	Renter Household Income						
8	Less than \$30,000	1.7%	1.388	48.5%	1.4%	0.629	45.4%
9	\$50,000 or more	0.7%	0.078	74.8%	0.8%	-0.144	72.6%
10	\$80,000 or more	0.0%	-3.585	56.2%	2.7%	1.374	54.9%
	Owner Housing Costs						
11	Less than \$800	0.9%	0.533	36.5%	0.6%	-0.745	32.6%
12	\$800–\$1,249	0.0%	-3.585	58.9%	0.3%	-1.812	62.4%
13	\$1,250 or more	0.4%	-0.784	27.3%	0.9%	-0.165	32.9%
	Owner Household Income						
14	Less than \$59,999	1.0%	0.675	37.6%	0.9%	-0.122	32.9%
15	\$60,000–\$99,999	0.3%	-1.154	61.9%	0.2%	-1.973	64.4%
16	\$100,000 or more	0.0%	-3.585	32.3%	0.6%	-0.833	41.4%

Appendix C: Rental Dynamics Tables

Exhibit C-1. Forward-Looking Rental Dynamics Analysis, Counts: 2015–2017

2015 Rental Stock	2015 Total	Non-Market, Extremely Low Rent, Very Low Rent in 2017	Low Rent, Moderate Rent in 2017	High Rent, Very High Rent, Extremely High Rent in 2017	Owner or Seasonal Stock in 2017	Lost to Stock by 2017
Non-Market, Extremely Low Rent, Very Low Rent	256,000	137,000	52,000	10,000	57,000	256,000
Low Rent, Moderate Rent	234,000	32,000	137,000	22,000	43,000	234,000
High Rent, Very High Rent, Extremely High Rent	86,000	8,000	13,000	51,000	14,000	86,000
Total	576,000	177,000	202,000	83,000	114,000	576,000

Exhibit C-2. Forward-Looking Rental Dynamics Analysis, Row Percentages: 2015–2017

2015 Rental Stock	2015 Total	Non-Market, Extremely Low Rent, Very Low Rent in 2017	Low Rent, Moderate Rent in 2017	High Rent, Very High Rent, Extremely High Rent in 2017	Owner or Seasonal Stock in 2017	Lost to Stock by 2017
Non-Market, Extremely Low Rent, Very Low Rent	256,000	53.5	20.3	3.9	22.3	256,000
Low Rent, Moderate Rent	234,000	13.7	58.5	9.4	18.4	234,000
High Rent, Very High Rent, Extremely High Rent	86,000	9.3	15.1	59.3	16.3	86,000
Total	576,000	30.7	35.1	14.4	19.8	576,000

Exhibit C-3. Backward-Looking Rental Dynamics Analysis, Counts: 2015–2017

2017 Rental Stock	2017 Total	Non-Market, Extremely Low Rent, Very Low Rent in 2015	Low Rent, Moderate Rent in 2015	High Rent, Very High Rent, Extremely High Rent in 2015	Owner or Seasonal Stock in 2015	Added by 2017
Non-Market, Extremely Low Rent, Very Low Rent	234,000	145,000	36,000	9,000	41,000	3,000
Low Rent, Moderate Rent	254,000	54,000	149,000	14,000	32,000	5,000
High Rent, Very High Rent, Extremely High Rent	103,000	9,000	23,000	54,000	12,000	5,000
Total	591,000	208,000	208,000	77,000	85,000	13,000

Exhibit C-4. Backward-Looking Rental Dynamics Analysis, Row Percentages: 2015–2017

2017 Rental Stock	2017 Total	Non-Market, Extremely Low Rent, Very Low Rent in 2015	Low Rent, Moderate Rent in 2015	High Rent, Very High Rent, Extremely High Rent in 2015	Owner or Seasonal Stock in 2015	Added by 2017
Non-Market, Extremely Low Rent, Very Low Rent	234,000	62.0	15.4	3.8	17.5	1.3
Low Rent, Moderate Rent	254,000	21.3	58.7	5.5	12.6	2.0
High Rent, Very High Rent, Extremely High Rent	103,000	8.7	22.3	52.4	11.7	4.9
Total	591,000	35.2	35.2	13.0	14.4	2.2

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