Measuring Aggregate Housing Wealth: New Insights from Automated Valuation Models

Susan Hume McIntosh

Flow of Funds Section

Board of Governors of the Federal Reserve System

Financial Information Forum: V Meeting

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Note: The analysis and conclusions set forth are those of the authors and do not indicate concurrence by the Board of Governors.
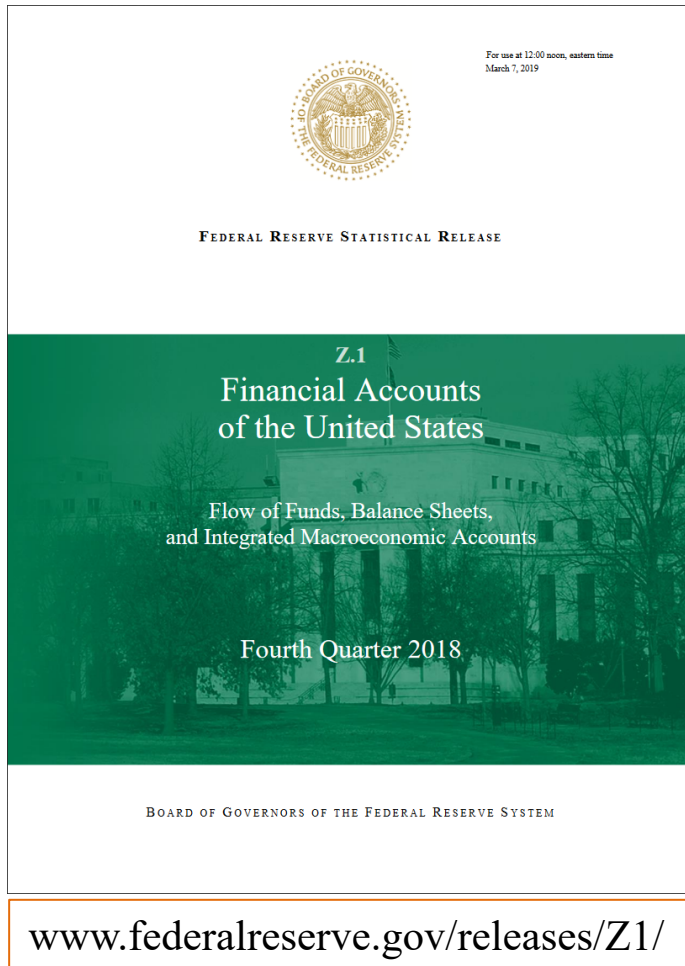
Why Care About Aggregate Household Housing Wealth?

- Affects many aspects of household financial decision-making: consumer spending, savings, small business formation, investment in education, geographic mobility

- Major component of total household wealth: value of the primary residence represents about 2/3 of a typical household's total assets (SCF 2016)

- Key driver of wealth changes during the Great Recession

- Frequent input into empirical and quantitative macro models and analyses

Financial Accounts of the United States

For use at 12:00 noon, eastern time
March 7, 2019

FEDERAL RESERVE STATISTICAL RELEASE

Z.1
Financial Accounts
of the United States

Flow of Funds, Balance Sheets,
and Integrated Macroeconomic Accounts

Fourth Quarter 2018

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM

www.federalreserve.gov/releases/Z1/

- Time series:
  Annual 1945 – 2018
  Quarterly 1951:Q4 – 2018:Q4

- Includes flows, levels, some balance sheets, Integrated Macroeconomic Accounts, and more

- Published 10 weeks after the end of the reference quarter

- All data available in the Federal Reserve's Data Download Program (DDP)
  www.federalreserve.gov/datadownload/Choose.aspx?rel=Z.1

Household Residential Real Estate

Real Estate as a Percent of Total Household Assets

Source: Financial Accounts of the United States, March 7, 2019
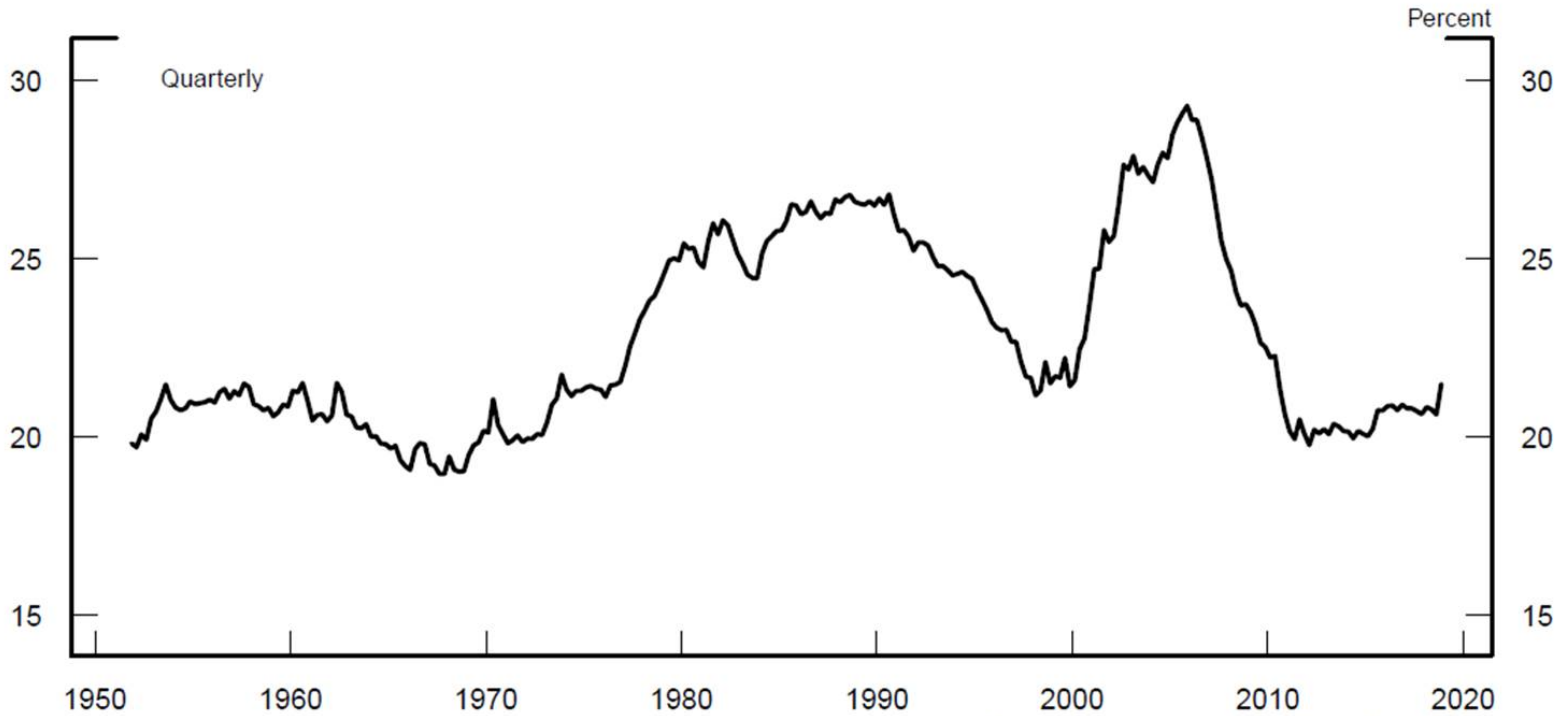
Methods of Measuring Residential Real Estate Values

1. **Owners' reported values from nationally representative household surveys**: Survey of Consumer Finances (SCF), the American Community Survey (ACS), the biennial American Housing Survey (AHS)

2. **House price index**: currently use a repeat-sales housing index with an AHS benchmark to calculate housing value in the U.S. Financial Accounts (FA)

3. **New FRB method using an automated valuation model (AVM):** leverages machine learning and "big data" collected by Zillow

Owners' Reported Values

Strengths

- Value entire stock of owner-occupied homes

- Captures quality changes

Weaknesses

- Over-optimism in normal times

- Lagged recognition of changing market conditions

Repeat Sales Housing Price Index

Strengths

- Market-price driven
- No reporting bias

Weaknesses

- Transacting homes only
- Holds quality constant
- Needs a benchmark value

Automated Valuation Model

Strengths

- Values entire stock
- Market-driven
- Captures quality changes, not just transaction pairs
- Model predictions testable against actual prices for traded units

Weaknesses

- Limited historical data
- Not nationally representative
- Modest model bias
- Rental properties included in AVM prices

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Measuring the Market Value of Residential Real Estate

- **Current**: American Housing Survey (AHS) benchmarks (2005), fixed investment from BEA, and CoreLogic repeat-sales house price index

- **September 2019**: Zillow "big data" automated valuation models (AVM) for average prices and property counts from U. S. Census Bureau for quantities

What is Zillow?
(2006 , Seattle, former Microsoft employees)

Zillow Research Mission Statement:

"Zillow Research aims to be the most open, authoritative source for timely and accurate housing data and unbiased insight. Our goal is to empower consumers, industry professionals, policymakers and researchers to better understand the housing market."

Zillow Research Principles:

- Provides unbiased data and analysis about the housing market in a transparent way

- Is independent of Zillow's business goals and is not a revenue center

- Benchmarks findings against outside datasets to ensure accuracy and appropriate context

- Respects the integrity of data and uses it honestly

Why did we choose Zillow?

- Willing to provide data free of charge

- Very helpful in working with us

- Widely known in the U.S.

- One of the first companies to use this methodology on this scale

- Other vendors with related products did not offer clear advantages

Zillow's Data

What is Zillow's AVM?

- AVM source data from tax records when sales occur plus rich local data (school quality, water views, etc.)

- Thousands of models estimated frequently and combined to produce value estimates.

- Compares predictions against observed transactions

What did the FRB get?

- Average AVM estimates and counts of valued homes monthly, by county, for single family and multi-family separately, from 1996 to present

- Detailed information about coverage and model errors by geography, property type, and sales price

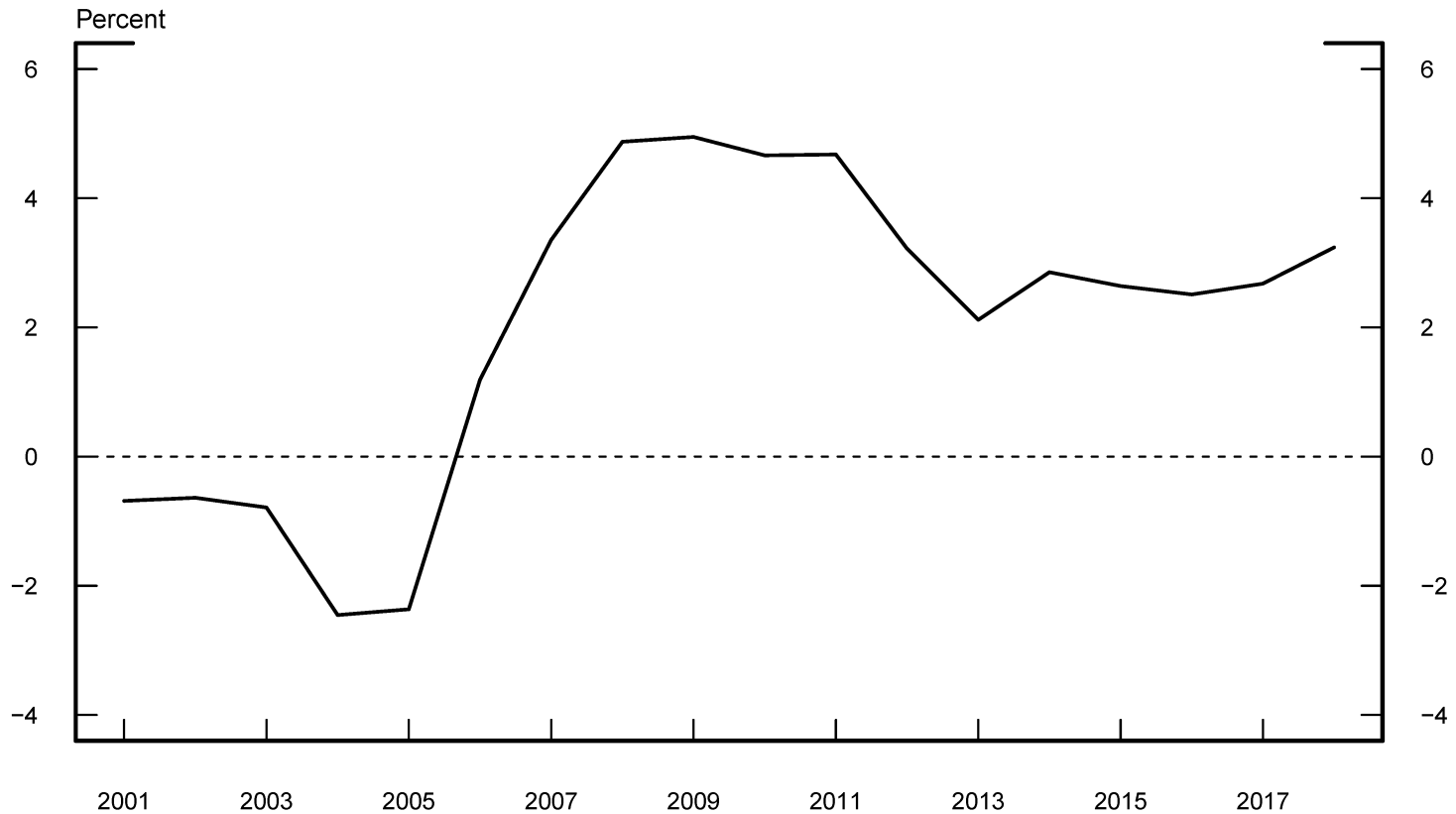# AVM Does Not Cover All Homes and Covers Some Rentals

Property Counts in 2017

(millions of units)

	ACS		Zillow
	Total	Own-Use	Total
Single-Family	92.9	76.4	78.7
Multi-Family	35.9	5.8	7.7
Total	128.8	82.1	86.3

AVM Value-Weighted Errors Are Close to 0

Percent



Source: Zillow and FRB calculations

Empirical Method
Price(AVM)* Quantity (ACS)

- **Problem:** Coverage issues prevent us from simply summing Zillow's AVM estimates, which are modestly biased

- **Solution:**
  - Use property count data from the ACS
  - For each county i, property type (mf or sf) c, and quarter t

  Aggregate Value $_{i,c,t}$ = Property Counts ACS$_{i,c,t}$ x Average value AVM$_{i,c,t}$

  - *Average value AVM$_{i,c,t}$* adjusted for model bias using value-weighted average error
  - Does not adjust for the inclusion of rental properties – likely a modest downward bias

Aggregate Housing Wealth
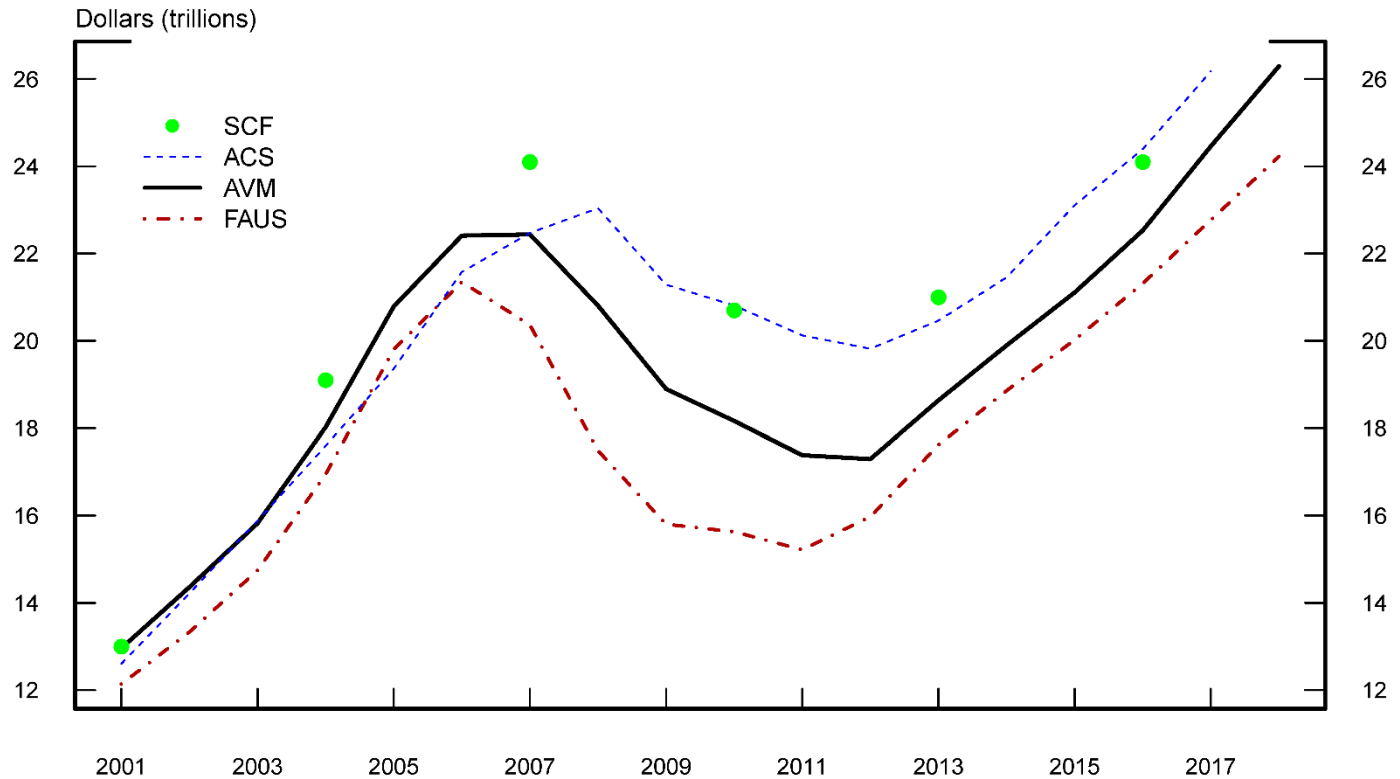
Source: American Community Survey (U.S. Census Bureau), Financial Accounts of the United States, Survey of Consumer Finance (triennial), and Zillow.

Conclusion

- AVM method overcomes known biases of prior wealth estimation methods

- AVM method "splits the difference" between owner-reports and House price indexes

- AVM measure is currently an Enhanced Financial Account (EFA) release:

https://www.federalreserve.gov/releases/efa/alternative-measure-of-owner-occupied-real-estate.htm