Thoughts on Measuring Aggregate Housing Services

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Disclaimer: Any opinions and conclusions expressed herein are those of the authors and do not indicate concurrence with other members of the research staff of the Federal Reserve or the Board of Governors.
• The Goal: Estimate housing services supplied by residential structures
• Can use rental payments for rental housing
• What about owner-occupied housing?
Three Methods to Impute Rent to Owner-Occupied Structures

1. Based on property characteristics
   - Assume that the services provided by a given set of characteristics are the same for owners and renters
   - Need a large sample of owner-occupied and rental properties with detailed property characteristics and rents for rental units
   - Estimate correlation between rent and characteristics, then use characteristics of owner-occupied properties to predict rent.

2. Based on the value of the property

3. Based on owners’ expenditures (or “user cost”)

Three Methods to Impute Rent to Owner-Occupied Structures

1. Based on property characteristics

2. Based on the value of the property
   - Assume that housing services are proportional to property value
   - Need a large sample of owner-occupied and rental properties with values for all properties and rents for rental units
   - Rent for owner-occupied property is same as rent for rental property with equal value.

3. Based on owners’ expenditures (or “user cost”)
Three Methods to Impute Rent to Owner-Occupied Structures

1. Based on property characteristics
2. Based on the value of the property
3. Based on owners’ expenditures (or “user cost”)
   - Assume that housing services equal owners’ expenditures less expected capital gains.
   - Need large dataset on owner-occupied properties with data on mortgage interest, property taxes, homeowners insurance, maintenance, expected capital gains.
   - Many measurement issues
Data sources

• Most prior attempts to impute rents have used
  o the American Community Survey
  o the Residential Finance Survey, last conducted in 2001

• Could public records data help?
Public records data

• Advantages
  o Very large dataset of residential property with detailed property characteristics
  o Market transaction prices of all properties (owner-occupied and rental)
  o Automated Valuation Models (AVMs) can be used to estimate the value of all properties—e.g. Zillow’s “Zestimate”

• Disadvantages
  o Don’t know whether a property is owner-occupied, renter-occupied, or vacant
  o Don’t observe rents of rental units
Public records data

- Merge public records and AVM estimates with ACS
  - ACS gives info on owner/renter status and rents
- Could follow any of the approaches outlined above
- Can impute rents to owner-occupied units using property characteristics
  - Much more detailed characteristics than the ACS, such as unit square footage, lot square footage
  - Zillow already does this based on rents from MLS registries and other sources, but only back to 2010
Public records data

- Can use the ratio of rent/AVM of rental units to impute rents to owner-occupied units.
  - Much more current than the 2001 RFS
  - AVM is based on market transaction prices, not owner valuations.
- Can use mortgage and property tax info to follow the user cost approach
- The Census Bureau has already obtained public records and AVM data!
Measuring Aggregate Housing Wealth: New Insights from Automated Valuation Models

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Our Goal

- Measure the aggregate value of residential property owned for personal use
  - Includes owner-occupied, seasonal, vacant for-sale, other vacant
  - Excludes income-generating property
- A major component of household wealth
- Reported in the Financial Accounts of the US
Two common methods to measure value

• Owner self-report of a home’s value.
  o Advantages: Reflect all owner-occupied properties, capture quality changes.
  o Disadvantage: Owners may be slow to update their beliefs, especially when prices fall.  Ihlanfeldt and Martinez-Vasquez (1986), Goodman and Ittner (1992), Kieland Zabel (1999), Bucks and Pence (2006), Henriques (2013), Chan, Datrup, and Ellen (2014), Benitez-Silva etal. (2016), Davis and Quintin (2017), ...

• Repeat-sales price index.
  o Advantage: Disciplined by market prices.
  o Disadvantages:
    • Holds quality constant.
A new contender: (Zillow’s) AVM

- Automated Valuation Models (AVMs):
  - Hedonic-like models that use sales data and property characteristics
  - Use machine learning techniques
  - Zillow estimates values for a large fraction of residential property in the US

- Advantages:
  - Can capture property characteristics (like owner reports)
  - Disciplined by market prices (like repeat-sales indexes)
  - Estimates updated frequently

- Disadvantages:
  - Method is black box (to us).
  - Not designed to be nationally representative
Universe of Zillow estimates

• AVM estimates will be missing for properties with missing characteristics or where sales are infrequent

• AVM estimated for rental property as well as owner-occupied property (hard to tell the difference in public records)
  o Will be a problem for estimating the value of own-use property if the average value of rental units is not equal to the average value of owner-occupied units.
Our method

• Can’t just add up the AVM estimates all properties
• Instead, multiply the average AVM for a “market” by the number of units in that market from the American Community Survey.
  o Market defined by county and property type (SF vs MF)
  o Adjust for the average “error” of the AVM
  o Then sum over markets.

\[ \sum_{m=1}^{M} n_{m} \overline{AVM}_{m} F_{m} \]
AVM “errors”

- Difference between the AVM estimate in the month prior to a sale and the sale price.
  - Zillow has given us data on the distribution of errors by market.
  - We focus on value-weighted error
Aggregate Own-Use Housing Wealth

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

• AVMs provide a viable alternative to measuring aggregate household housing wealth.

• But one needs to address a number of issues:
  o Representativeness of the sample
  o Model error
A similar strategy to estimate aggregate housing services?

• Obtain average rent estimates by market from Zillow

• Aggregate using unit counts by market from the ACS

• Could adjust for average difference in rent between Zillow and ACS

• Would not need raw public records data—leverages work already being done by Zillow.

• Caveat: would not work as well for multifamily structures because Zillow has focused on modeling single-family units and condos/coops.
Thank you!