

# Improving Measures of Housing Services in BEA's Accounts

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# Outline

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- Part I: Existing data sources and methodologies
- Part II: Proposed data source and methodology
- Part III: Results

Part I:  
Existing Data Sources and Methodologies  
(2001-present)

# Overview of Existing Methodologies

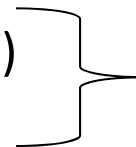
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- National level

- Two main components

- Average annual rental value (AARV)
    - Number of units



Current-dollar value =  
AARV x Units

- Several data sources

- State level

- National totals allocated using best available allocation factors

- Housing services estimates

- Personal consumption expenditures (PCE) by state
    - Rental income and persons (RIP) by state
    - Gross domestic product (GDP) by state

# Tenure Categories

- Owner-occupied

- Non-farm

- Permanent

- Mobile

- Farm

- Tenant-occupied

- Non-farm

- Permanent

- Mobile

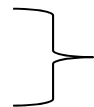
- Farm



70% total U.S. housing services

Published

- Vacancies



Unpublished

# Source Data for Current-Dollar Estimates

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- AARV
  - American Housing Survey (AHS)
  - Residential Finance Survey (RFS)
  - Consumer Expenditure Survey (CEX)
  - CPI for owners' equivalent rent (CPI)
  - Real dollar stock of owner-occupied structures (CapStk)
  
- Number of units
  - Decennial census
  - Housing Vacancy Survey (HVS)

# National Level Estimates

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- *Benchmark*

- AARV: rent-to-value approach: 2001
  - Tenant-occupied from the RFS
  - Owner-occupied from the AHS } Linked by value class
  - National average = \$11,829
  - Assumes units of equal value reap equal rents
- Number of units: decennial Census

- *Annual extrapolation:*

- AARV: 2002-present
  - 2002-2007 extrapolator: CEX
  - 2008-present extrapolator: CPI&CapStk
- Number of units: HVS

# State Level Allocations

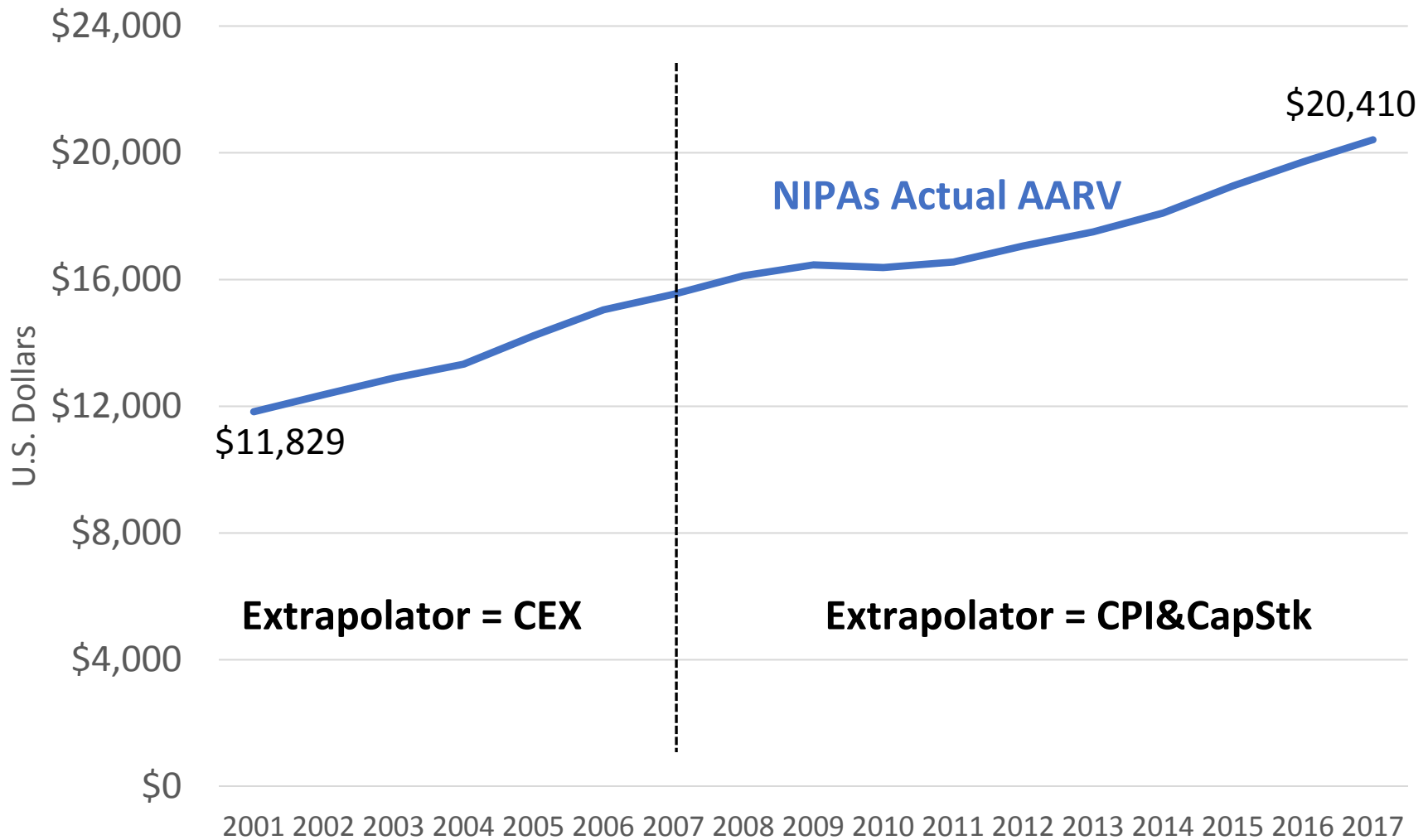
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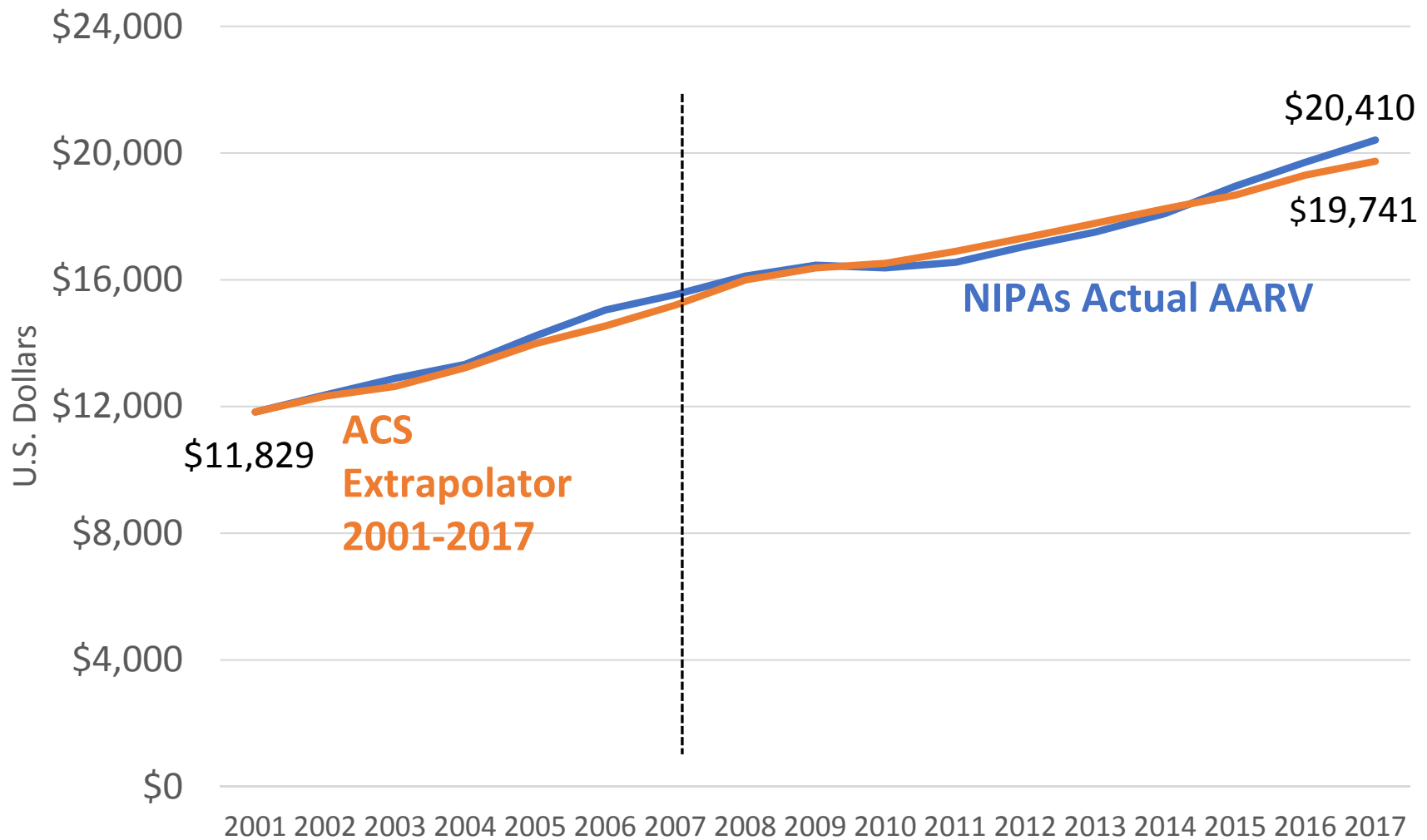
- Personal consumption expenditures
  - Allocation factor: ratio of owner-occupied to tenant-occupied expenditures from Regional Price Parities times tenant-occupied expenditures from ACS
- Rental income of persons
  - Allocation factor: data on housing values from ACS
- Gross domestic product
  - Allocation factor: imputed rental income of persons



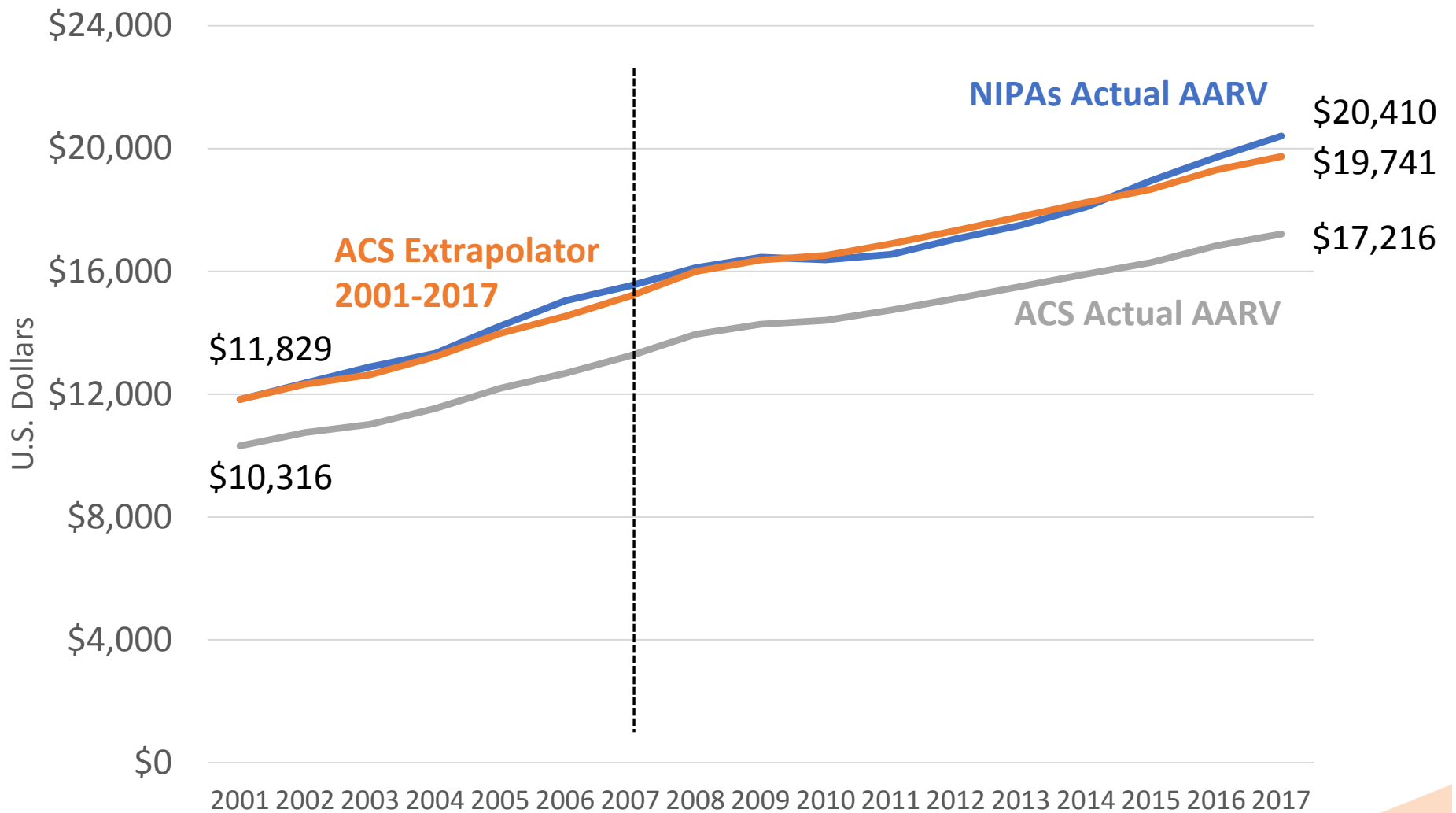
# AARV: NIPAs Actual Extrapolation



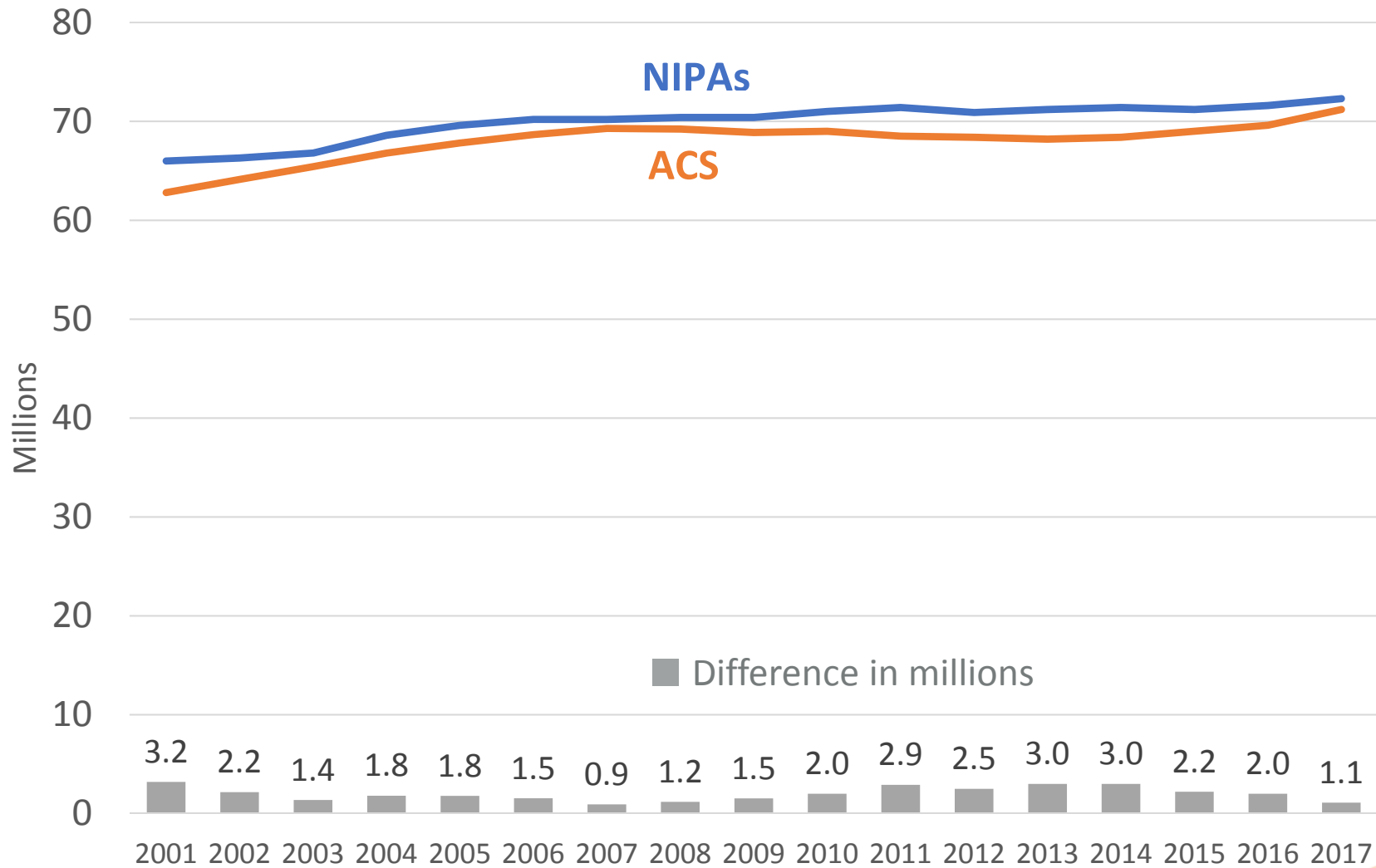
# AARV: ACS Extrapolation



# AARV: ACS Extrapolation



# Number of Units



# Part II: Proposed Data Source and Methodology

# American Community Survey Public Use Microdata

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U.S. Census Bureau

1. Why the ACS?
2. Why an Owner Premium?
3. ACS-Zillow for California
4. National aggregates
5. State aggregates
6. Treatment of Vacancies

# ACS: Large, Nationally Representative Sample

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1. Large sample size
  - 1.5 million housing records in 2017 PUMs
2. Transparent and replicable
  - Public data available from Census website
3. Bottom-up estimation
  - Observations are for individual dwelling units: tenant and owner-occupied
  - Stratified Rental Equivalence
4. Consistency: One BEA
  - One method for National and Regional accounts, including PCE, Personal Income, GDP and RPPs (state and metropolitan)
  - One method for all types of housing units, including Non-permanent sites, Farms and Vacant units

# Stratified Rental Equivalence

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- Observe monthly contract rents for tenant-occupied units
  - Stratify by characteristics that are common to owner-occupied units:
    - State
    - Type of structure
    - Number of bedrooms
    - Total number of rooms
    - Age of structure
- Find average of each combination of characteristics
- Assign average to owner-occupied units with same characteristics



# Rationale for an Owners' Premium

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1. Rental equivalence known to understate owner's costs
  - It is the reason why BEA used Rent to Value ratios from the RFS in 2001
2. Alternatives are User Cost and Opportunity Cost methods
  - Both make assumptions on interest and depreciation rates for all units\*
  - Both are volatile due to their dependence on housing prices
3. Owner Premium treats understatement
  - Less volatile, uses relative housing prices (beta)
  - Available at individual dwelling unit, simple and intuitive ratio
  - Owner Premium adjustment (formulaic beta): smoother and based on empirical evidence

\*no data on individual mortgage rates of dwelling units, one rate across U.S.

# What is the Owners' Premium Adjustment?

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- It is an adjustment to the Rental Equivalence method
- The adjustment uses information on the value of the owner-occupied unit
- The value is divided by the median value of similar units, termed beta ( $\beta$ )

## *Notation:*

Beta<sub>i</sub> =  $P_i / (\text{Median } P_i \text{ by state, type of structure, \# bedrooms})$

$P_i$  = value of individual owner-occupied dwelling unit (\$)

RE = stratified monthly rent (\$)

# How Can This Adjustment Be Applied to the RE (1)?

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1) Beta Adjustment:  $RE * Beta$

# Example (1)

1) Beta Adjustment:  $RE * Beta$

1) Beta Adjustment				
RE (1)	Value (2)	Median Value (3)	Beta (4)	RE*Beta (5)
\$1,000	\$200k	DC \$600k	0.33	\$330
		WV \$120k	1.67	\$1,670

Example: Single family 2-bedroom owner-occupied home

# Example (2)

1) Beta Adjustment:  $RE * Beta$

2) Owner Premium Adjustment (formulaic beta):  $RE * f(Beta)$

- If  $Beta \leq 0.5$  then  $f(Beta) = 1.05$
- If  $0.5 < Beta \leq 1$  then  $f(Beta) = 0.95 + 0.20 Beta$
- If  $1 < Beta$  then  $f(Beta) = 0.85 + 0.30 Beta$

1) Beta Adjustment					2) Owner Premium Adjustment	
RE (1)	Value (2)	Median Value (3)	Beta (4)	RE*Beta (5)	f(Beta) (6)	RE*f(Beta) (7)
\$1,000	\$200k	DC \$600k	0.33	\$330	1.05	\$1,050
		WV \$120k	1.67	\$1,670	$1.35 = 0.85 + (0.3 * 1.67)$	\$1,350

Example: Single family 2-bedroom owner-occupied home

# ACS – Zillow Comparison for California

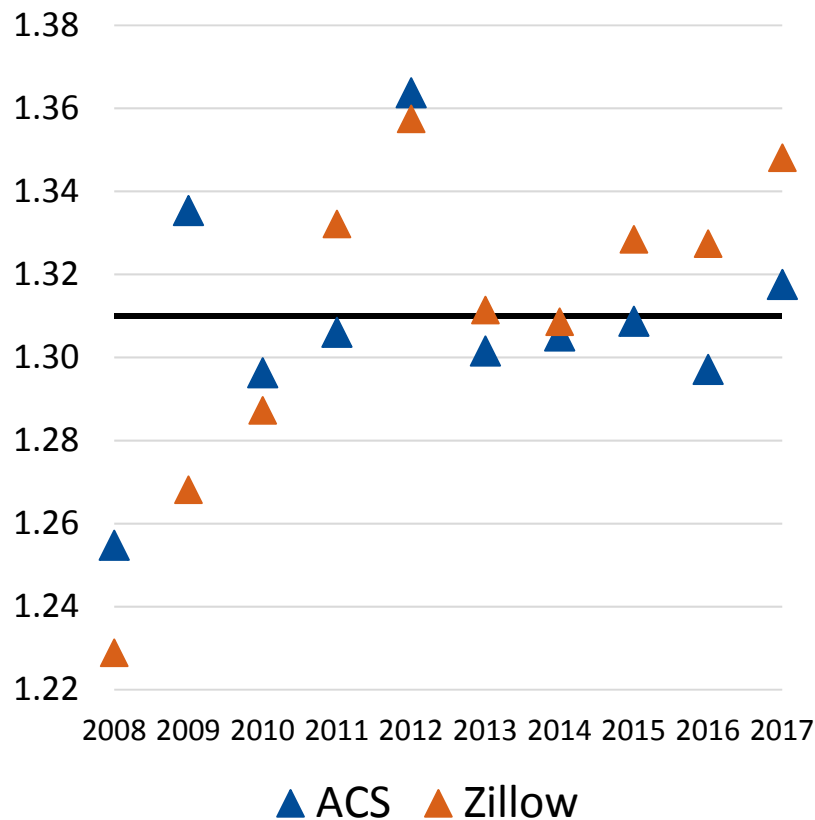


California	Beta		Owner Premium f(Beta)	
	ACS	Zillow	ACS	Zillow
2008-2017	ACS	Zillow	ACS	Zillow
APT 1	1.31	1.27	1.27	1.26
APT 2+	1.33	1.22	1.27	1.24
SF 2	1.26	1.37	1.26	1.29
SF 3+	1.34	1.39	1.28	1.29
Geomean	1.31	1.31	1.27	1.27

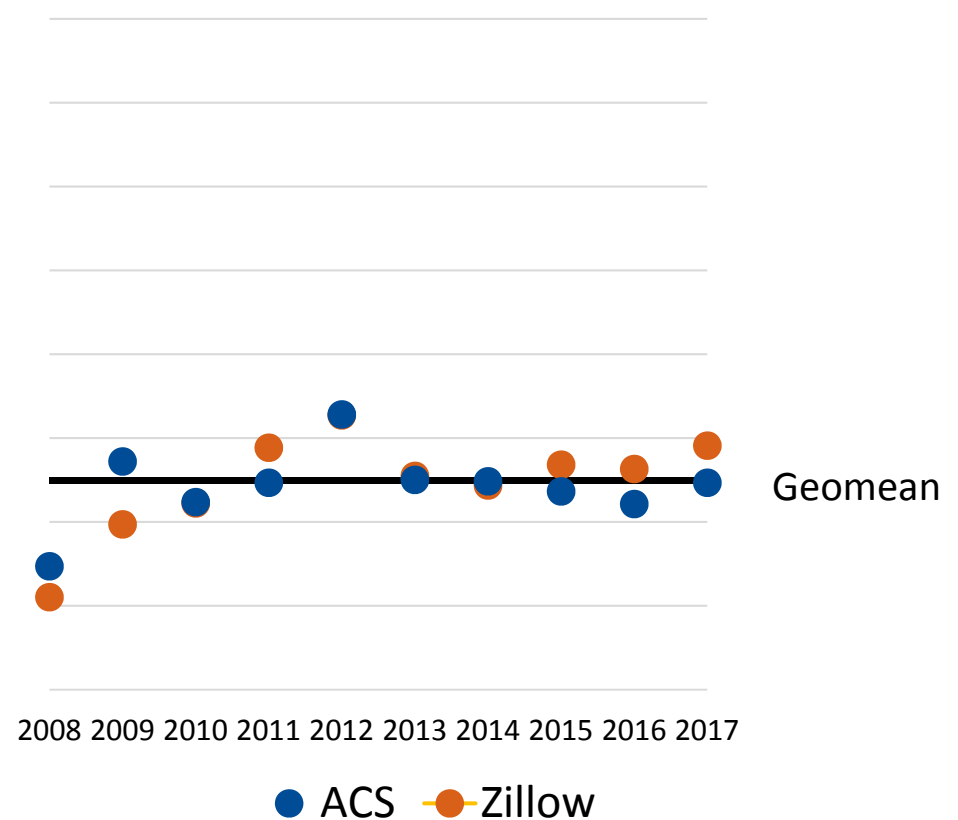
# ACS-Zillow Comparison 2008-2017 CA



## Beta



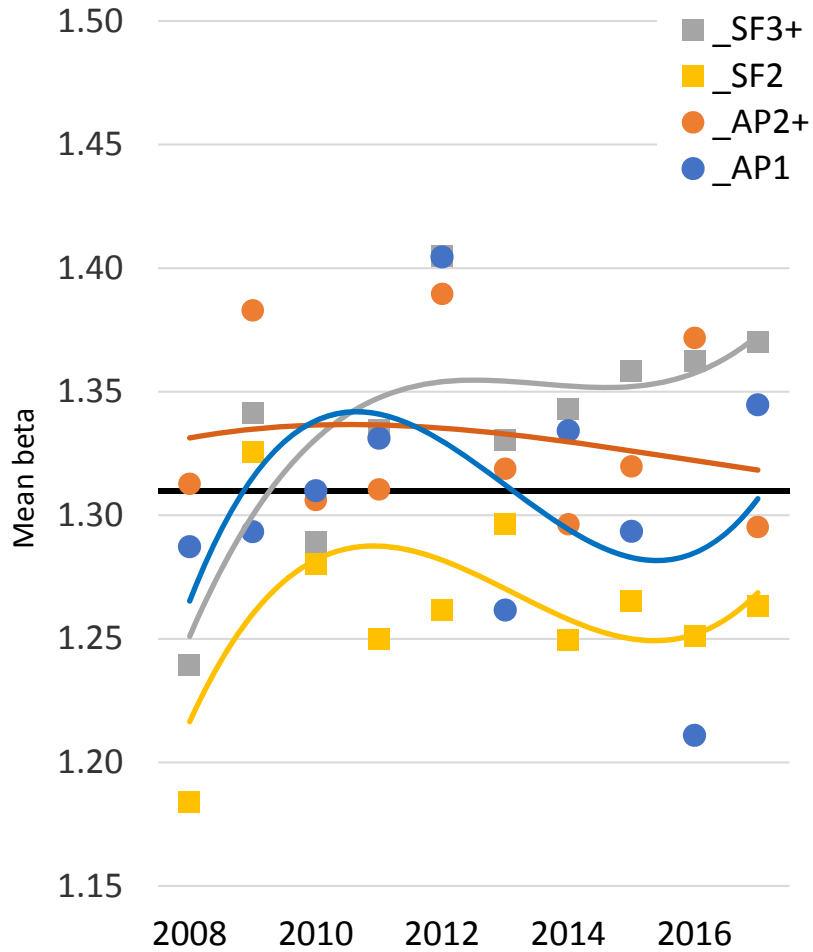
## f(Beta)



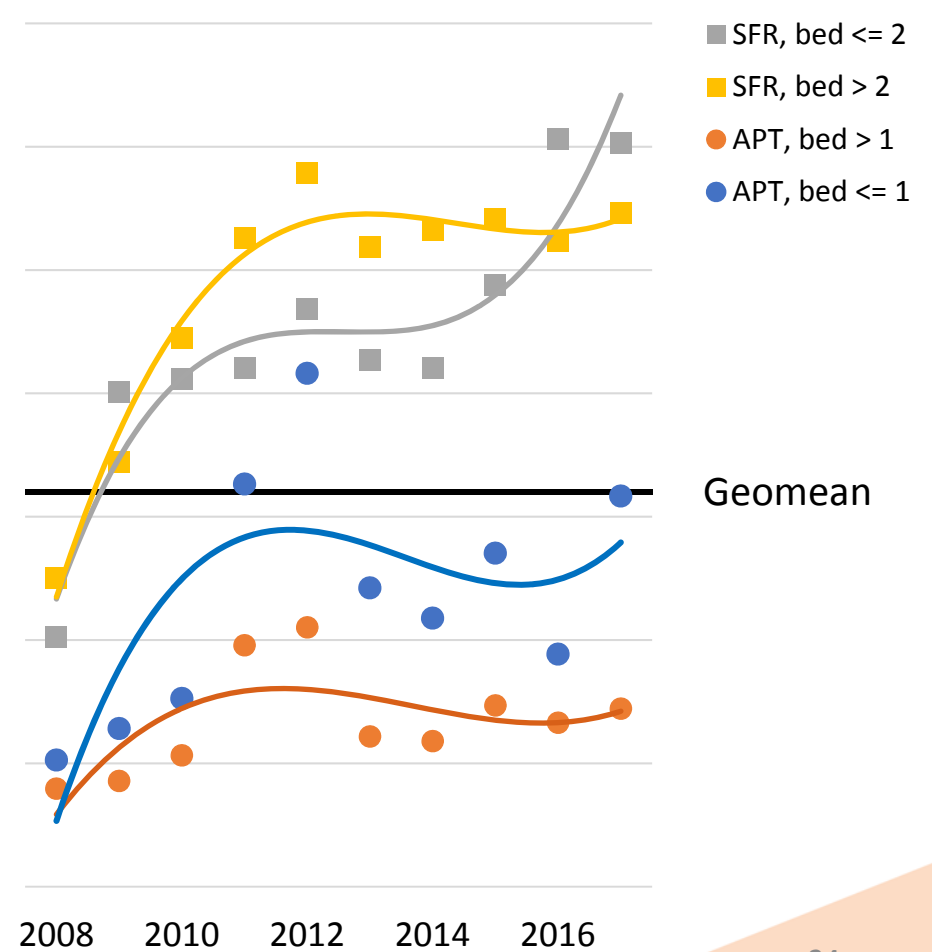
# Beta Comparison for CA



## ACS Betas



## Zillow Betas



Geomean

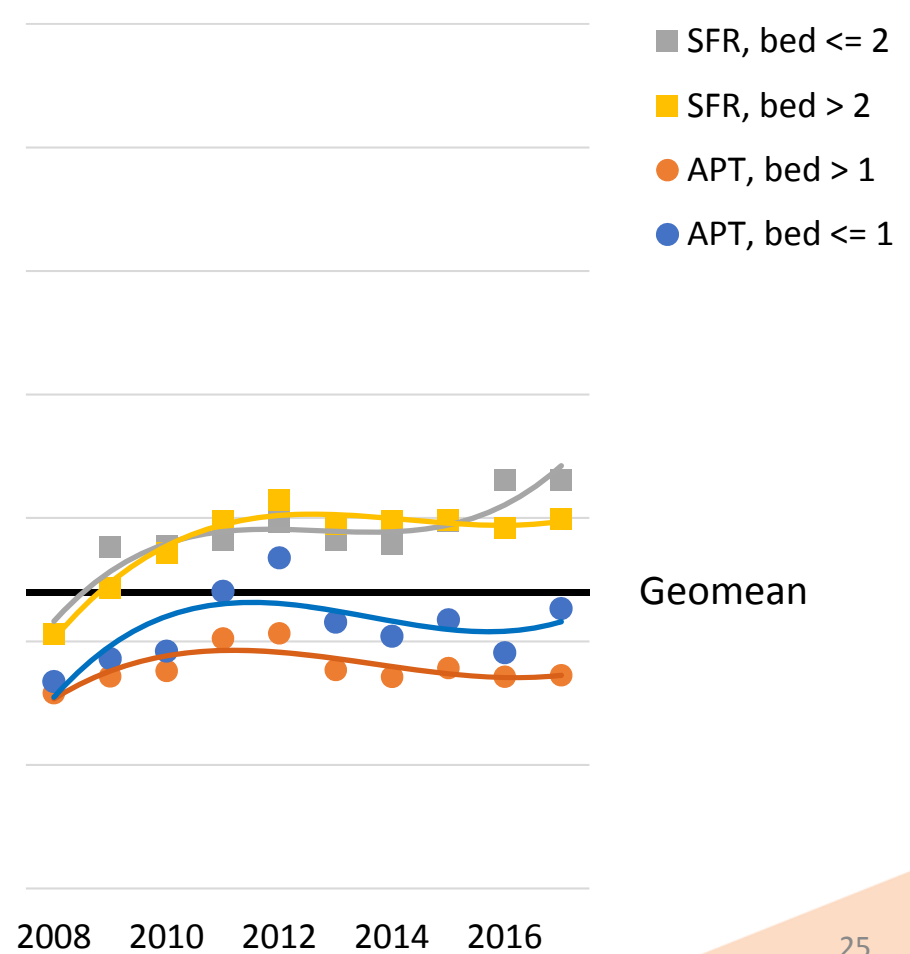
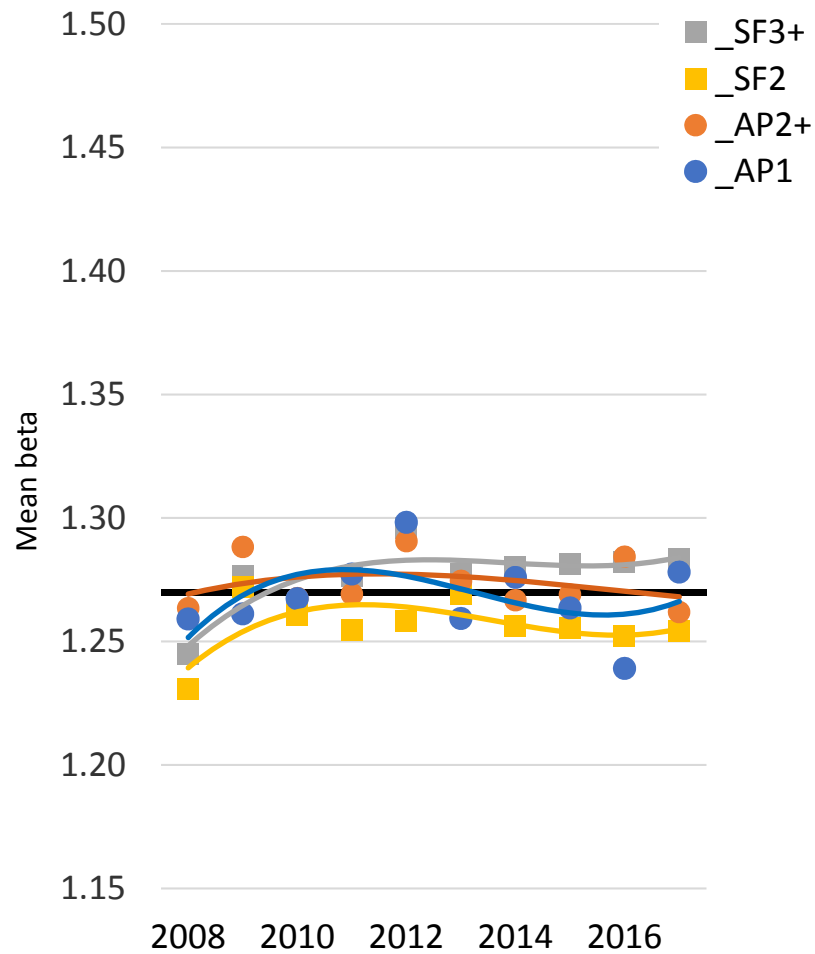


# Formulaic Beta Comparison for CA



### ACS f(Beta)

### Zillow f(Beta)



Geomean

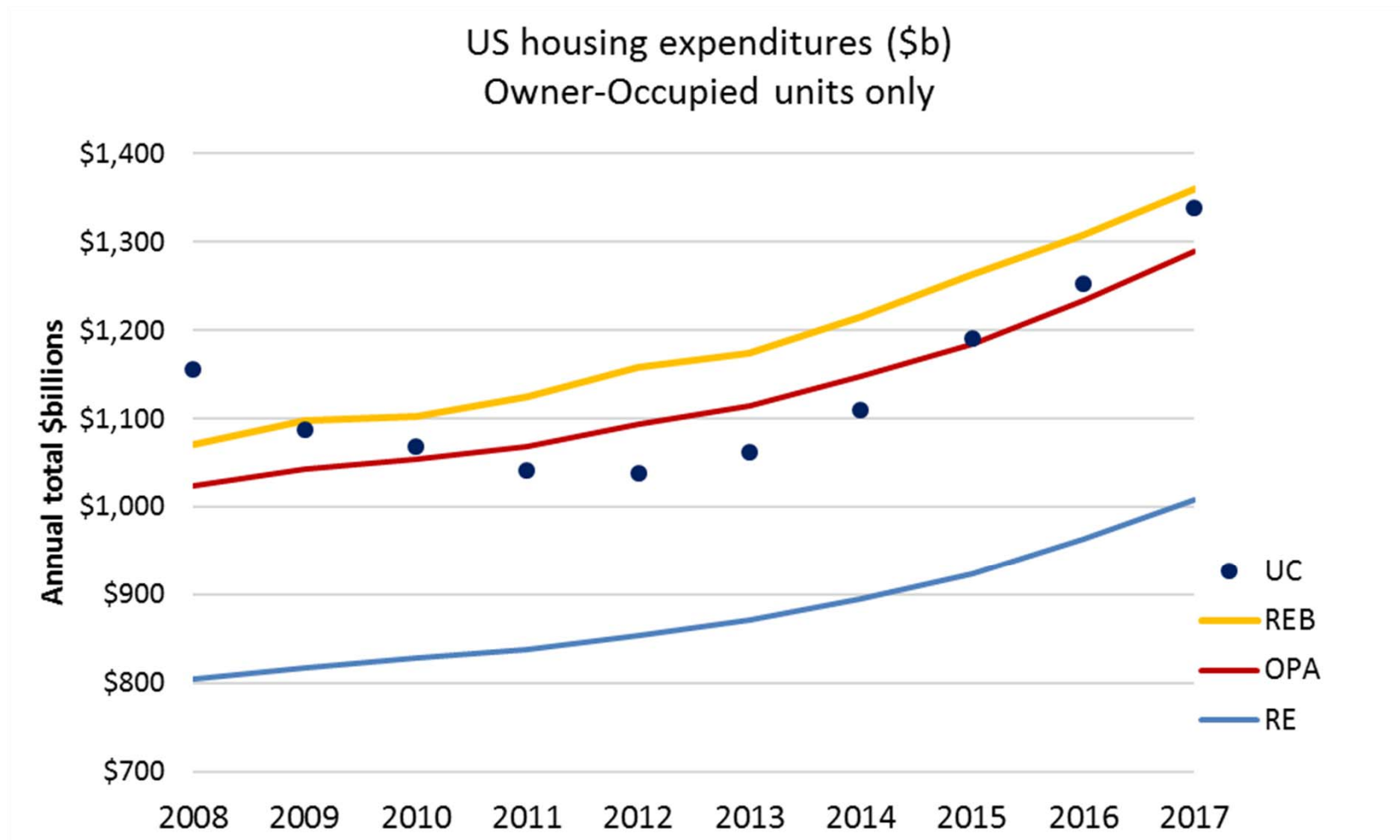
# Results: OOH Expenditures United States



	<b>RE</b> Rental Equivalence (w/out Premium)	<b>REB</b> RE x Beta	<b>OPA</b> Owner Premium Adjustment	<b>UC</b> User Cost at 2.5% interest rate	<b>Beta</b>	<b>f(Beta)</b>	<b>UC/ RE</b>	
<b>Units</b>								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
	\$ Millions	\$ Billions						
<b>2008</b>	75.3	805	1,070	1,024	1,155	1.33	1.27	1.43
<b>2011</b>	74.4	838	1,124	1,069	1,042	1.34	1.28	1.24
<b>2014</b>	74.1	895	1,215	1,147	1,110	1.36	1.28	1.24
<b>2017</b>	76.8	1,009	1,361	1,289	1,338	1.35	1.28	1.33

\* Results includes Non-permanent site (Mobile homes & other) and Farms

# Results: OOH Expenditures United States



# State Results: OOH Expenditures 2017

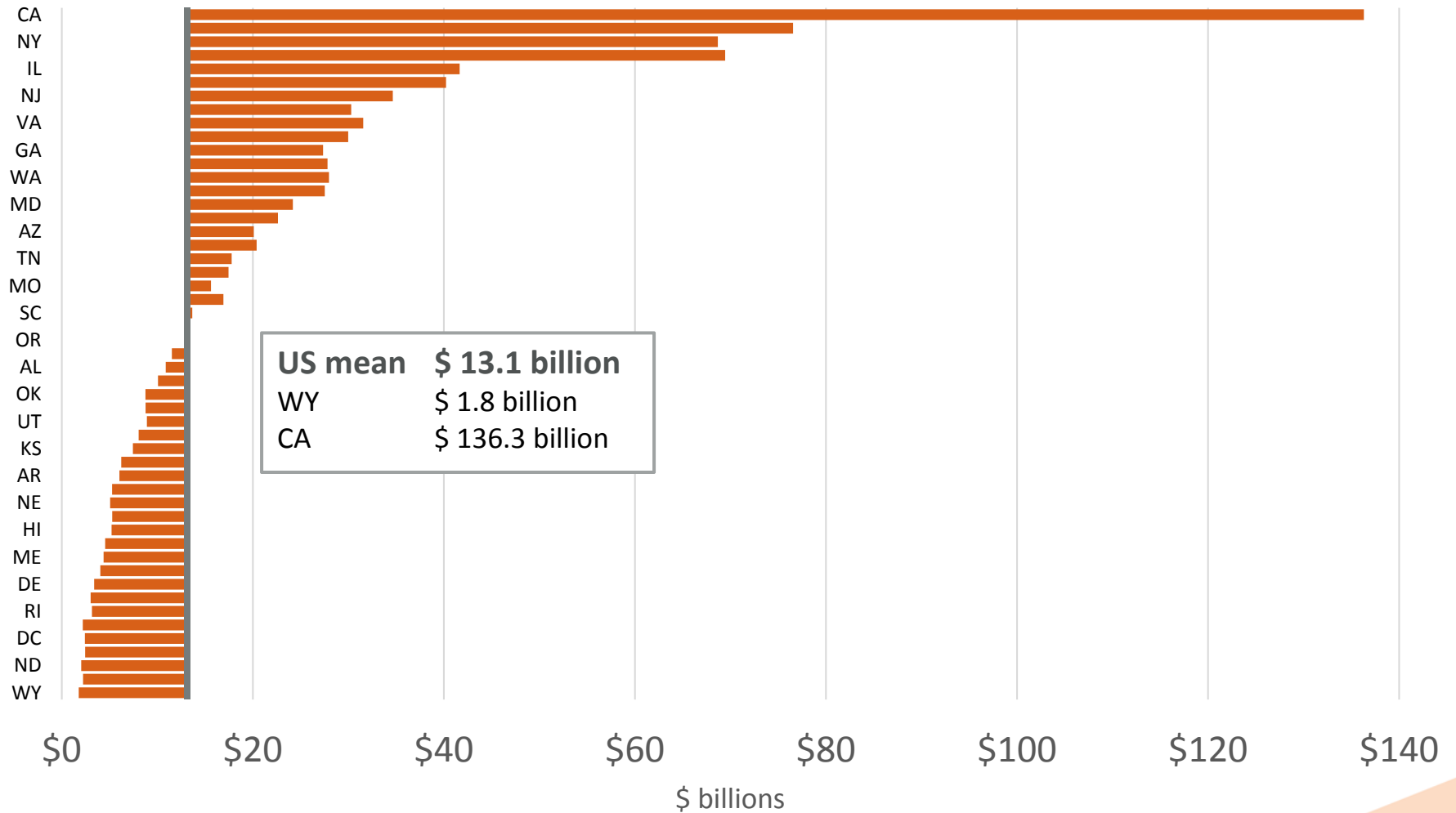


	<b>RE</b>	<b>REB</b>	<b>OPA</b>	<b>UC</b>				
<b>Units</b>	<b>Rental Equivalence</b>	<b>RE x Beta</b>	<b>Owner Premium Adjustment</b>	<b>User Cost at 2.5% interest rate</b>	<b>Beta</b>	<b>f(Beta)</b>	<b>UC/RE</b>	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
<b>\$ Millions</b>	<b>\$ Billions</b>							
<b>DC</b>	0.1	2.4	2.9	3.0	4.5	1.17	1.22	1.87
<b>WY</b>	0.2	1.8	2.6	2.3	2.1	1.50	1.32	1.21
<b>IA</b>	0.9	8.8	11.8	11.2	10.0	1.30	1.26	1.14
<b>NJ</b>	2.1	34.7	43.1	43.1	56.0	1.23	1.24	1.62
<b>TX</b>	6.0	76.6	108.4	99.4	89.6	1.38	1.29	1.17
<b>CA</b>	7.1	136.3	186.7	175.1	248.6	1.37	1.28	1.82
<b>US</b>	76.8	1,009	1,361	1,289	1,338	1.35	1.28	1.33

\* OOH expenditures include Non-permanent site (Mobile homes & other) and Farms

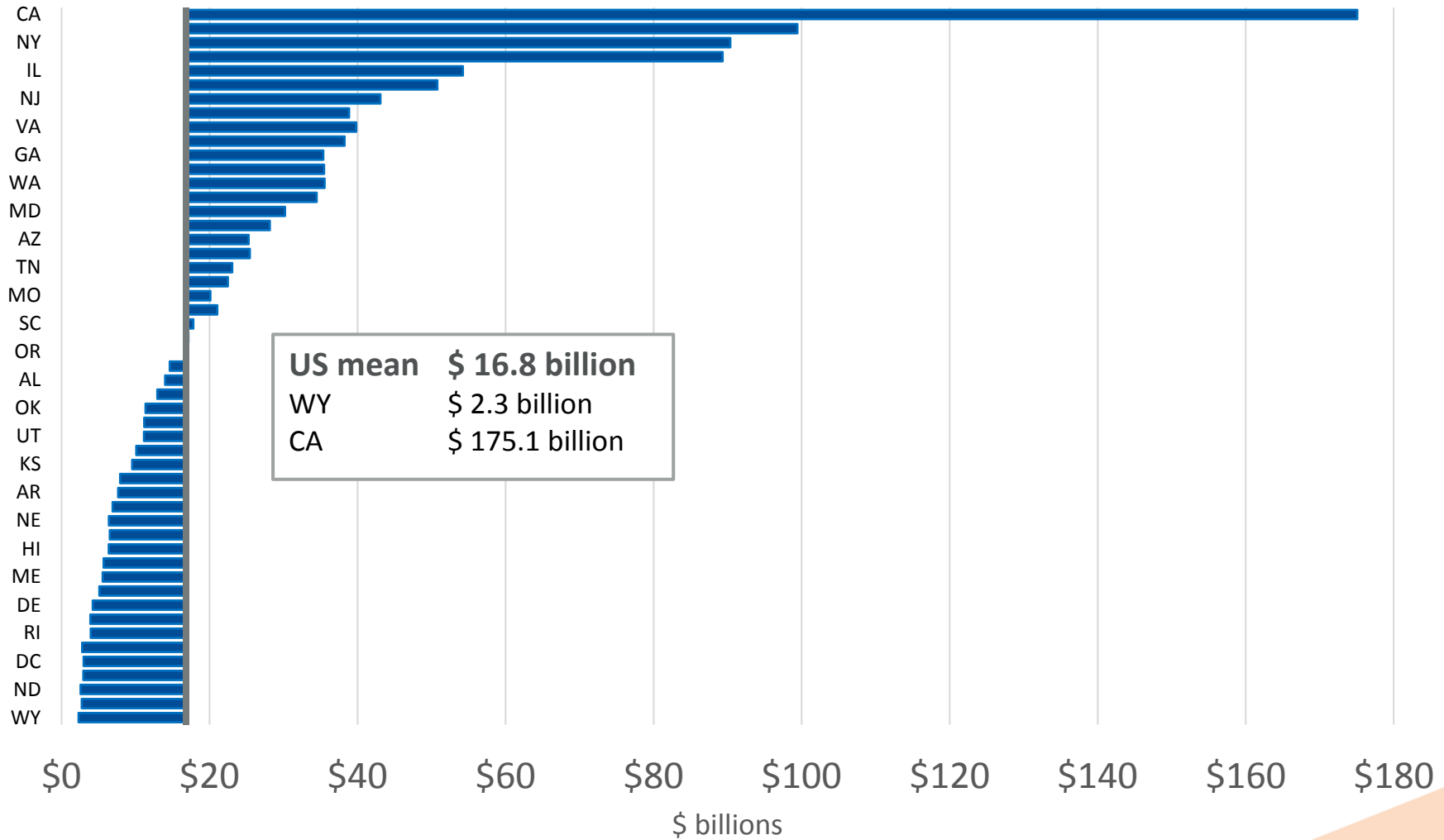
# ACS Without Premium

## OOH expenditures 2017 (RE)

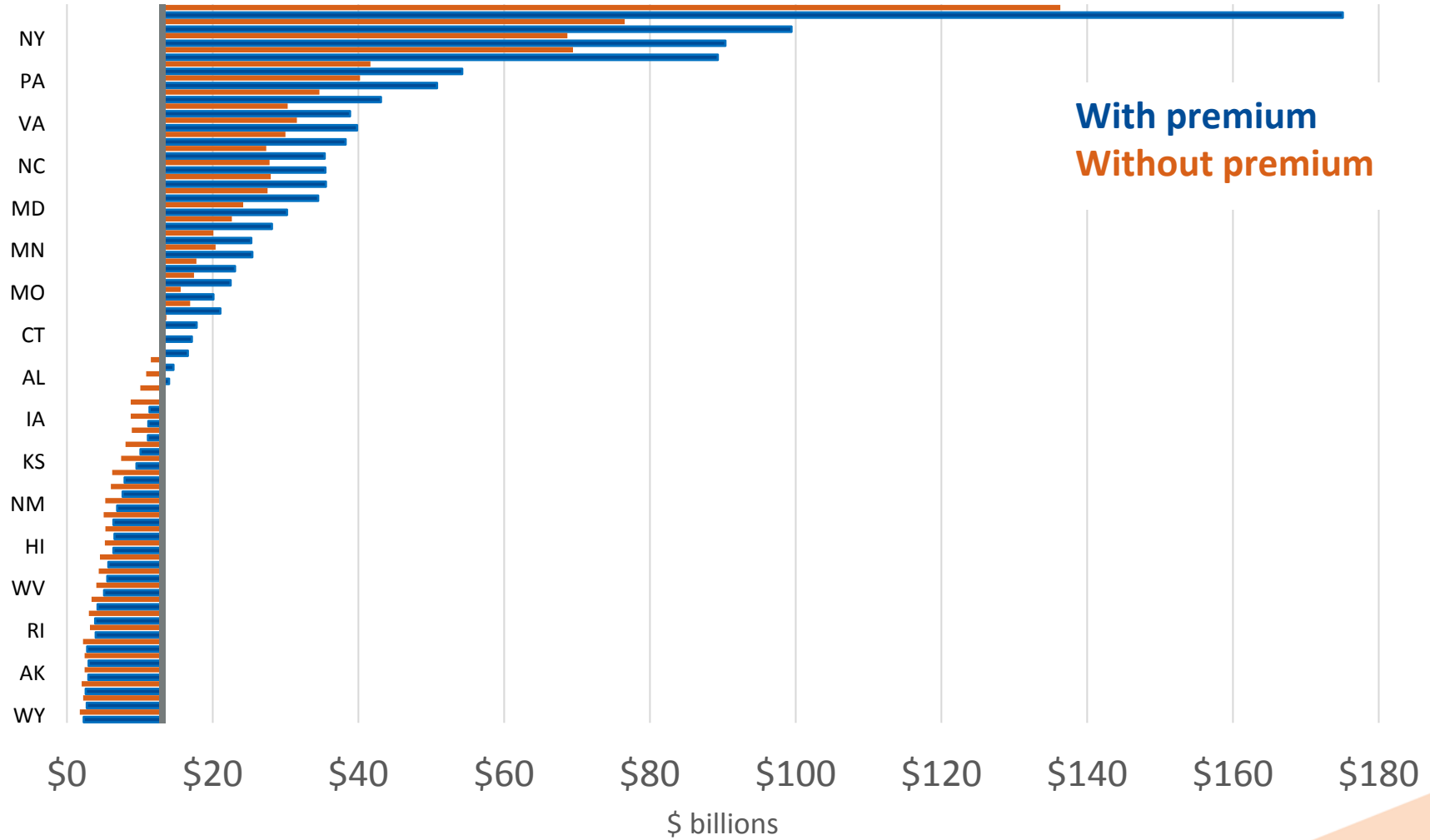


# ACS With Premium

## OOH expenditures 2017 f(Beta)



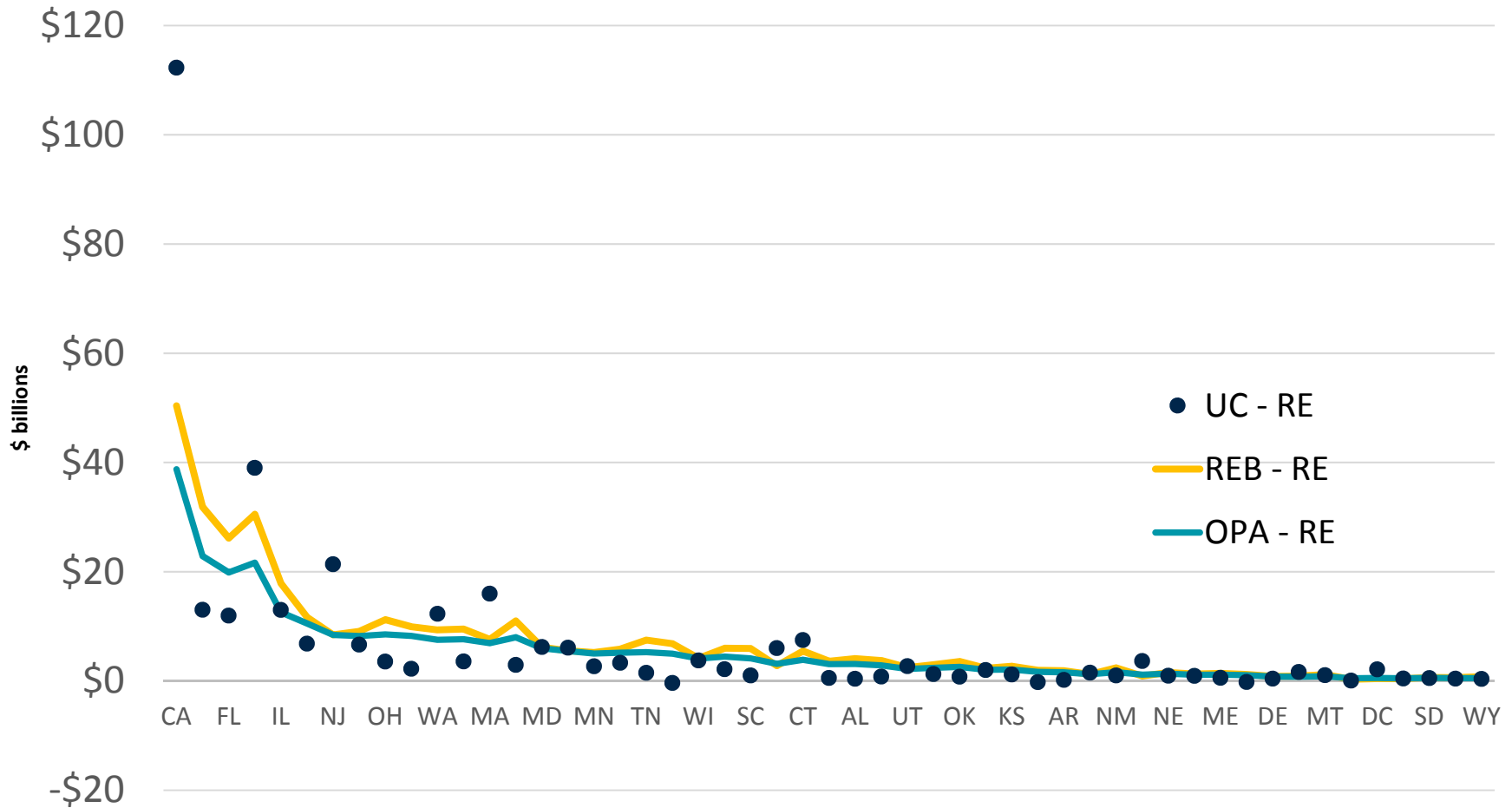
### OOH expenditures 2017 RE and OPA f(Beta)



# State Results: OOH Expenditures 2017



Differences in \$ billions





# State and Type of Structure: DC and CA



2017	Type/ beds	Units	RE Rental Equivalence	REB RE x Beta	OPA Owner Premium Adjustment	UC User Cost 2.5% interest rate	Beta	f(Beta)	UC/ RE
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		\$ Millions	\$ Billions						
DC	_AP1	0.02	0.3	0.3	0.4	0.4	0.98	1.16	1.11
	_AP2+	0.02	0.3	0.4	0.4	0.6	1.10	1.20	1.73
	_SF2	0.01	0.2	0.3	0.3	0.4	1.22	1.24	1.74
	_SF3+	0.07	1.5	1.9	1.9	3.2	1.23	1.24	2.08
CA	MOB0+	0.33	4.5	7.9	6.4	2.0	1.72	1.41	0.45
	_AP1	0.09	1.5	2.0	1.9	2.7	1.34	1.28	1.79
	_AP2+	0.32	5.9	7.7	7.4	11.4	1.30	1.26	1.94
	_SF2	0.98	16.0	20.3	20.1	27.4	1.26	1.25	1.71
	_SF3+	5.41	108.4	148.9	139.3	205.2	1.37	1.28	1.89

# Treatment of Vacant Units

ACS	ACS code	%
For rent	1	16%
For sale only	3	7%
Rented, not occupied	2	4%
Sold, not occupied	4	4%
Seasonal/ recreational/ occasional	5	32%
Migrant workers	6	2%
Other	7	35%
<b>Total</b>		<b>100%</b>

# Treatment of Vacant Units



ACS	ACS code	%	1	2	P	NIPA current	NIPAs
			Upper Bound	Middle Ground	EU practical		
For rent	1	16%	100%	-	-	-	N/A
For sale only	3	7%	100%	-	-	-	N/A
Rented, not occupied	2	4%	100%	100%	100%	50%	Rented or sold, not occupied
Sold, not occupied	4	4%	100%	100%	100%	100%	
Seasonal/ recreational/ occasional	5	32%	100%	100%	50%	100%	Occasional
Migrant workers	6	2%	100%	100%	50%	50%	Seasonal vacant (includes migrant workers)
						100%	Usual residence elsewhere
Other	7	35%	100%	-	-	-	N/A
<b>Total</b>		<b>100%</b>					



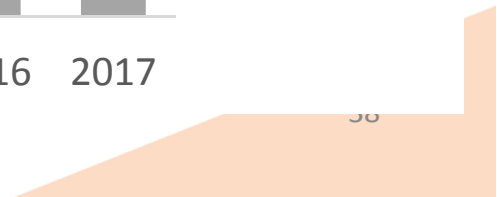
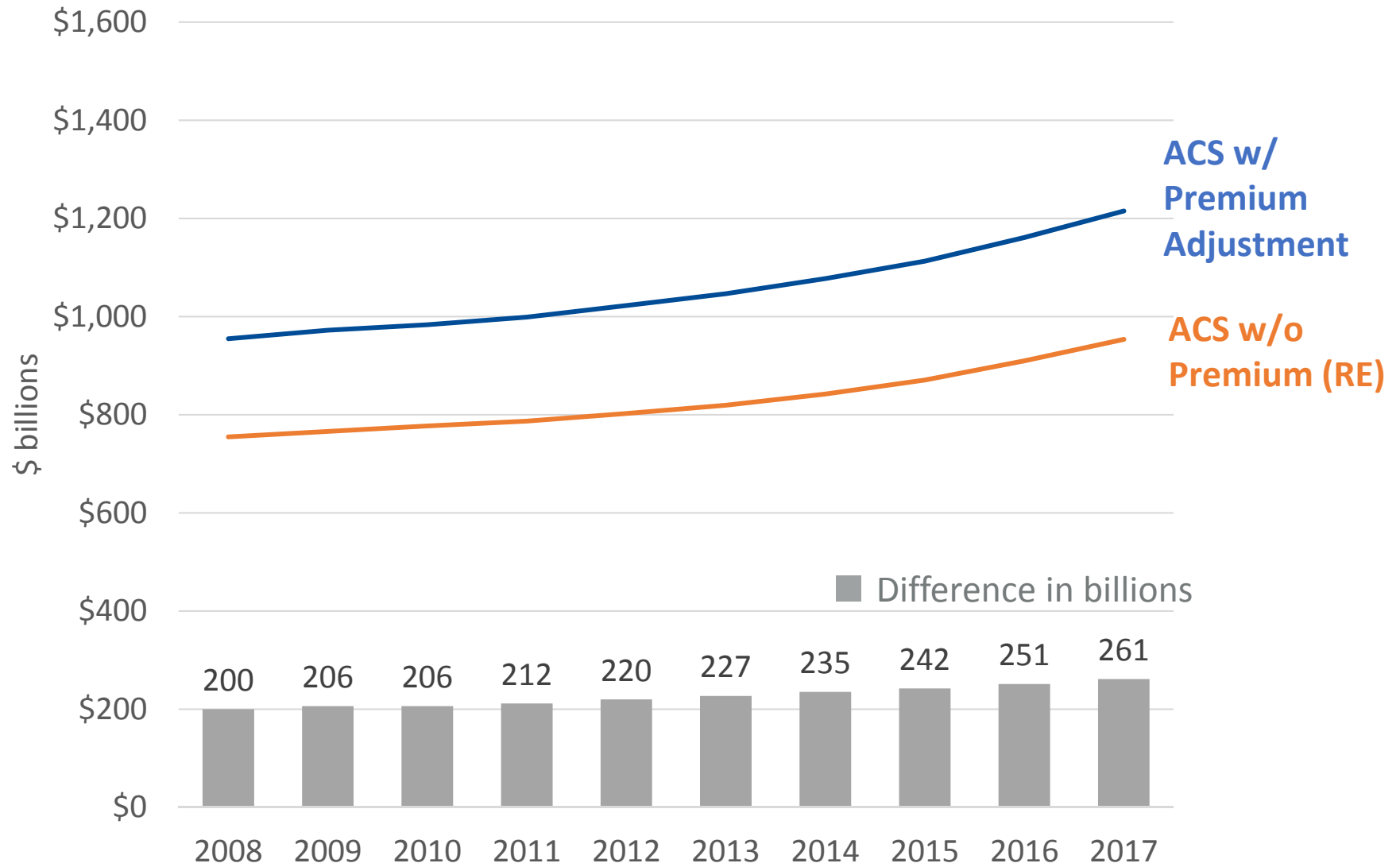
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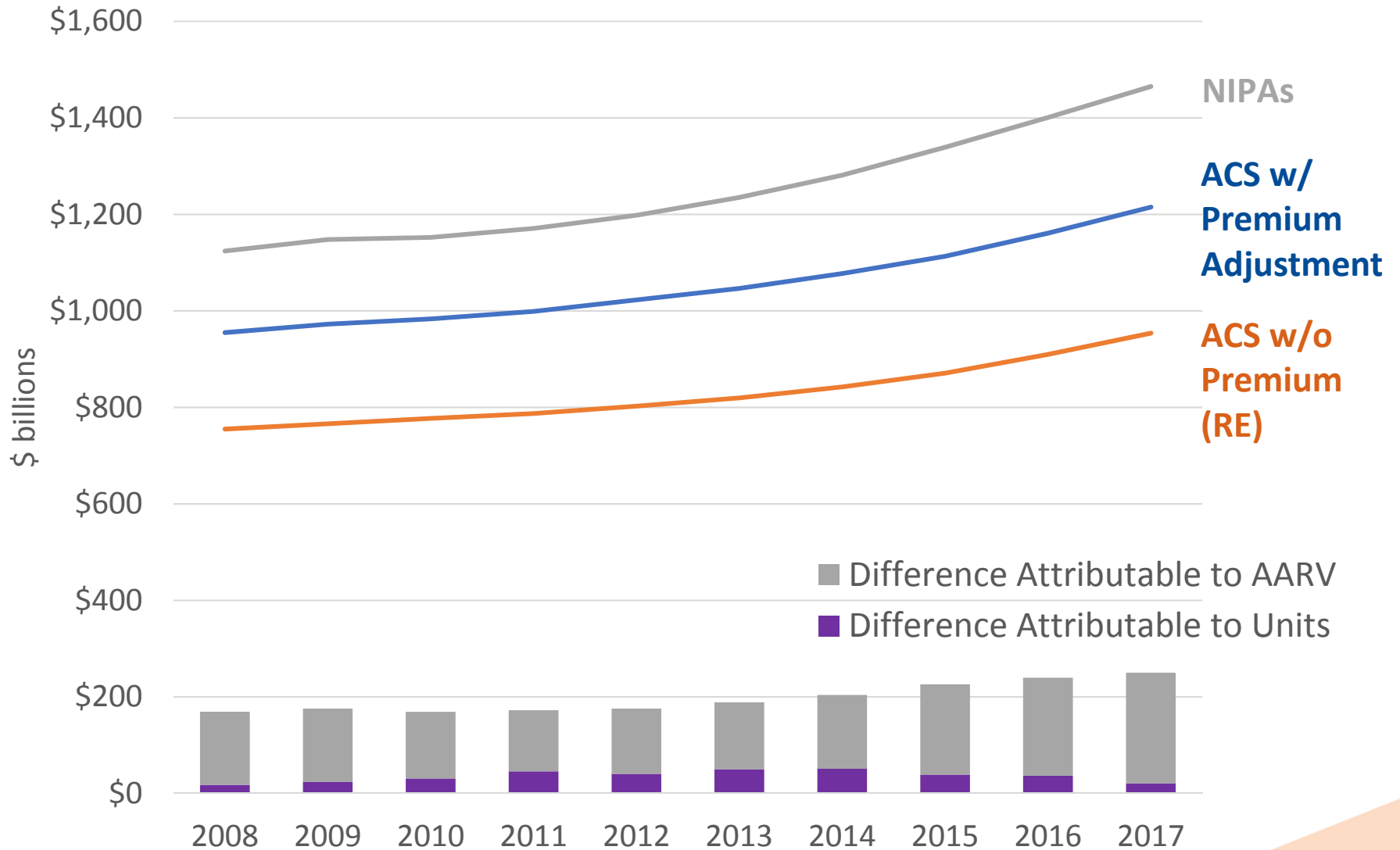
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Sold, not occupied	4	4%	100%	100%	100%	100%	
Seasonal/ recreational/ occasional	5	32%	100%	100%	50%	100%	Occasional
					50%		
Migrant workers	6	2%	100%	100%	50%		Seasonal vacant (includes migrant workers)
						100%	Usual residence elsewhere
Other	7	35%	100%	-	-	-	N/A
<b>2017 Total (billions)</b>			<b>\$196</b>	<b>\$80</b>		<b>\$50</b>	

# Part III: Results (2008-2017)

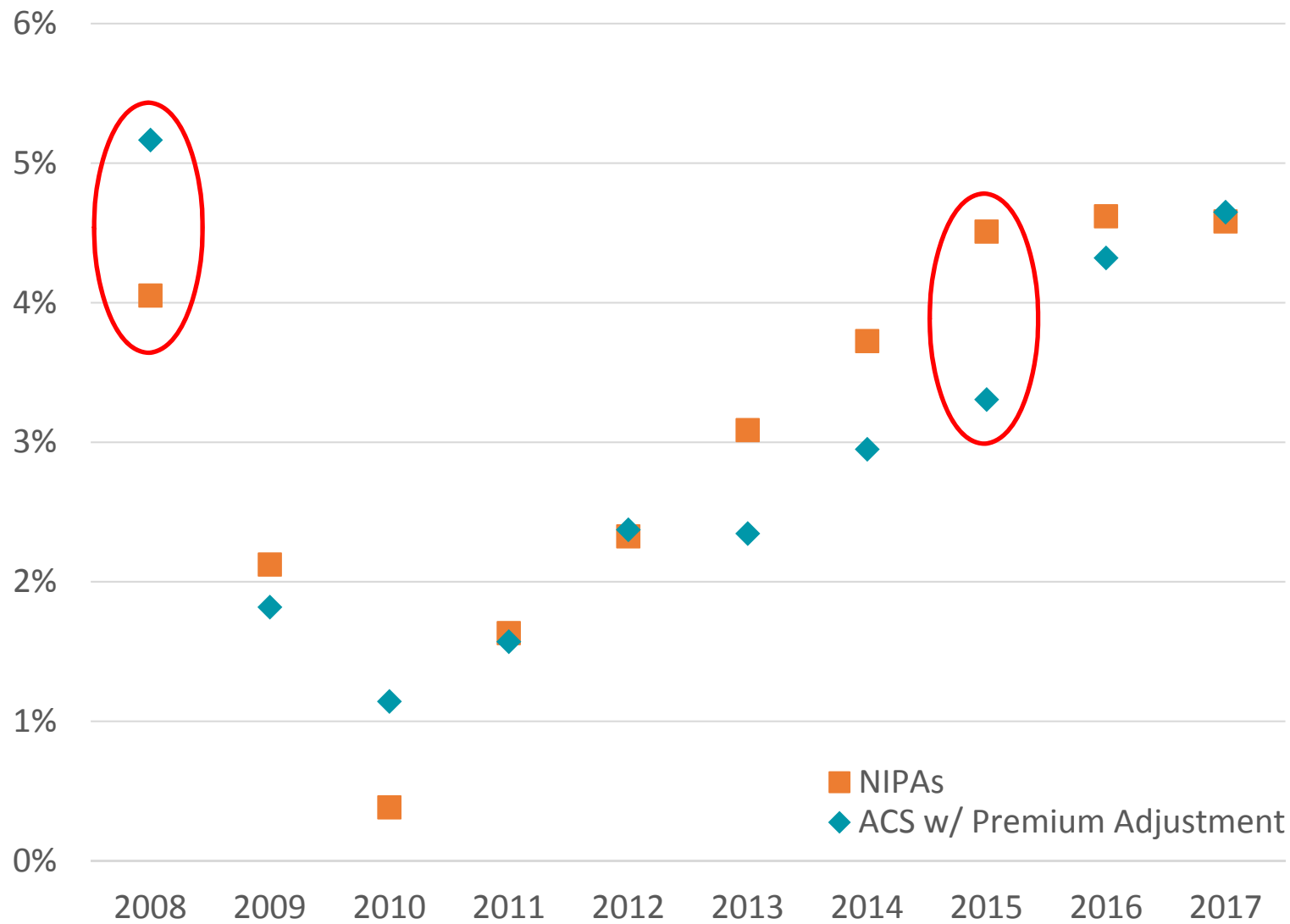
# Aggregate Current-Dollar Values



# Aggregate Current-Dollar Values

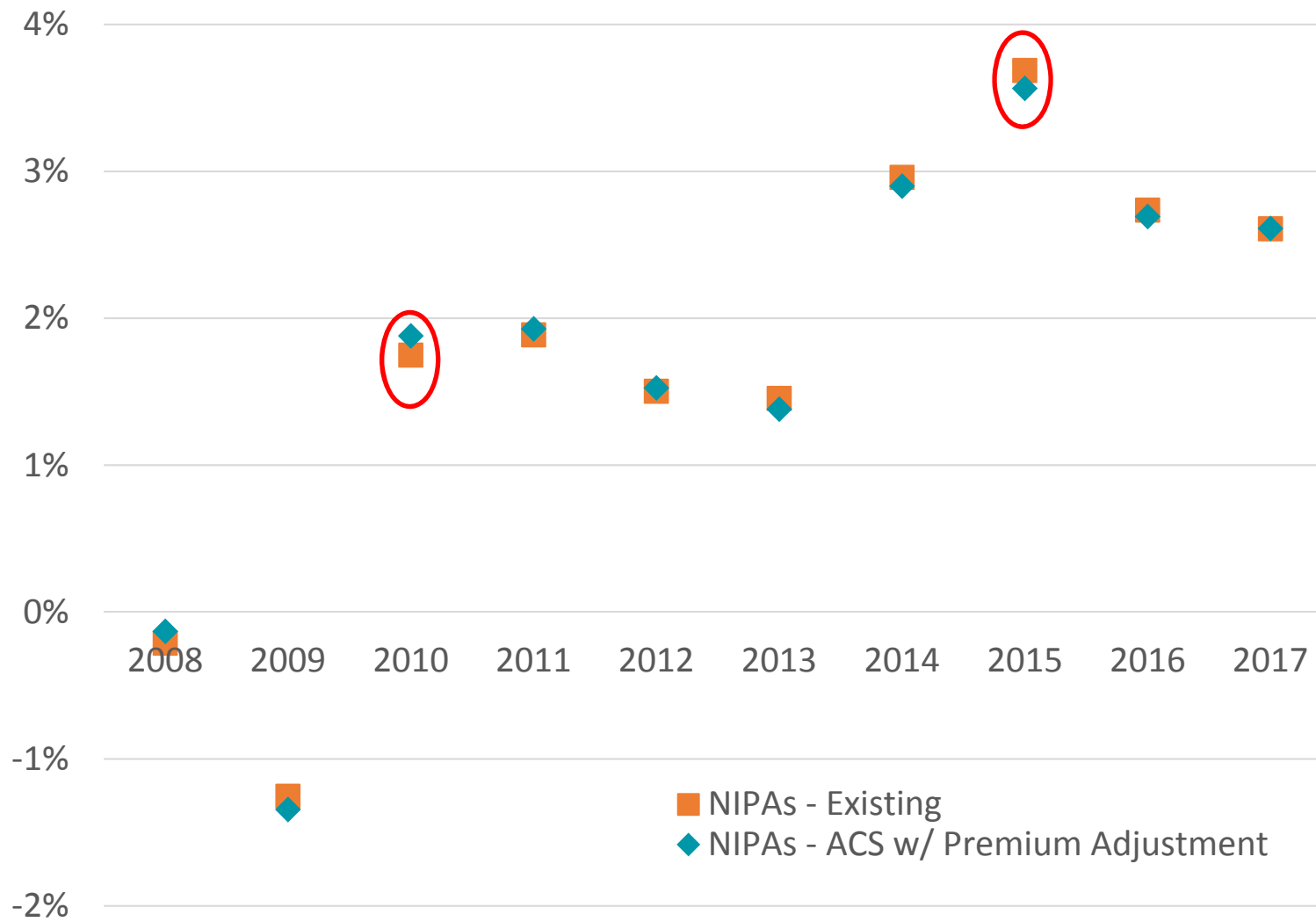


# Y-Y Percent Changes: OONFP

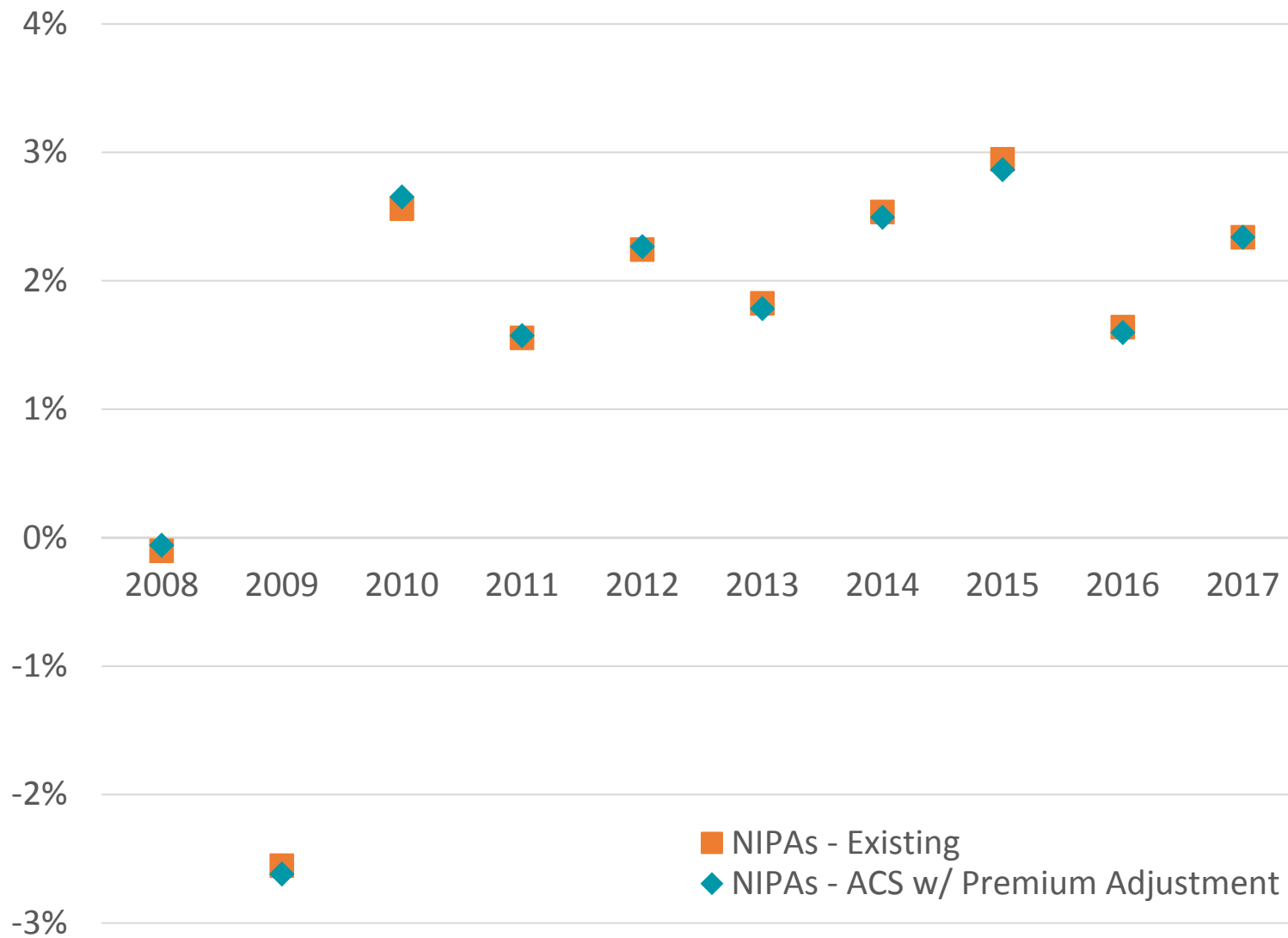




# Y-Y Percent Changes: Real PCE



# Y-Y Percent Changes: Real GDP



# Y-Y Percent Changes: Personal Income



# Conclusions and Questions

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- Differences between NIPA and ACS current-dollar values are driven by both the AARV and number of units
- Differences are relatively small in overall aggregates
  - $\approx$  1 percent level decrease in 2017 (\$20 trillion GDP)
  - $<$  0.1 pp difference for Y-Y percent changes in most years
- Level differences within housing are relatively large
  - \$200-250 billion in 2017 (\$1.5 trillion OONFP)
- Seeking input
  - Simple beta or formulaic beta?
  - Treatment of vacant units?