

Improving Measures of Housing Services in BEA's Accounts

Bettina H. Aten
Dylan G. Rassier



Prepared for the BEA Advisory Committee Meeting

Washington, DC

November 15, 2019

Outline



- 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)

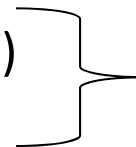
Overview of Existing Methodologies



- 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

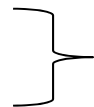
- Farm



70% total U.S. housing services

Published

- Vacancies



Unpublished

Source Data for Current-Dollar Estimates



- 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



- *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:*

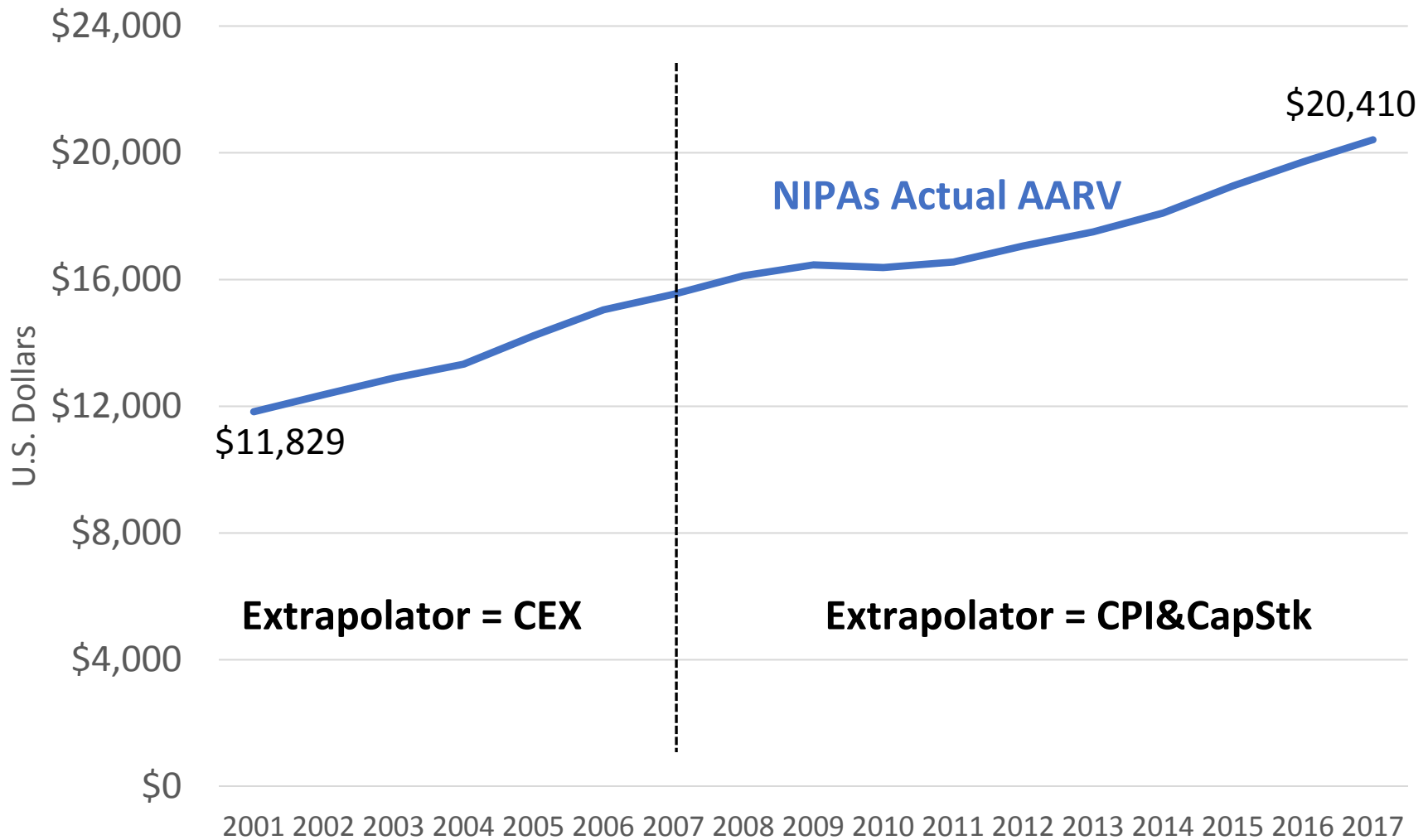
- AARV: 2002-present
 - 2002-2007 extrapolator: CEX
 - 2008-present extrapolator: CPI&CapStk
- Number of units: HVS

State Level Allocations

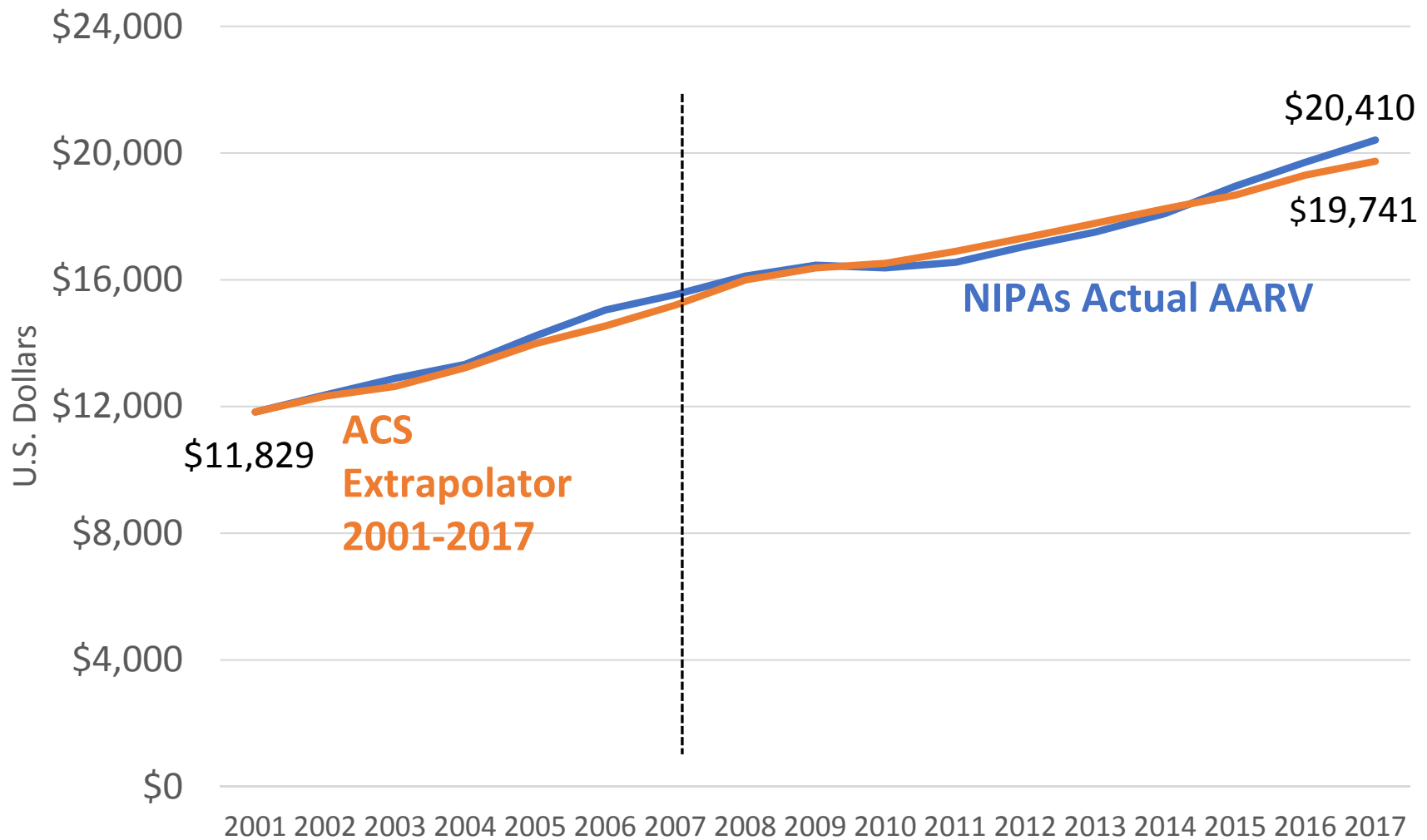


- Personal consumption expenditures
 - Allocation factor: ratio of owner-occupied to tenant-occupied expenditures from Regional Price Parities times tenant-occupied expenditures from ACS
- Rental income of persons
 - Allocation factor: data on housing values from ACS
- Gross domestic product
 - Allocation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

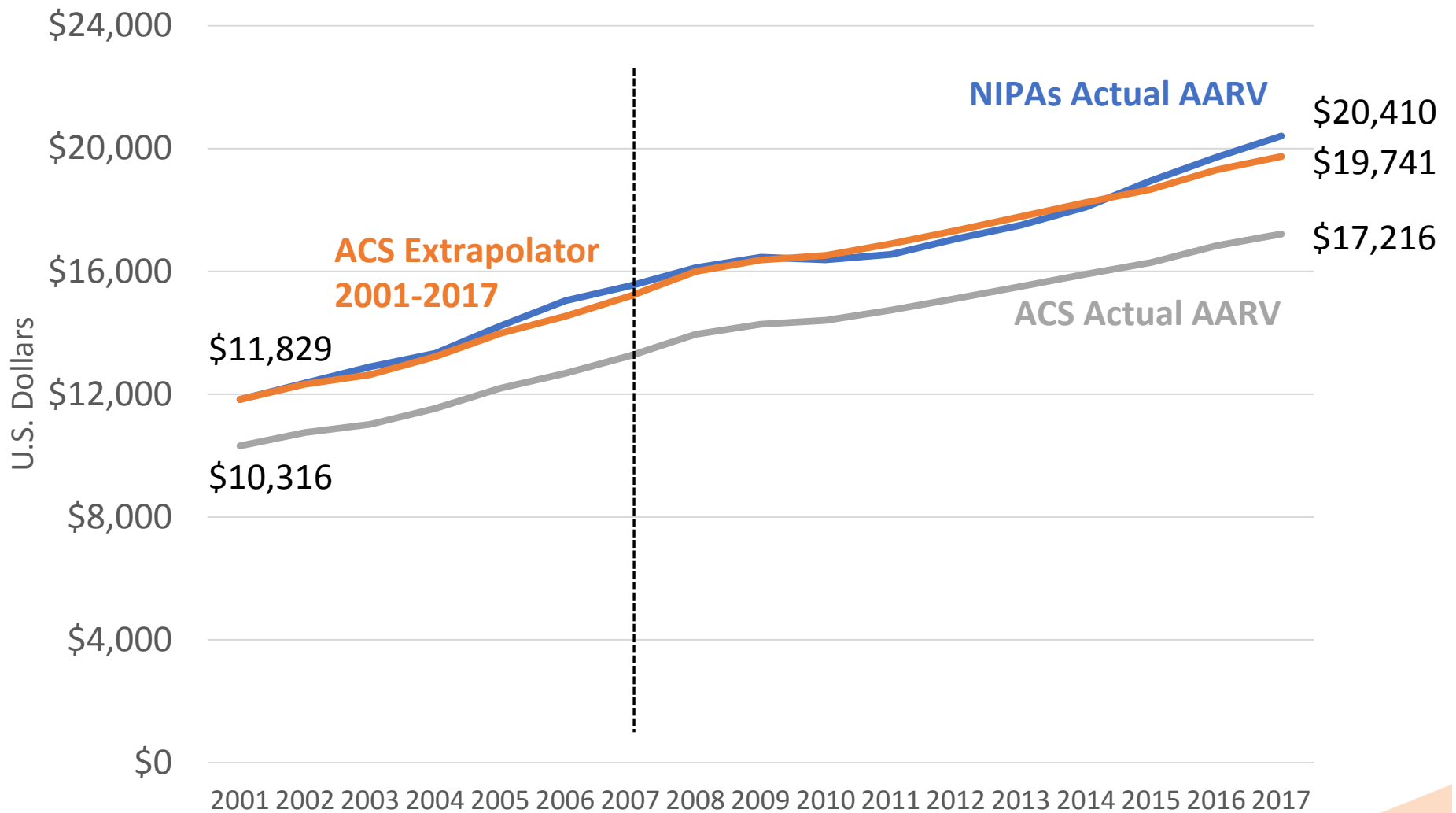
AARV: NIPAs Actual Extrapolation



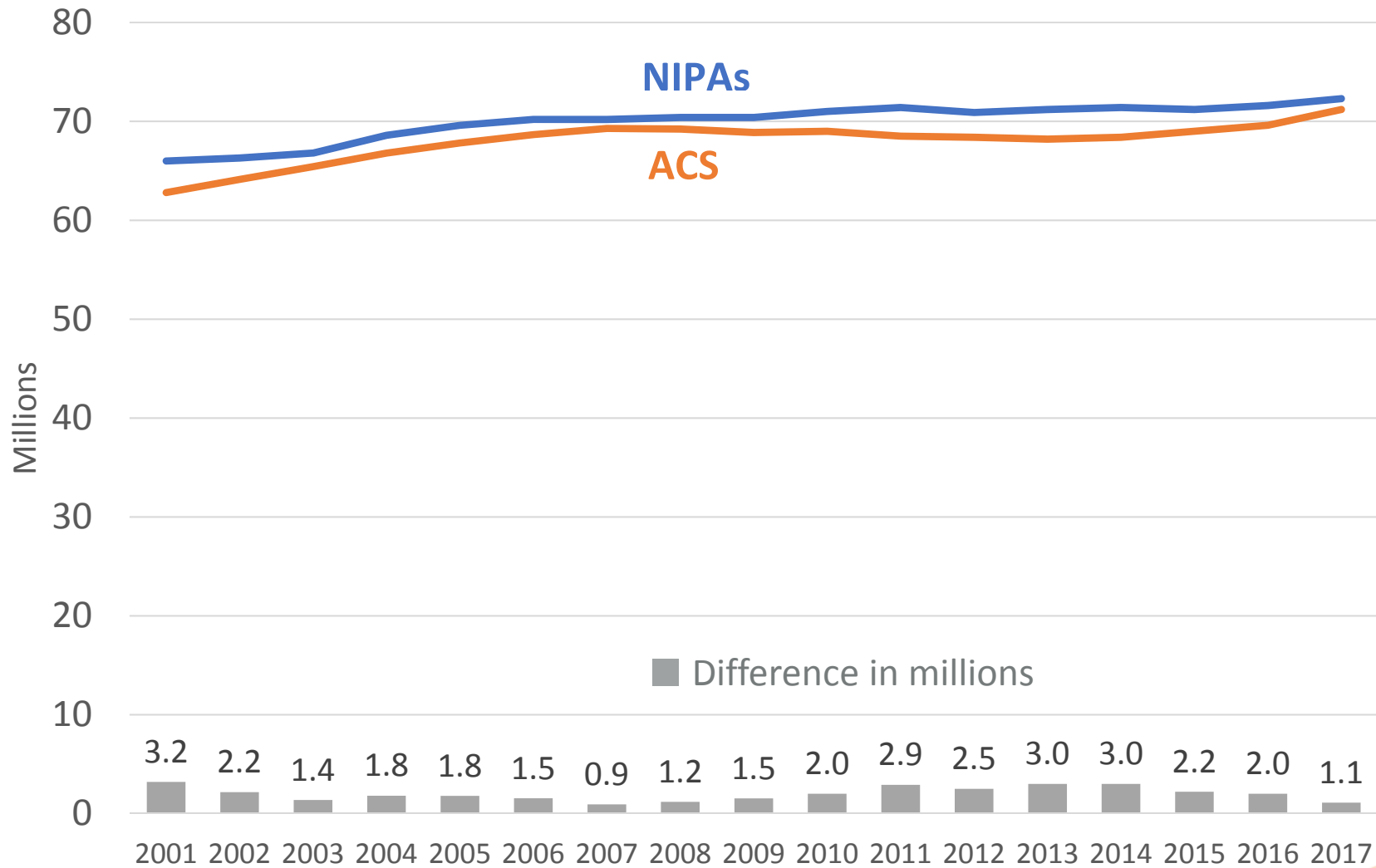
AARV: ACS Extrapolation



AARV: ACS Extrapolation



Number of Units



Part II: Proposed Data Source and Methodology

American Community Survey Public Use Microdata



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



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



- 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



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?



- 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 (β)

Notation:

Beta_i = $P_i / (\text{Median } P_i \text{ by state, type of structure, \# bedrooms})$

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

RE = stratified monthly rent (\$)

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



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

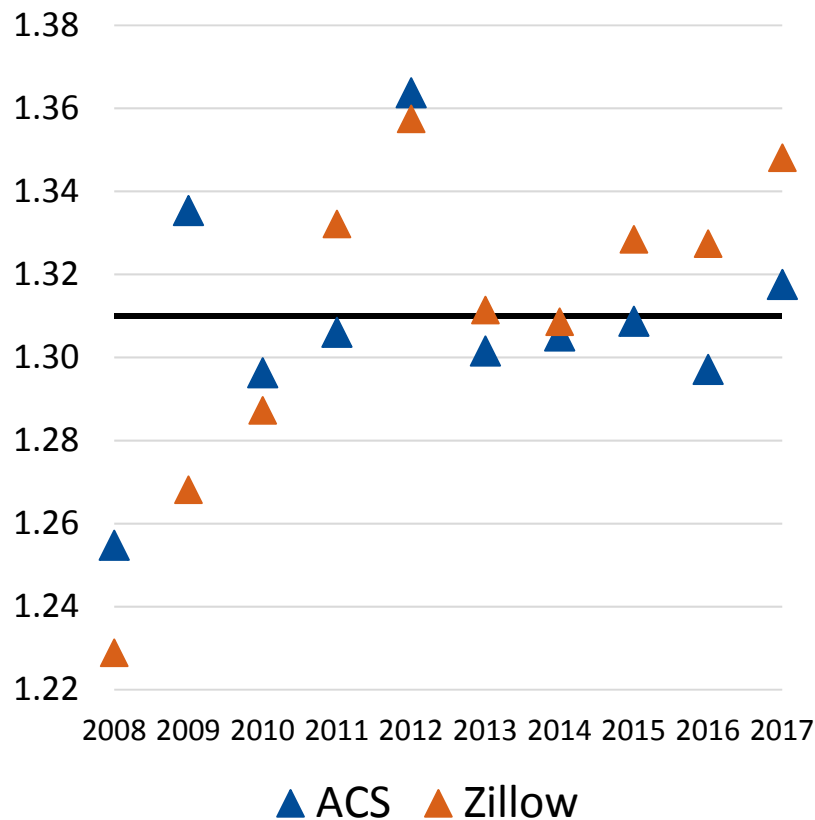


California	Beta		Owner Premium f(Beta)	
	ACS	Zillow	ACS	Zillow
2008-2017	ACS	Zillow	ACS	Zillow
APT 1	1.31	1.27	1.27	1.26
APT 2+	1.33	1.22	1.27	1.24
SF 2	1.26	1.37	1.26	1.29
SF 3+	1.34	1.39	1.28	1.29
Geomean	1.31	1.31	1.27	1.27

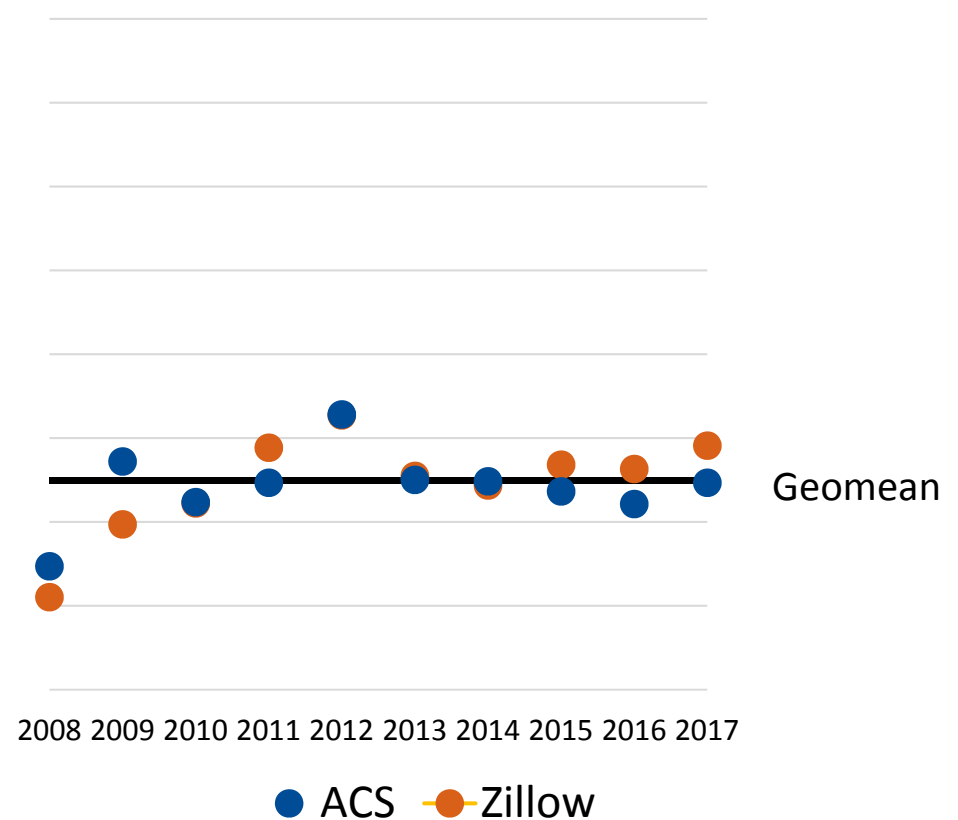
ACS-Zillow Comparison 2008-2017 CA



Beta



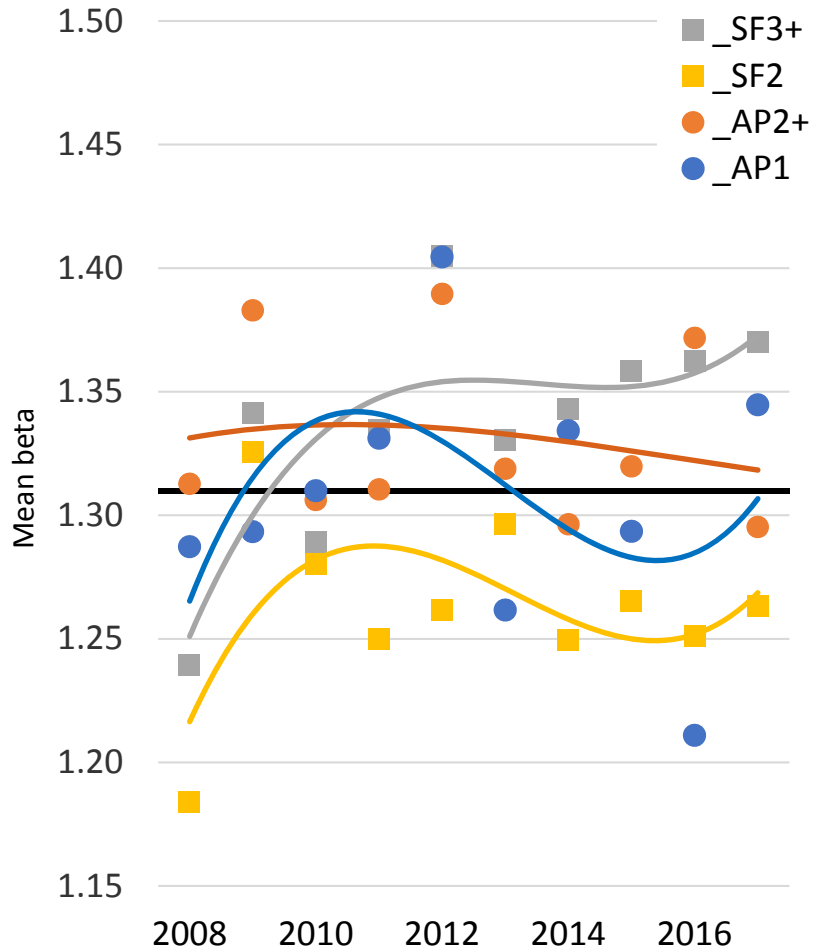
f(Beta)



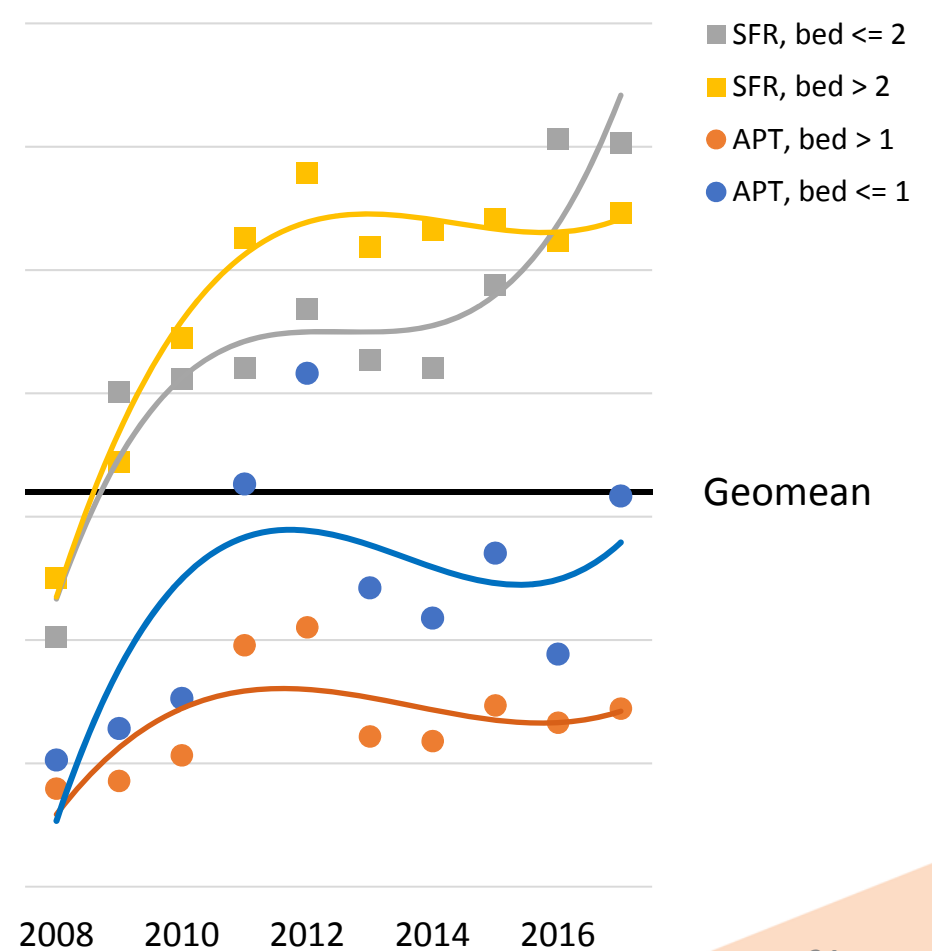
Beta Comparison for CA



ACS Betas



Zillow Betas

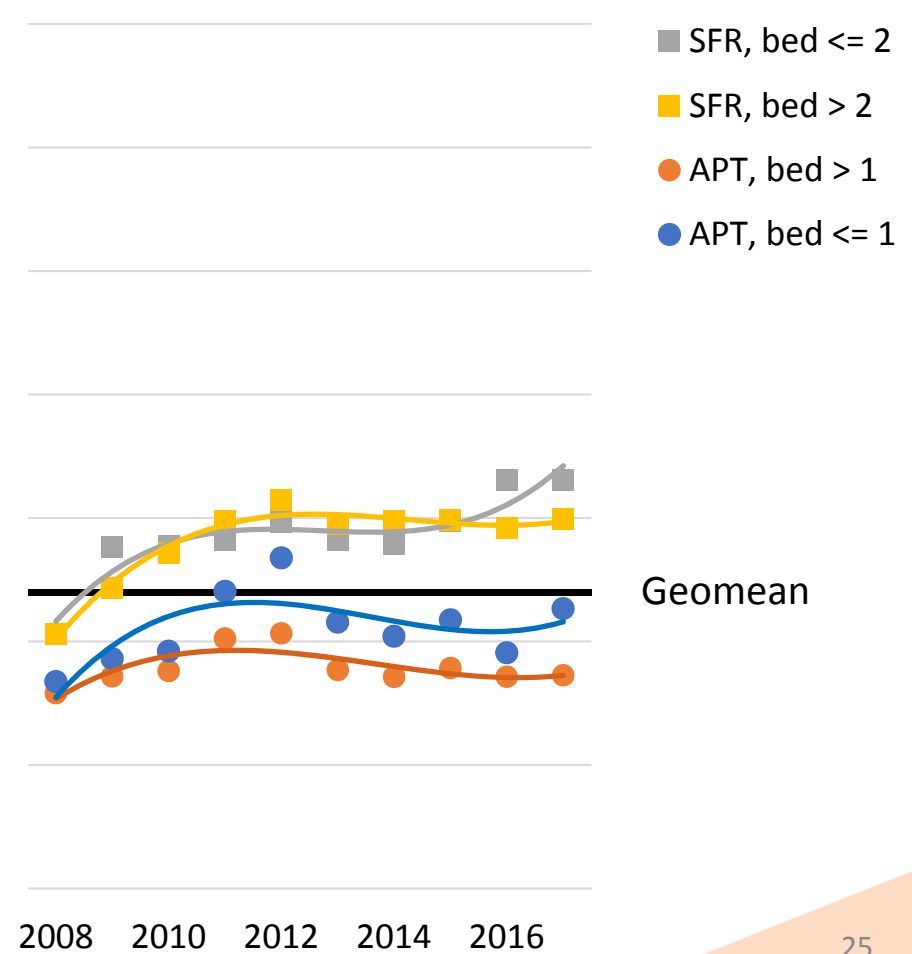
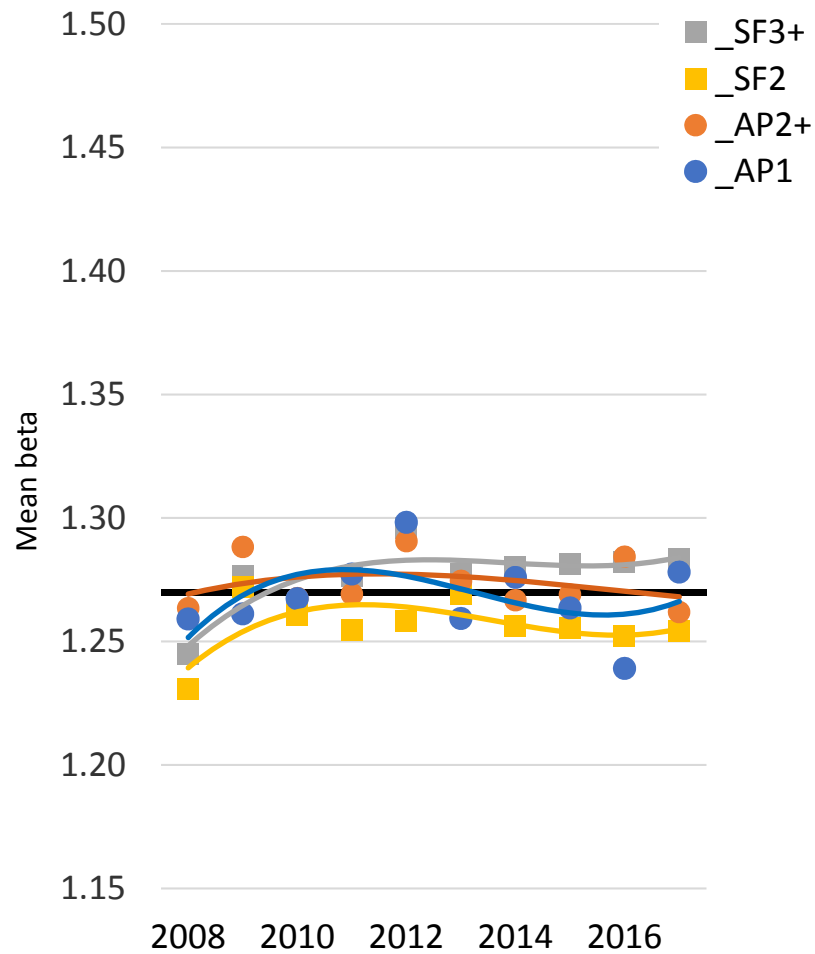


Formulaic Beta Comparison for CA



ACS f(Beta)

Zillow f(Beta)



Geomean

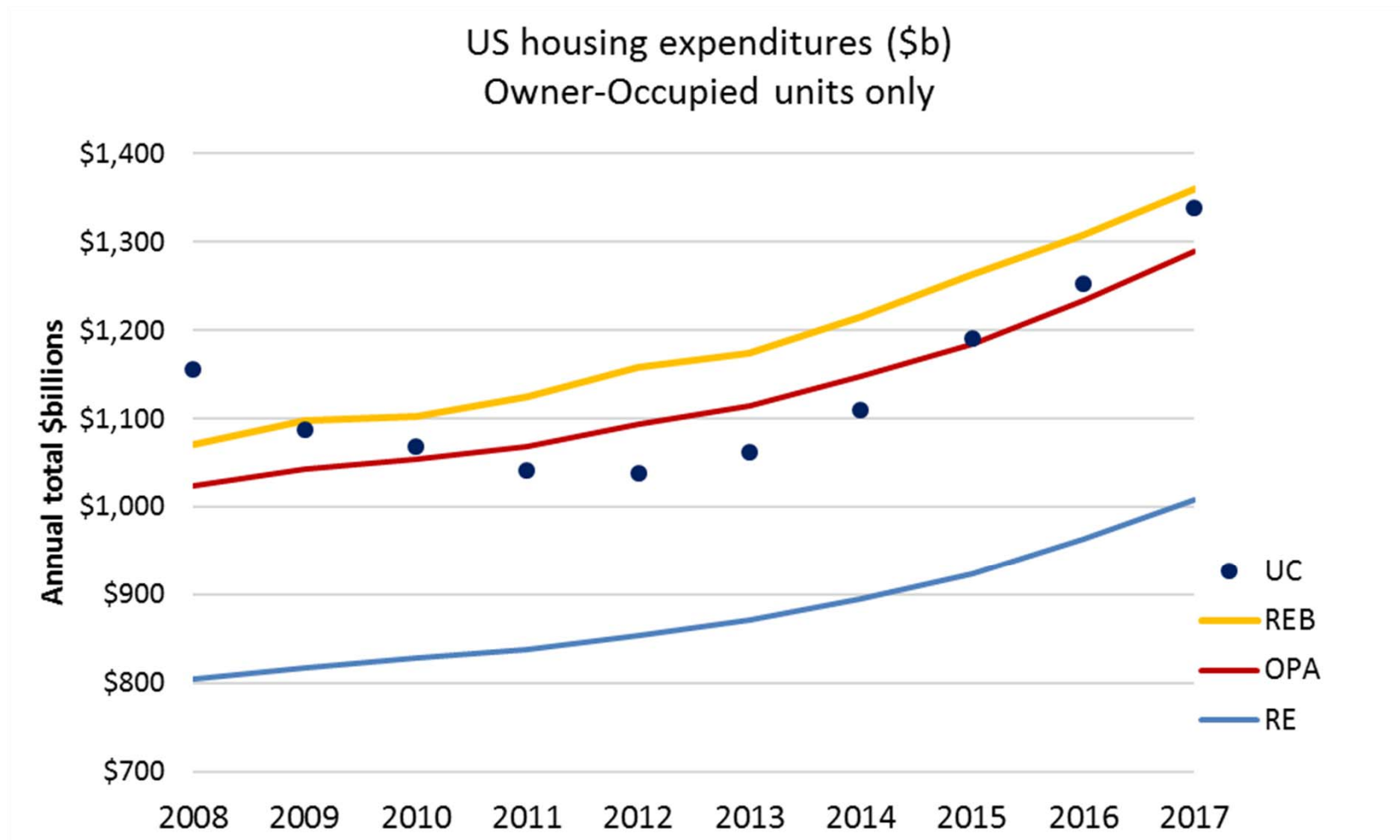
Results: OOH Expenditures United States



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

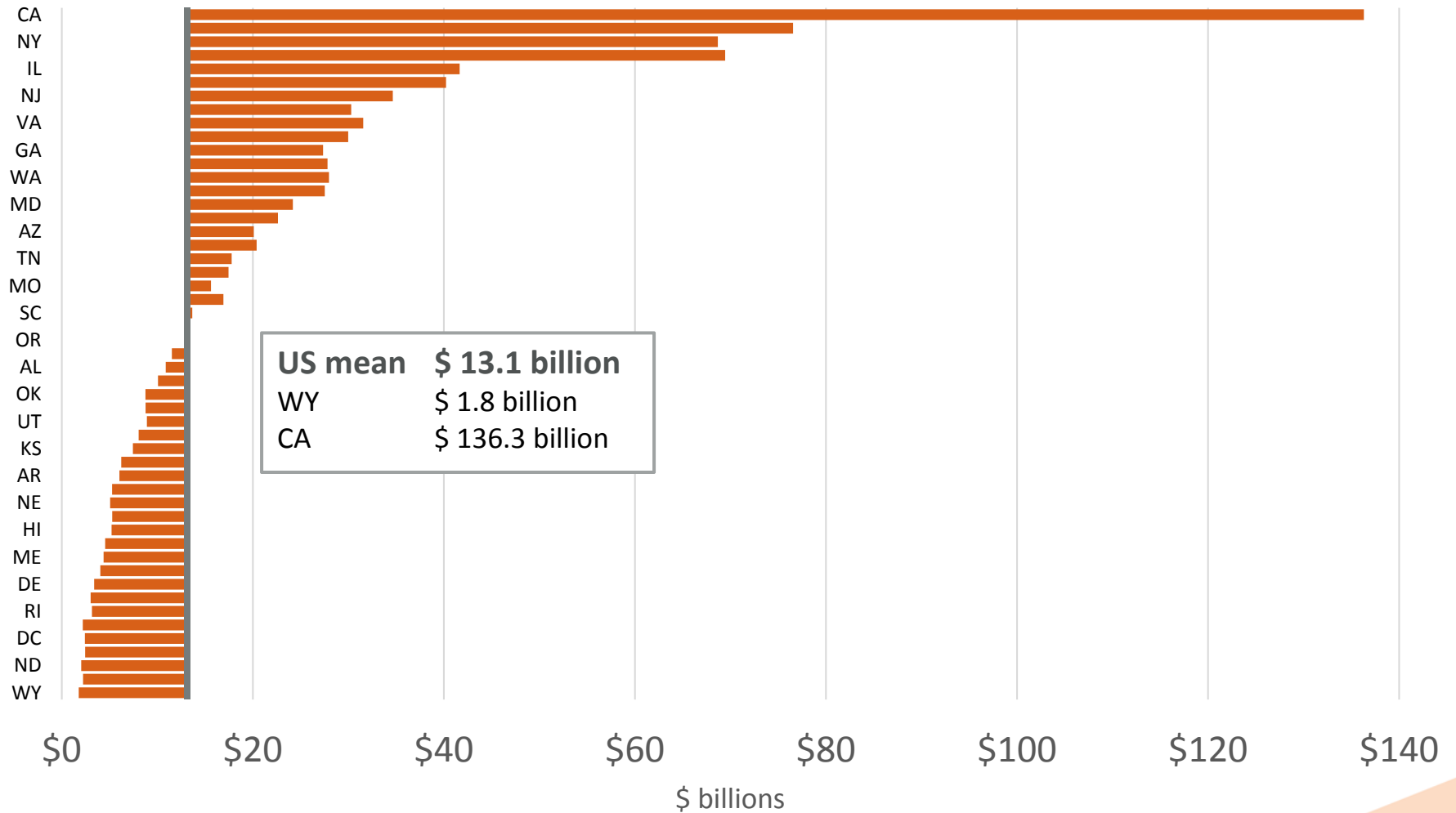


	RE	REB	OPA	UC				
Units	Rental Equivalence	RE x Beta	Owner Premium Adjustment	User Cost at 2.5% interest rate	Beta	f(Beta)	UC/RE	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
\$ Millions	\$ Billions							
DC	0.1	2.4	2.9	3.0	4.5	1.17	1.22	1.87
WY	0.2	1.8	2.6	2.3	2.1	1.50	1.32	1.21
IA	0.9	8.8	11.8	11.2	10.0	1.30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

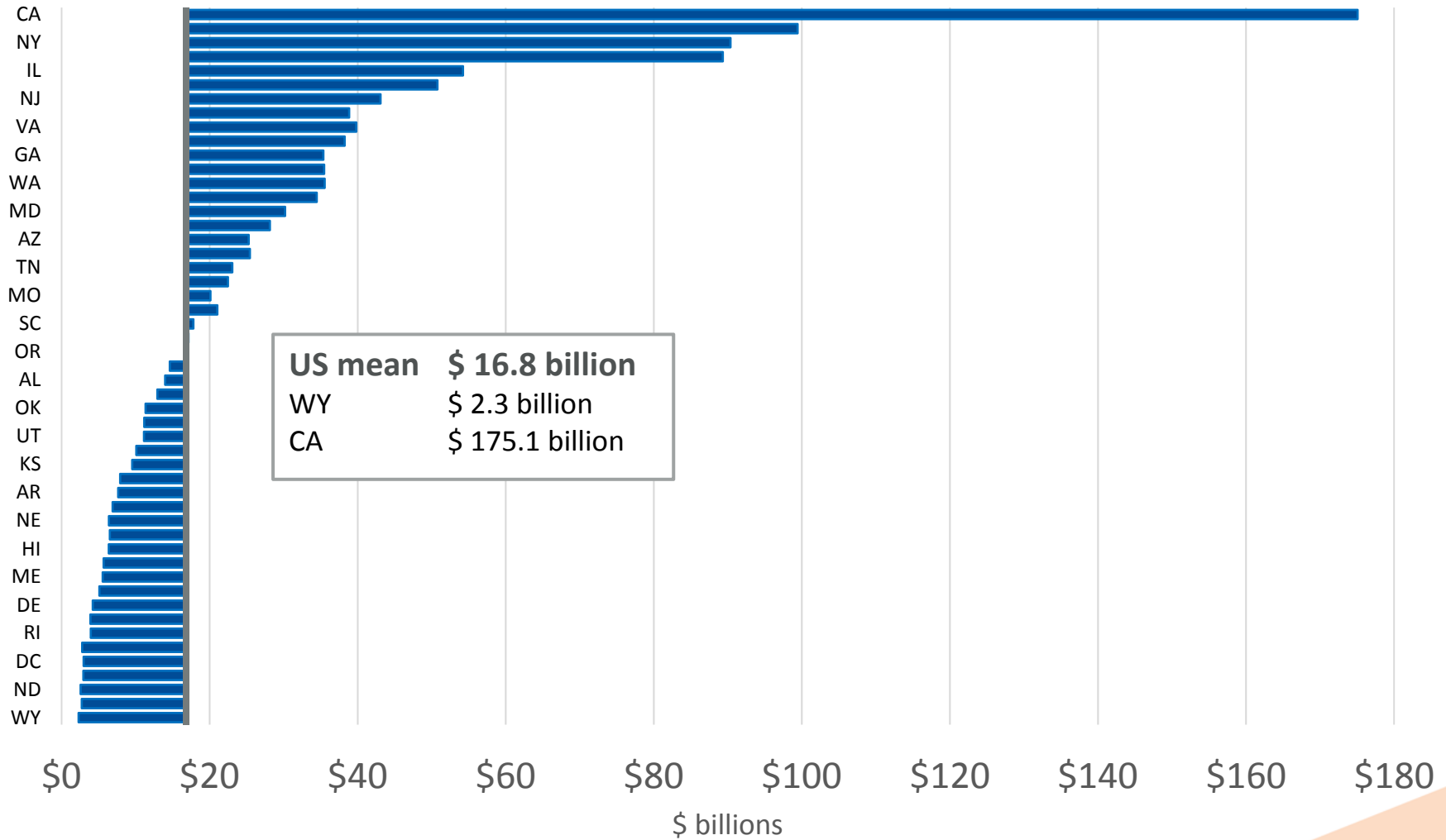
ACS Without Premium

OOH expenditures 2017 (RE)

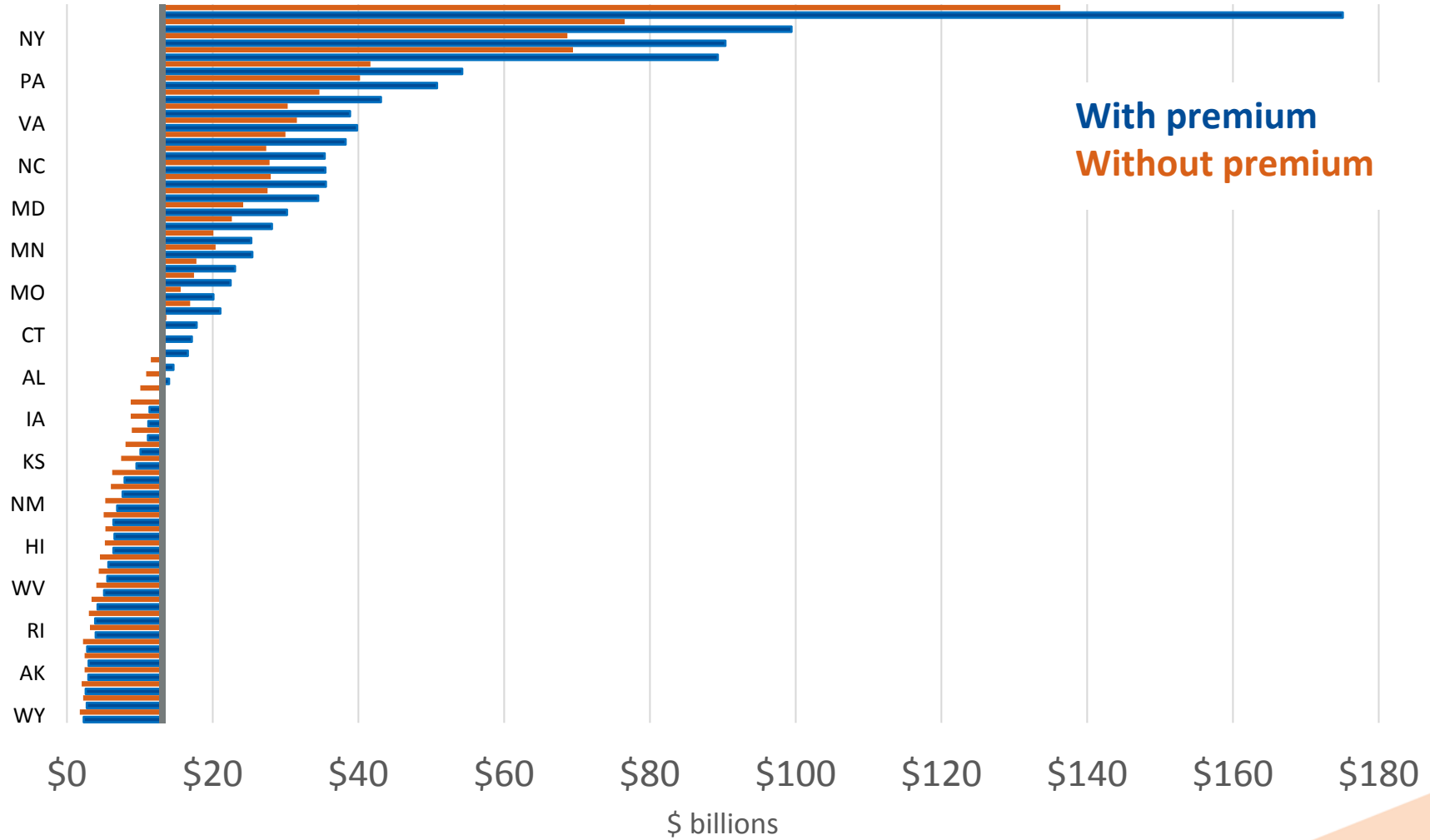


ACS With Premium

OOH expenditures 2017 f(Beta)



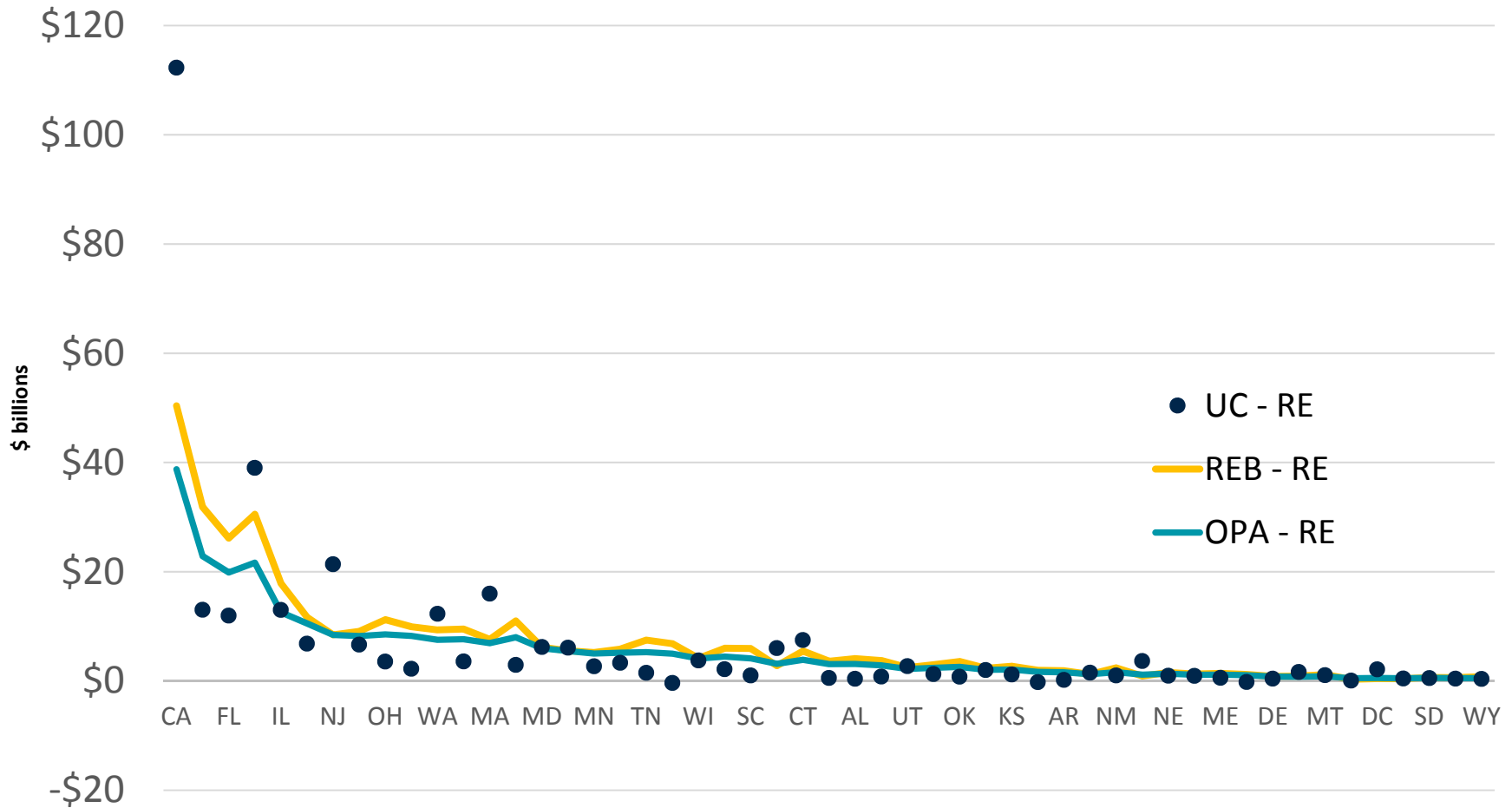
OOH expenditures 2017 RE and OPA f(Beta)



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%
Total		100%

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
Total		100%					



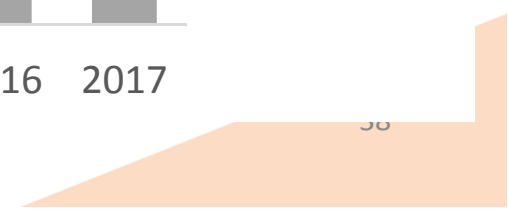
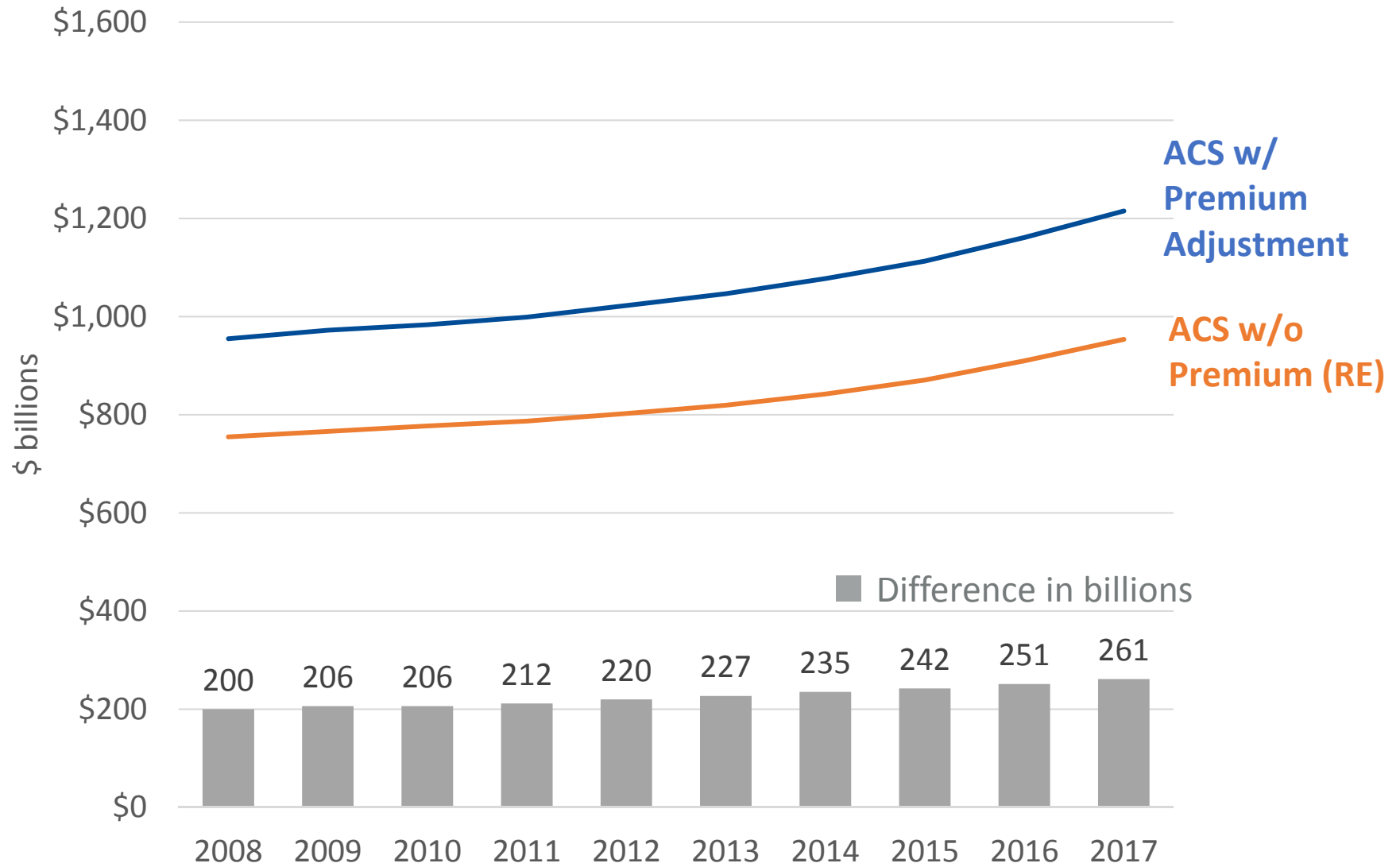
Treatment of Vacant Units



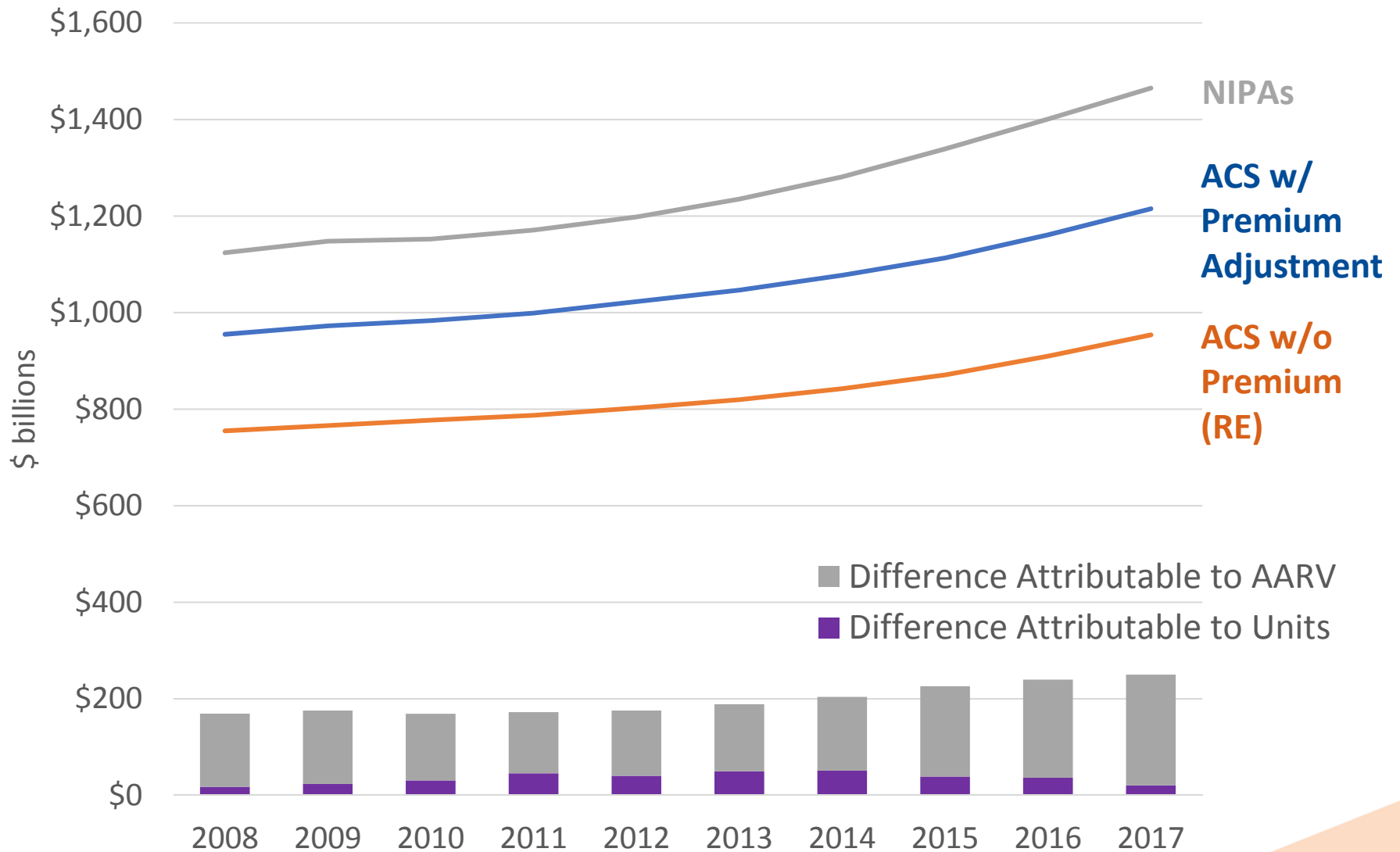
ACS	ACS code	%	1	2	P	NIPA current	NIPAs
			Upper Bound	Middle Ground	EU practical		
For rent	1	16%	100%	-	-	-	N/A
For sale only	3	7%	100%	-	-	-	N/A
Rented, not occupied	2	4%	100%	100%	100%	50%	Rented or sold, not occupied
Sold, not occupied	4	4%	100%	100%	100%	100%	
Seasonal/ recreational/ occasional	5	32%	100%	100%	50%	100%	Occasional
					50%		
Migrant workers	6	2%	100%	100%	50%		Seasonal vacant (includes migrant workers)
						100%	Usual residence elsewhere
Other	7	35%	100%	-	-	-	N/A
2017 Total (billions)			\$196	\$80		\$50	

Part III: Results (2008-2017)

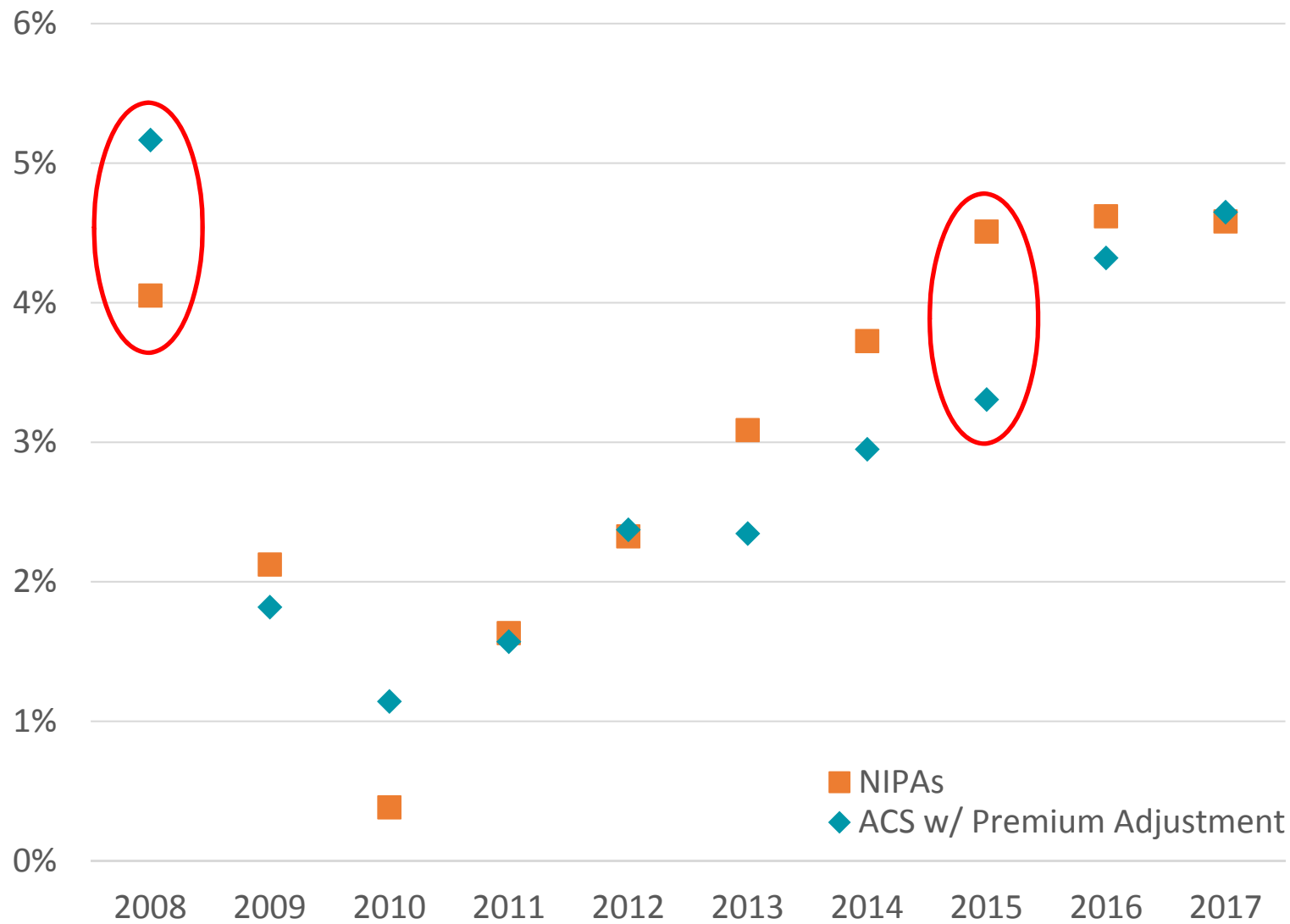
Aggregate Current-Dollar Values



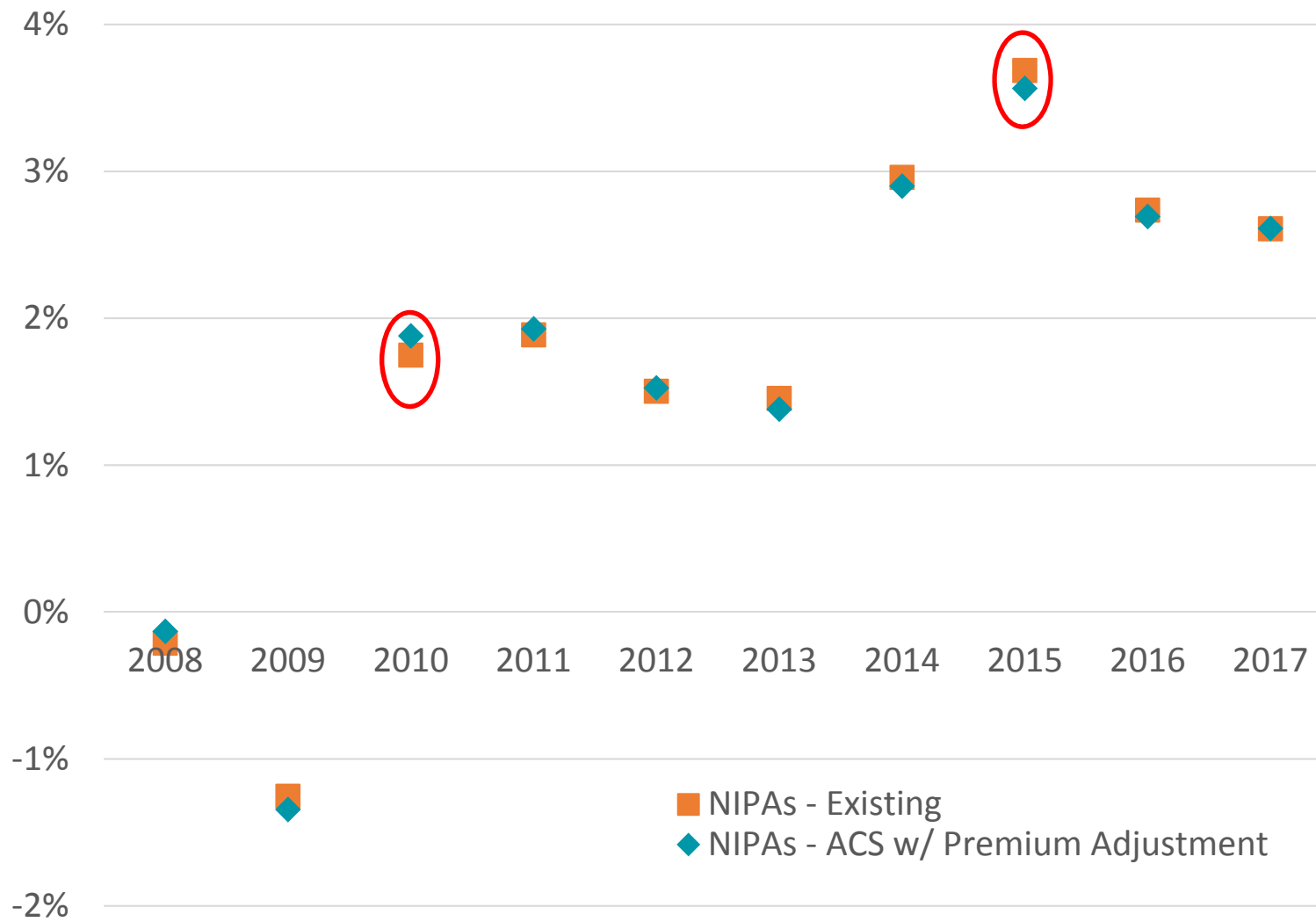
Aggregate Current-Dollar Values



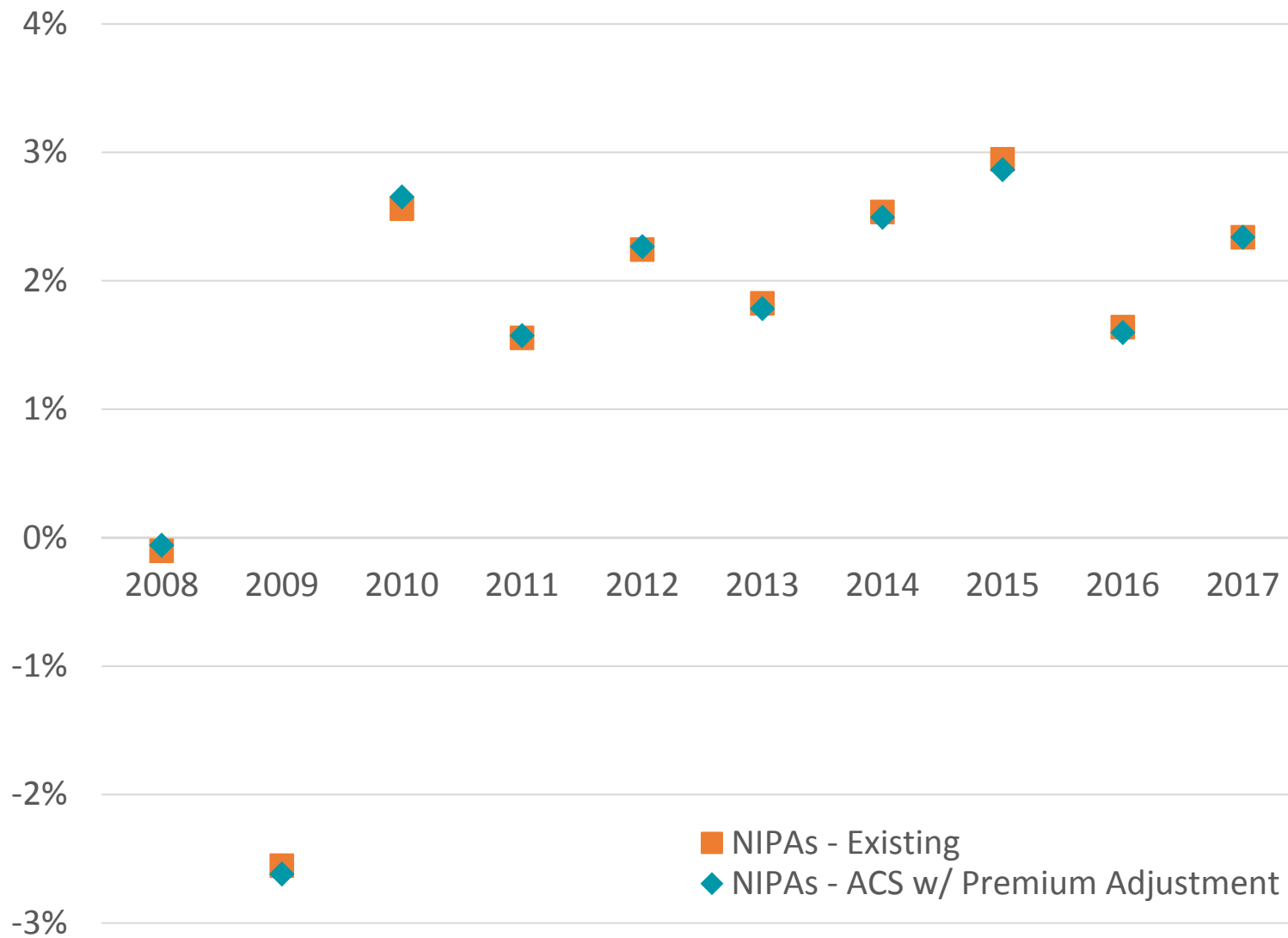
Y-Y Percent Changes: OONFP



Y-Y Percent Changes: Real PCE



Y-Y Percent Changes: Real GDP



Y-Y Percent Changes: Personal Income



Conclusions and Questions

- 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?