Housing Underproduction in the US:

Economic, Fiscal and Environmental Impacts of Enabling Transit-Oriented Smart Growth to Address America's Housing Affordability Challenge

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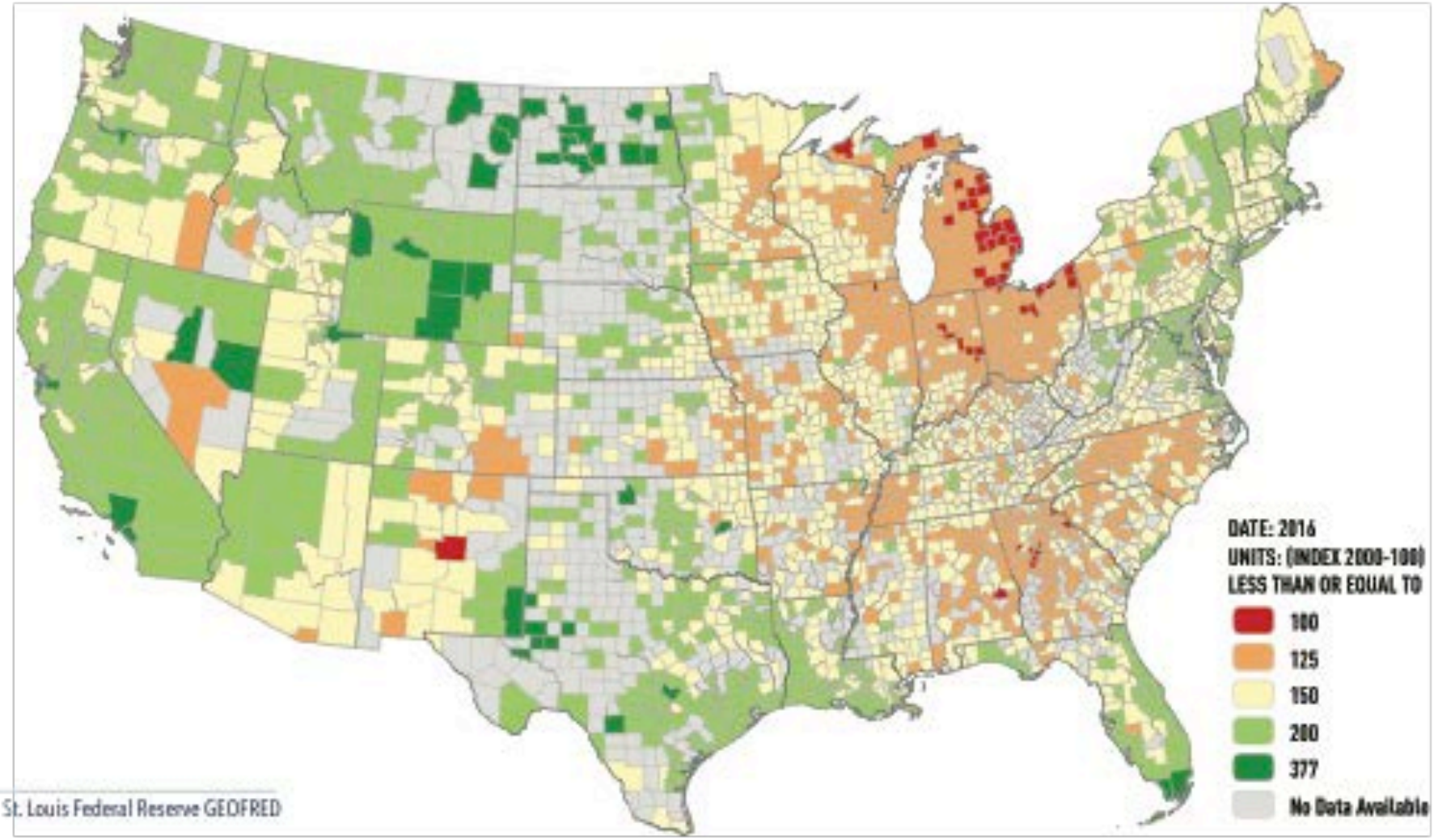
Purpose of Study

- Examine the impact of supply constraints on housing production

- Model economic and fiscal impacts supported through additional housing production nationally

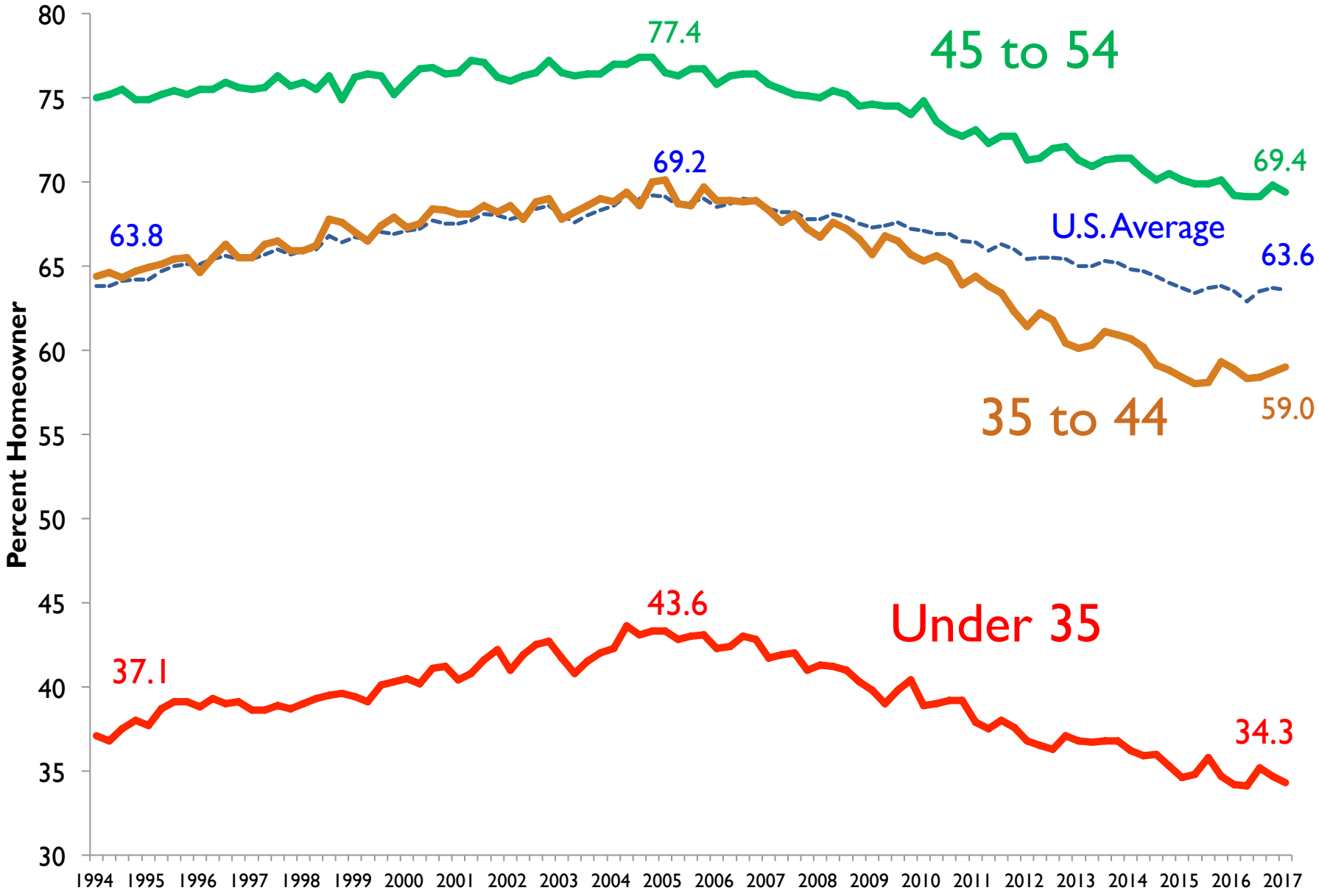
Housing Prices more than doubled in some areas since 2000

HOME PRICE APPRECIATION 2000-2016



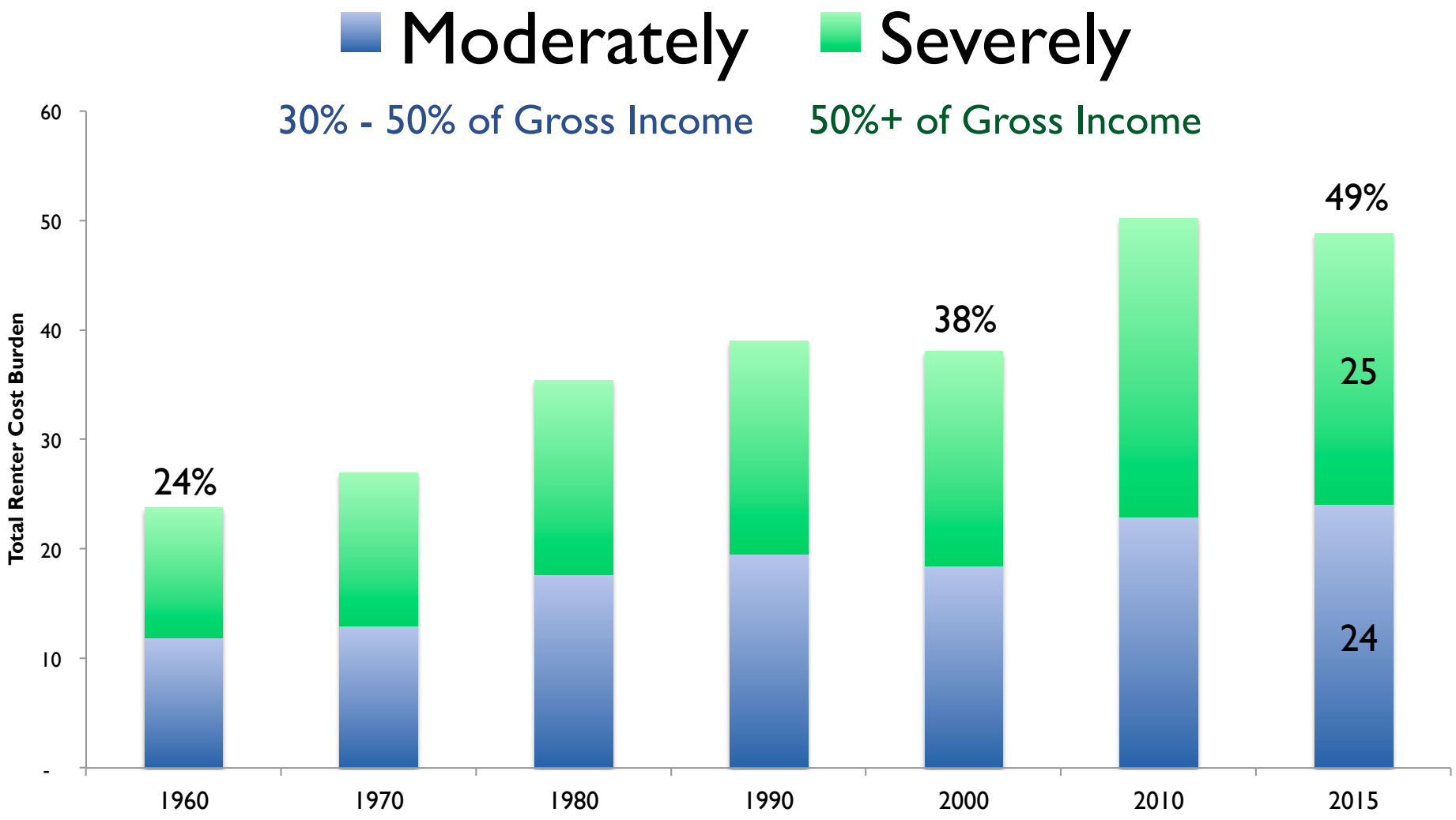
Source: St. Louis Federal Reserve GEOFRED

Homeownership decreasing for all ages



Source: U.S. Census Bureau

U.S. renter cost burden increasing



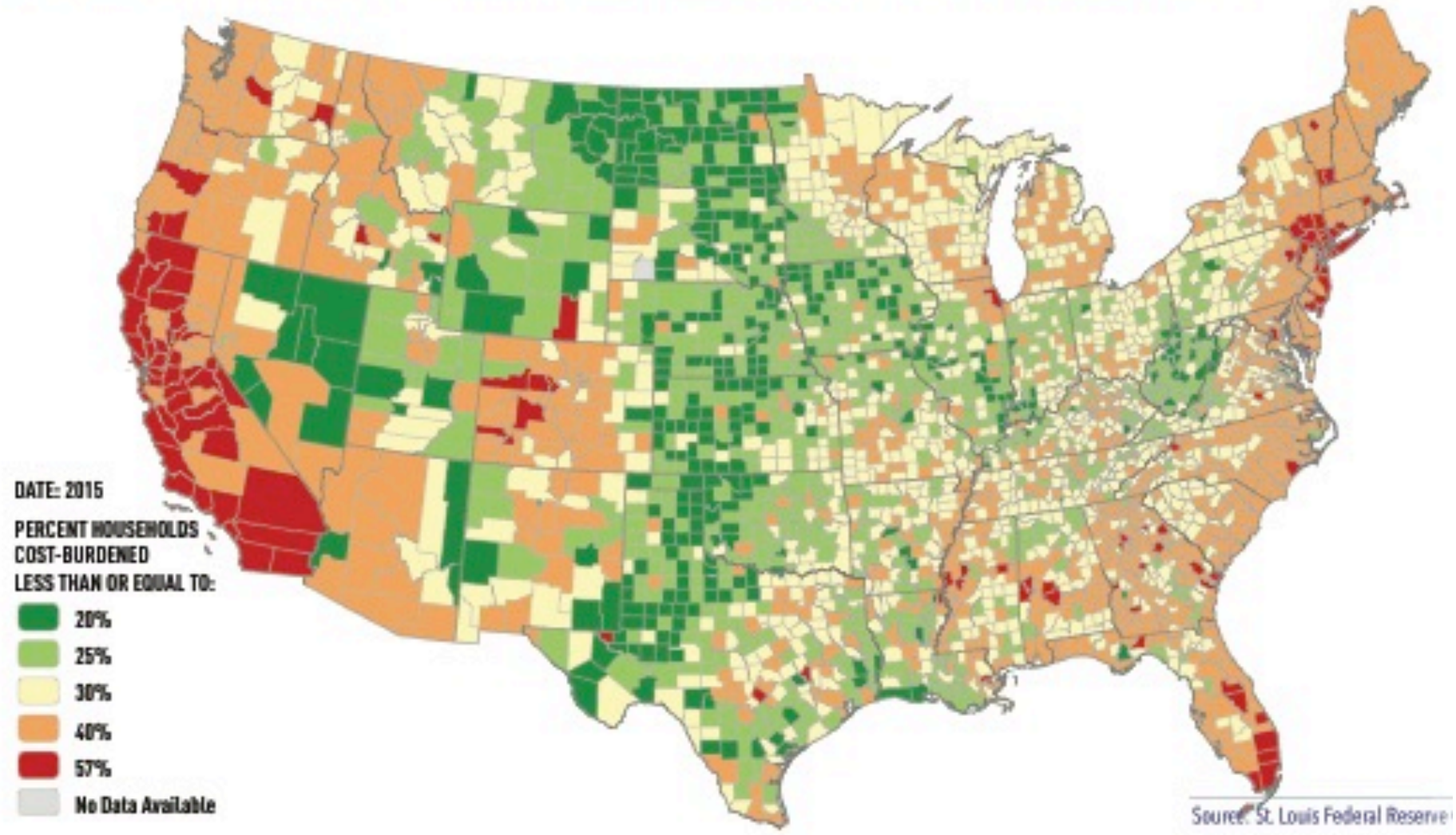
25% of renters nationally spend more than 50% of income on rent

Source: Harvard Joint Center for Housing Studies

Percent of Households that are Cost Burdened

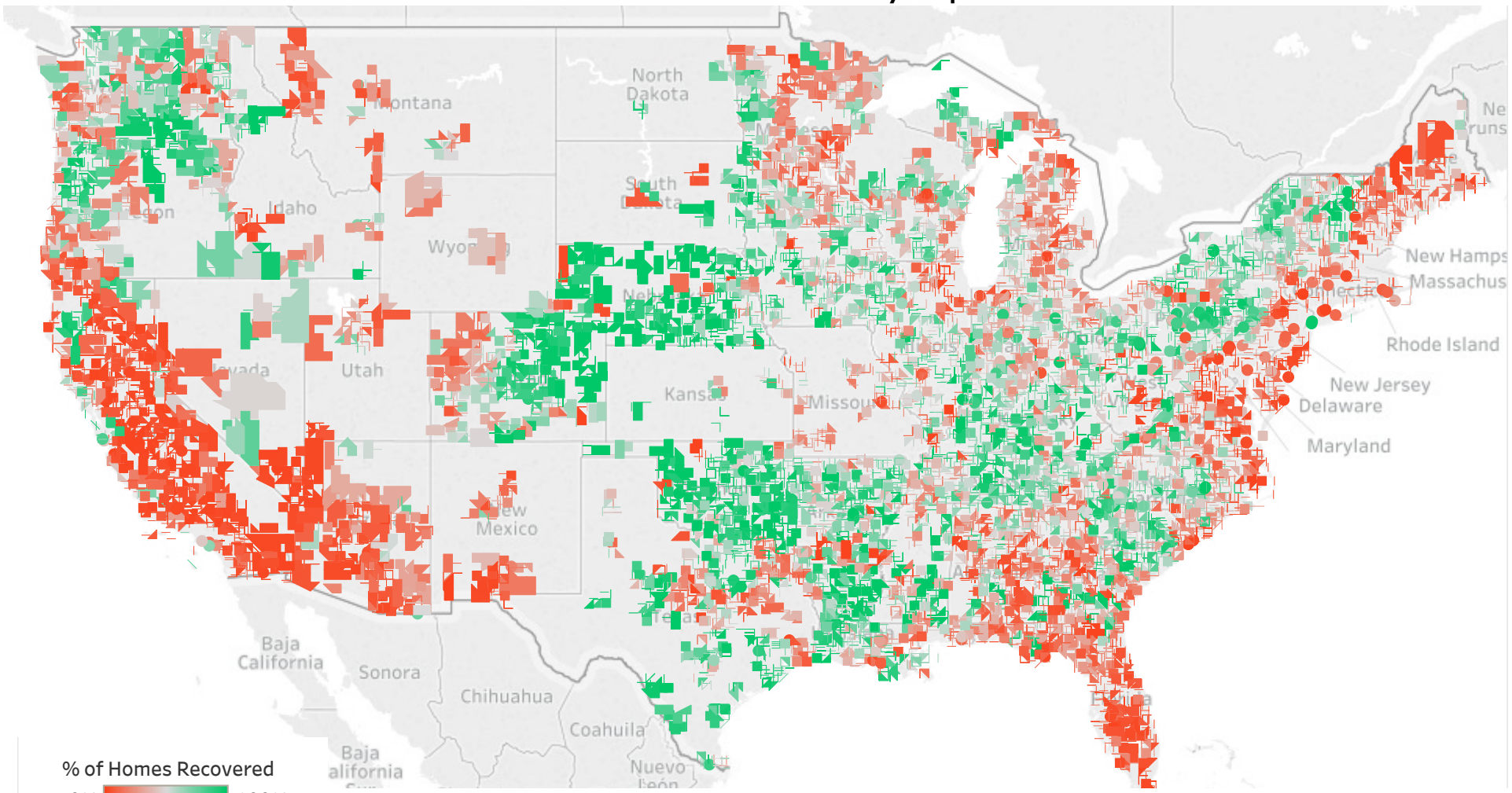
All Households (Owner + Renter) in 2015

Cost Burdened = Spending 30%+ of Gross Income on Housing

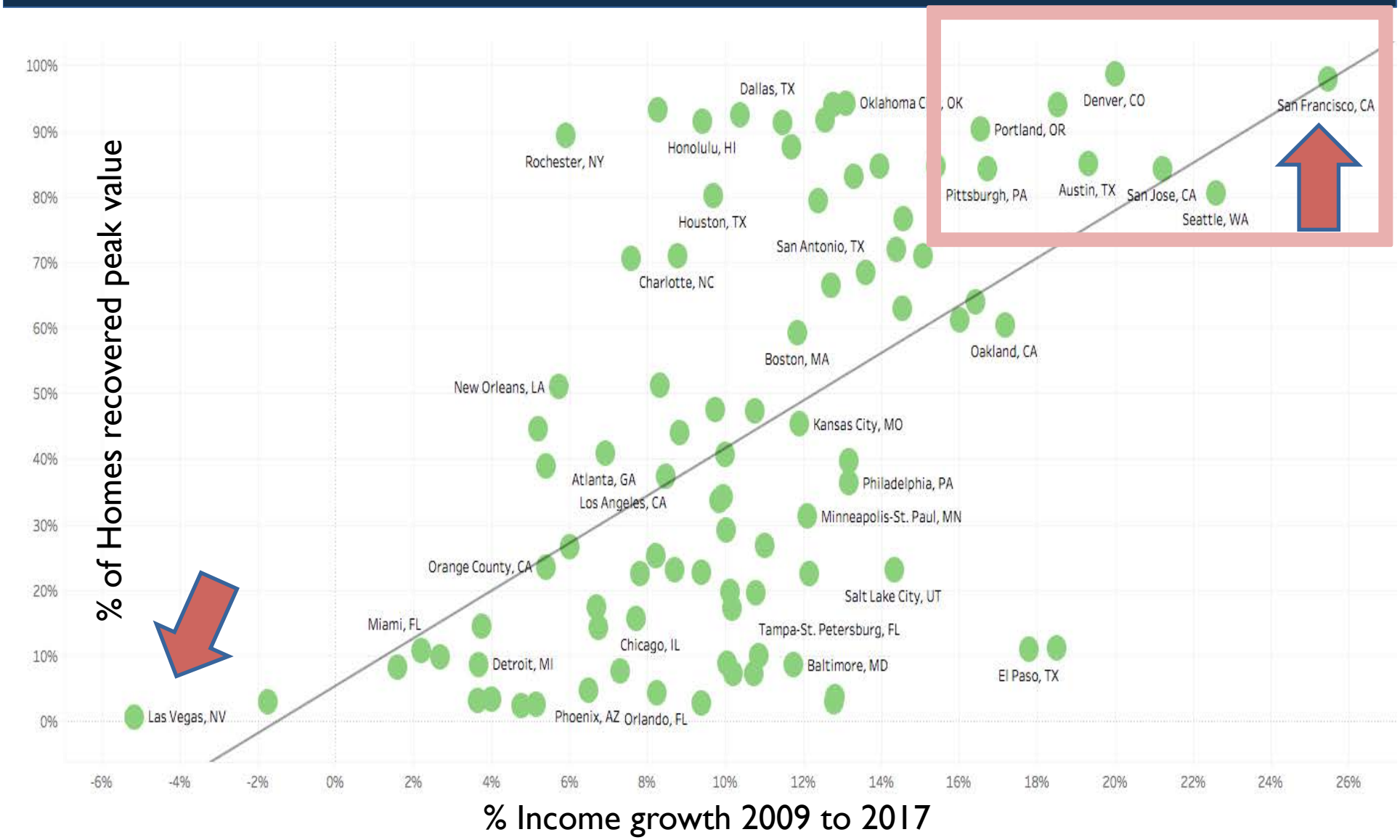


Individual Home Prices have not Recovered from 2007 Peak

% of Homes Recovered to Pre-Recession Peak Value, by Zip Code

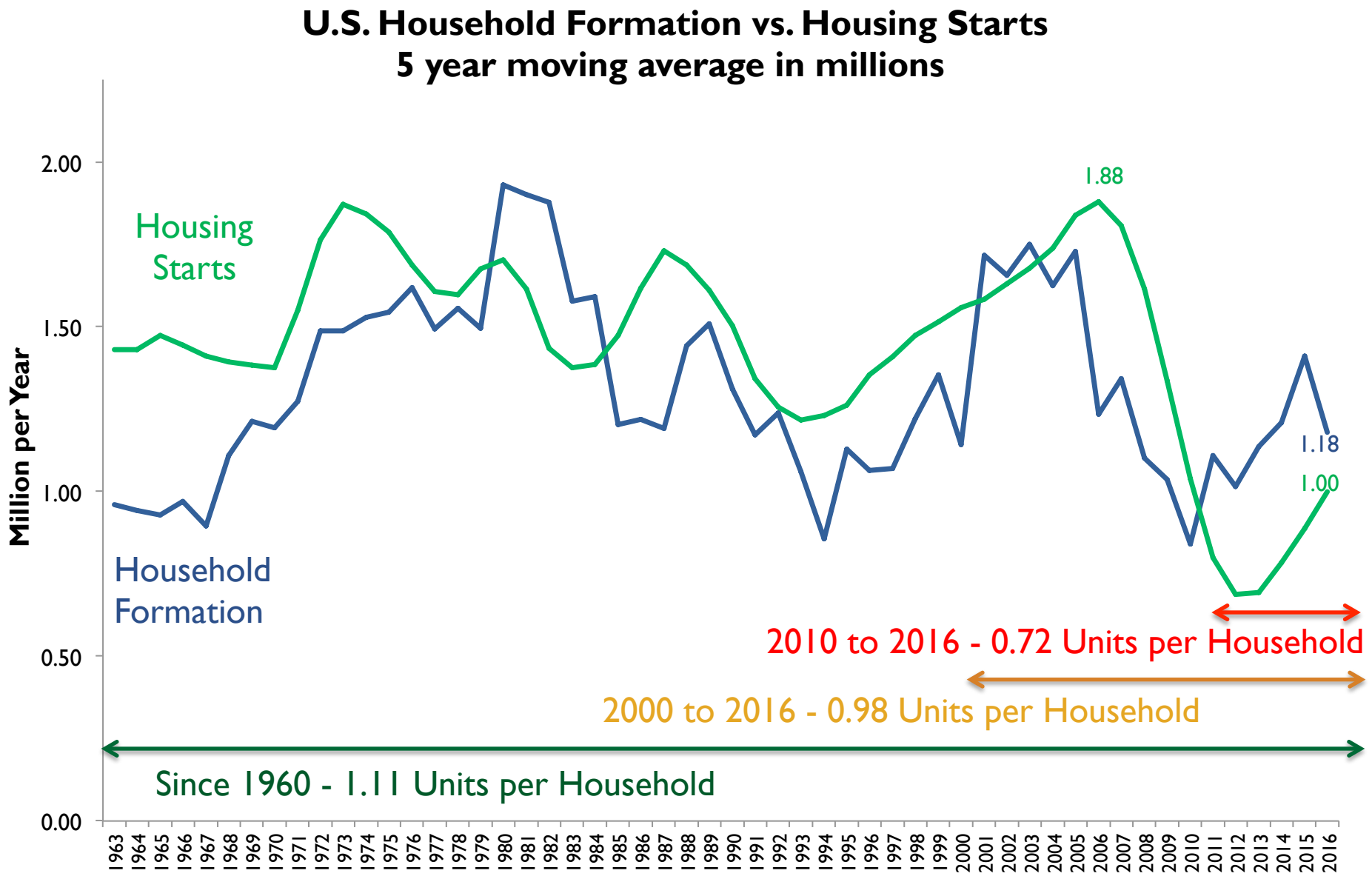


of Homes Recovered Peak Value vs. Income Growth



Source: Trulia

Housing starts haven't kept pace with household formation



Source: U.S. Census Bureau

Research Estimating Impacts of Housing Underproduction

"Our GDP growth has been diminished by increased constraints to housing supply in high productivity cities like New York, Seattle, Portland, San Francisco, San Jose and most of Southern California. Lowering regulatory constraints in these cities to the level of the median city would expand their workforce and increase U.S. GDP by 9.5 percent (or just under $2 trillion)."

— *Chang-Tai Hsieh and Enrico Moretti,*

"Why Do Cities Matter? Local Growth and Aggregate Growth" (2015)

Study Methodology

Contributes to existing literature through:

1) Econometric model to calculate housing supply elasticity and under-production of units
2) Model how and where to distribute new housing units in different growth scenarios
3) Use REMI to model dynamic economic and fiscal impacts of housing production growth
4) Discuss local and national policies to incentivize additional units of housing production

Process

- Task 1) Quantify underproduction of housing
- Task 2) Model growth scenarios
- Task 3) Quantify economic and fiscal impacts
- Task 4) Discuss national and local policy options

Quantify Underproduction

- Methodology:
  - Econometric model to estimate supply elasticity
  - Calculate baseline through 2000
  - Estimate number of units in 2015 if market were in historic equilibrium
  - Subtract forecast from the actual 2015 stock to determine underproduction of units
- Data Inputs:
  - Housing Price Index
  - Housing Stock
  - Population
  - Employment
  - Income

7.3 million housing units under produced from 2000 to 2015

Price Impacts from Additional Production over 20 years

Price Elasticity of Supply

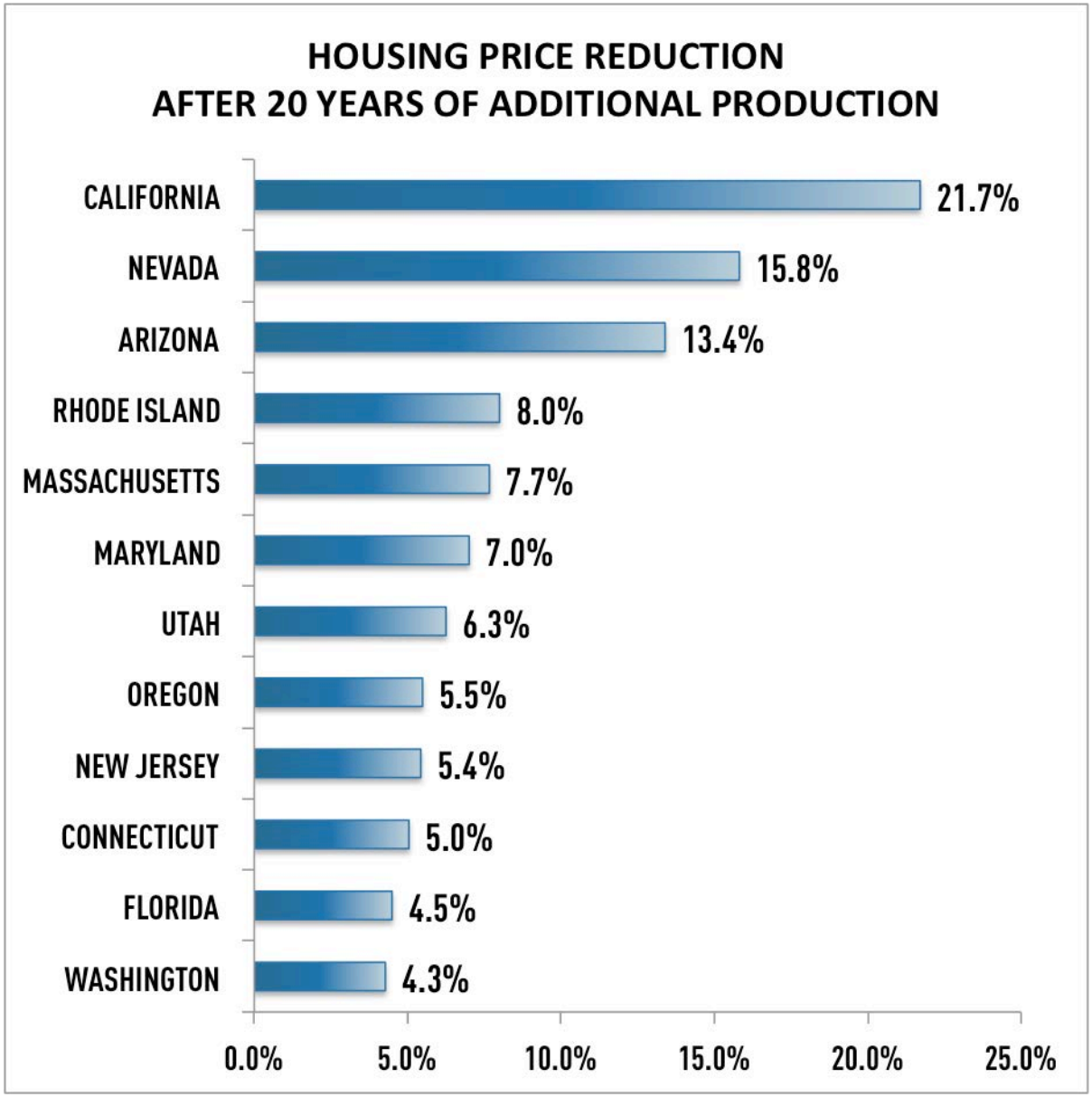
- 0.47

- 0.77

- 0.84

$$= \frac{\text{(\% change in supply)}}{\text{(\% change in price)}}$$

Note: less than one is considered inelastic



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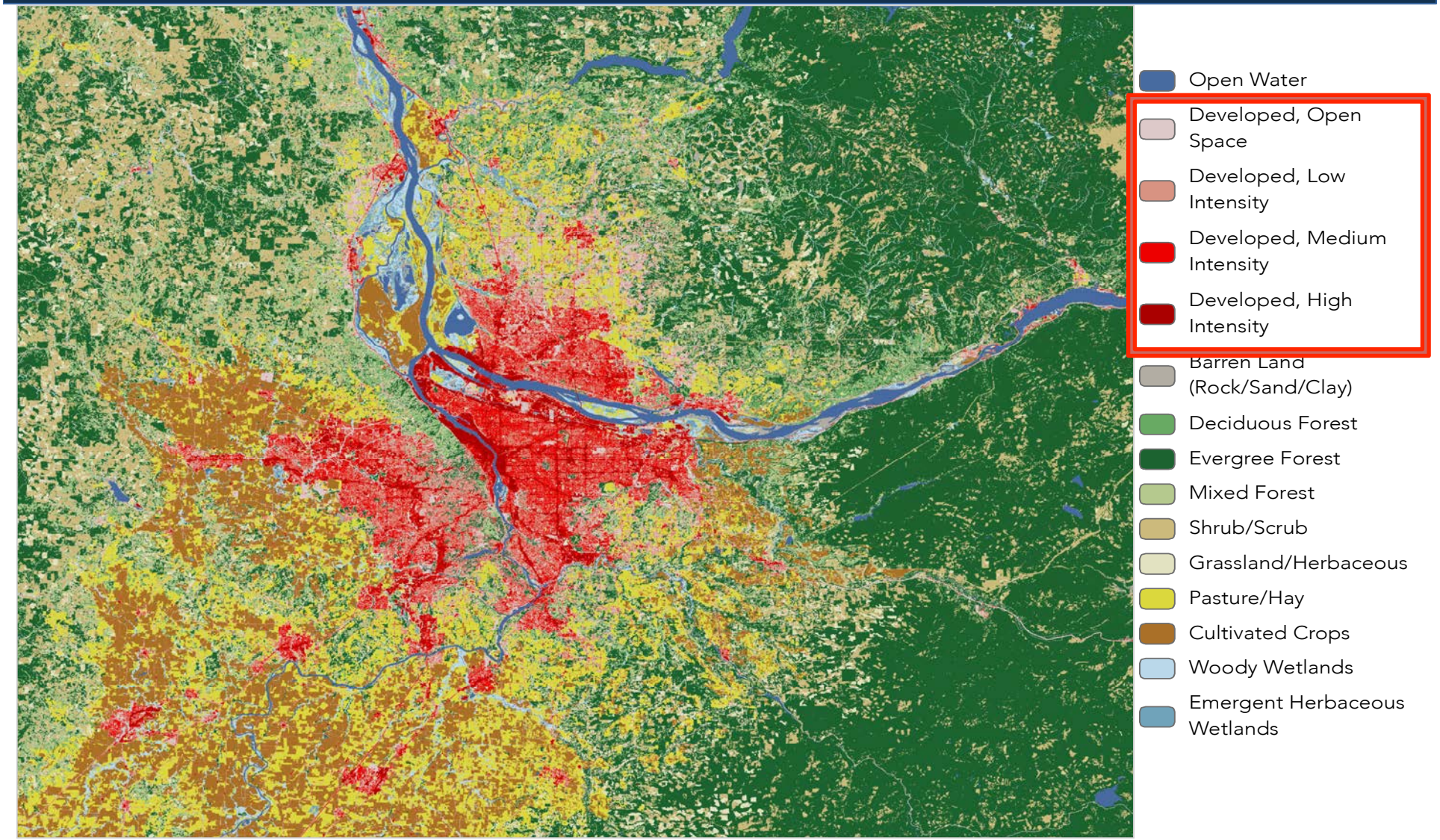
Satellite data used to calculate density--Portland, OR

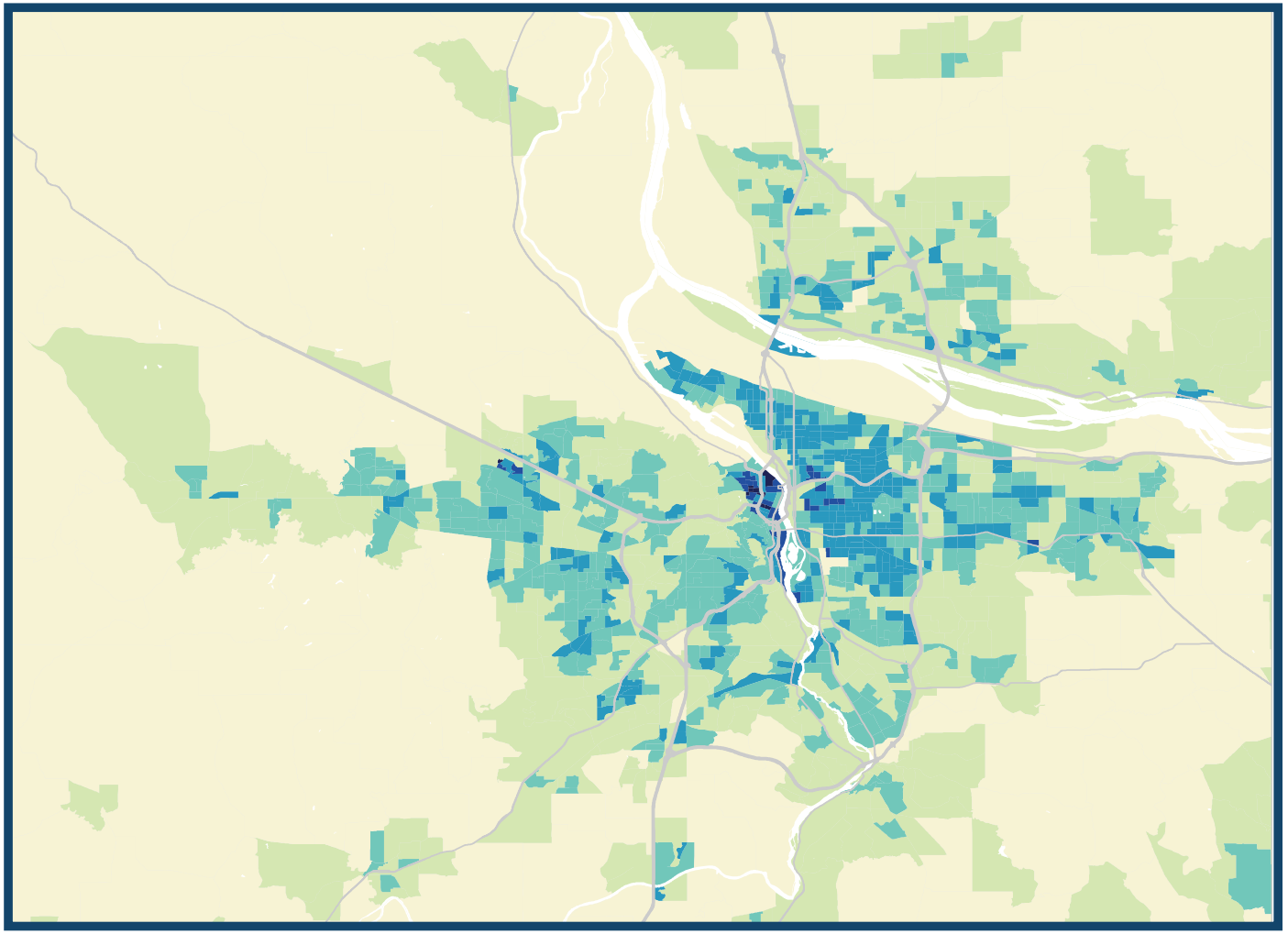


Density calculated based only on developed land categories

Source: NLCD 2011

Units Per Developed Acre – Portland Metro

ADJUSTED HOUSING DENSITY, PORTLAND METRO AREA



ADJUSTED DENSITY:

- Less Than 1
- 1 - 2.9
- 3 - 4.9
- 5 - 12.49
- 12.5 - 29.99
- 30 or More

Source: NLCD 2011, U.S. Census

How and where growth occurs

How = Housing Prototypes

Where = Growth Scenarios

Housing Prototypes

New housing units are distributed as 3 prototypes:

Single Family
5 Units per Acre

Mid-Rise Podium
Up to 5 stories
120 Units per Acre

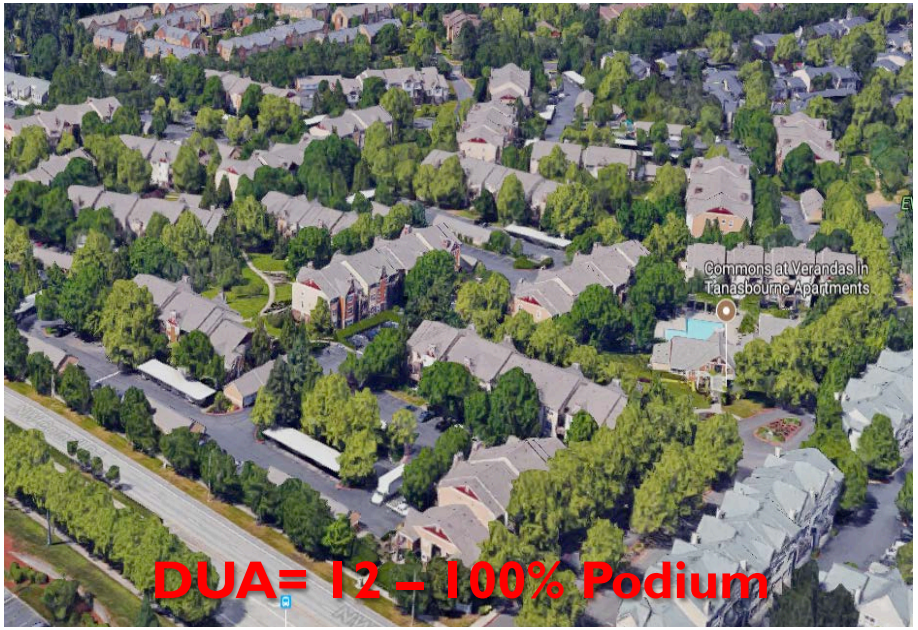
Tower
High Rise 6+ stories
240 Units per Acre

Growth Scenarios: Add Density

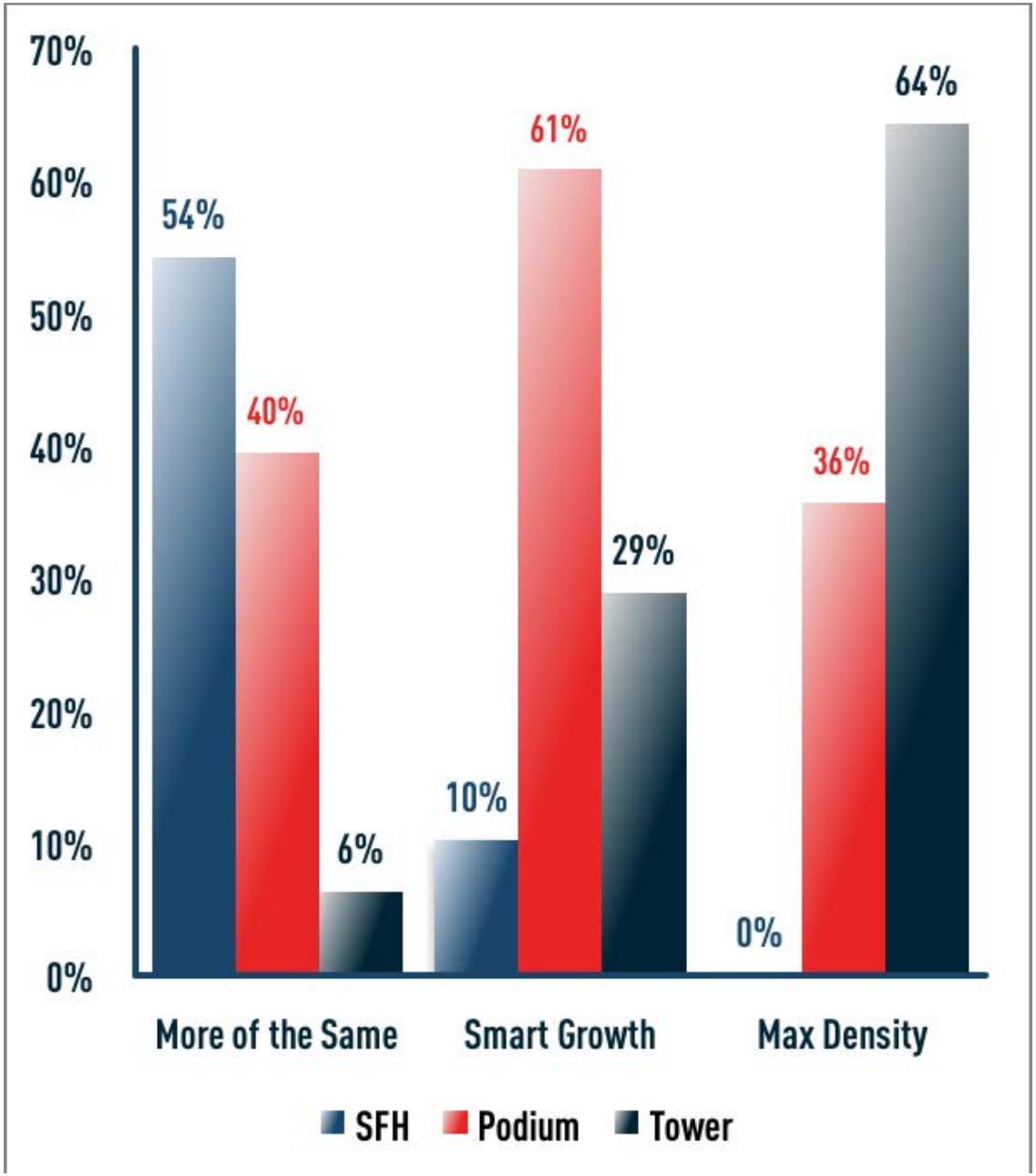
Prototypes are distributed as follows:

Current Density	% Tower	% Podium	% Single Family Homes
30.0+ units per acre	**100% tower**		
12.5 – 30 units per acre	**50% tower**	**50% podium**	
5.0 – 12.5 units per acre		**100% podium**	
3.0 – 5.0 units per acre		**25% podium**	**75% SFH**
1.0 – 3.0 units per acre			**100% SFH**
Less than 1.0 units per acre	Development Threshold– no density added		

Existing Density Examples – Prototype Assignment

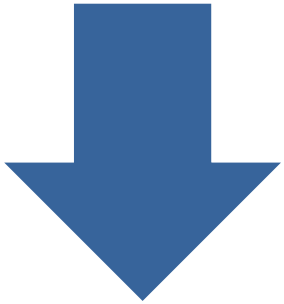


Growth Scenario Prototype Distribution Nationally



Benefits of Smart Growth Scenario

- Target low VMT areas for growth
- Transit corridors and employment centers

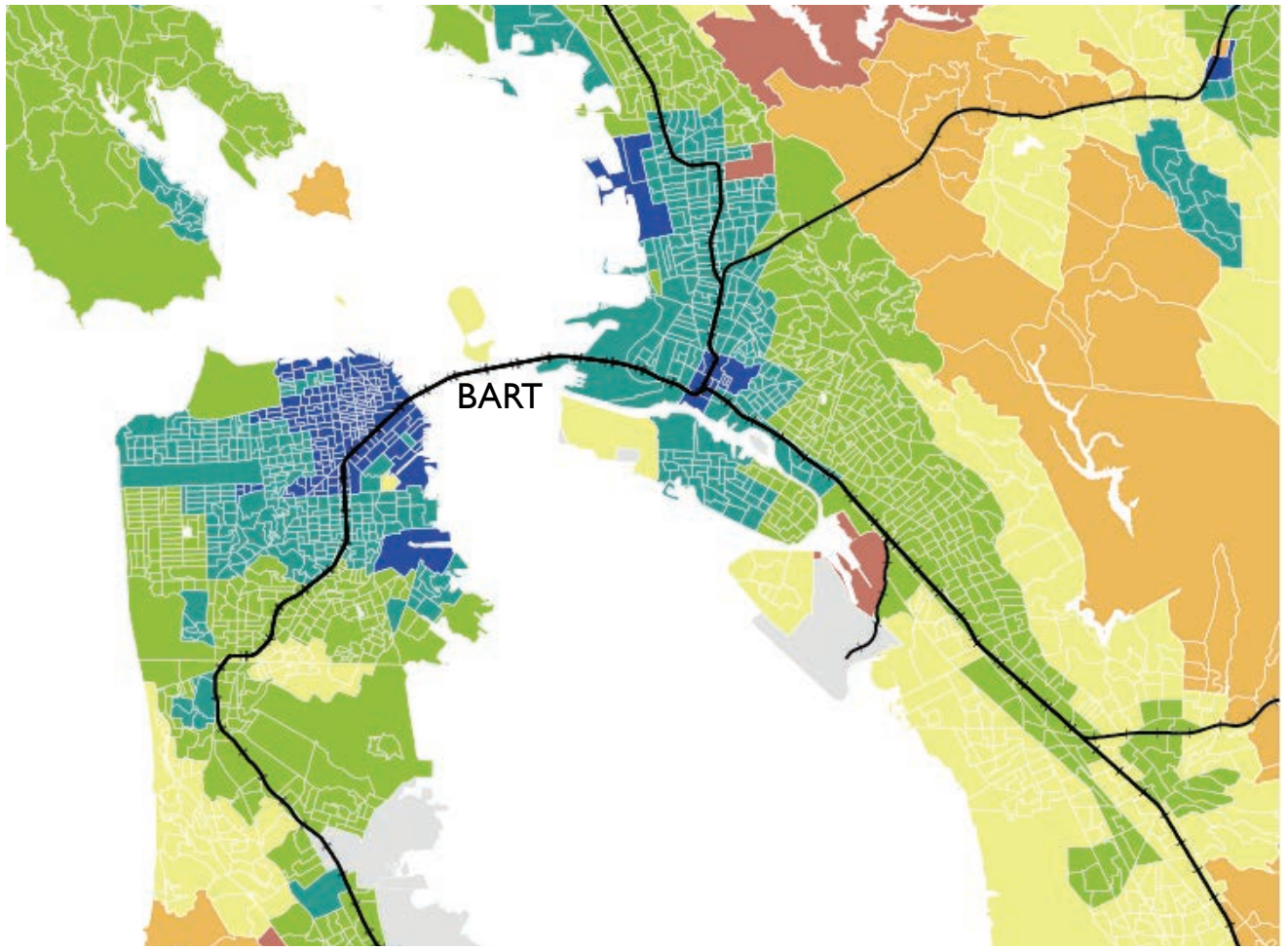


Improved economic and fiscal impacts

Fewer cars on the road and CO2 emissions

Bay Area -- VMT in Transit Corridors

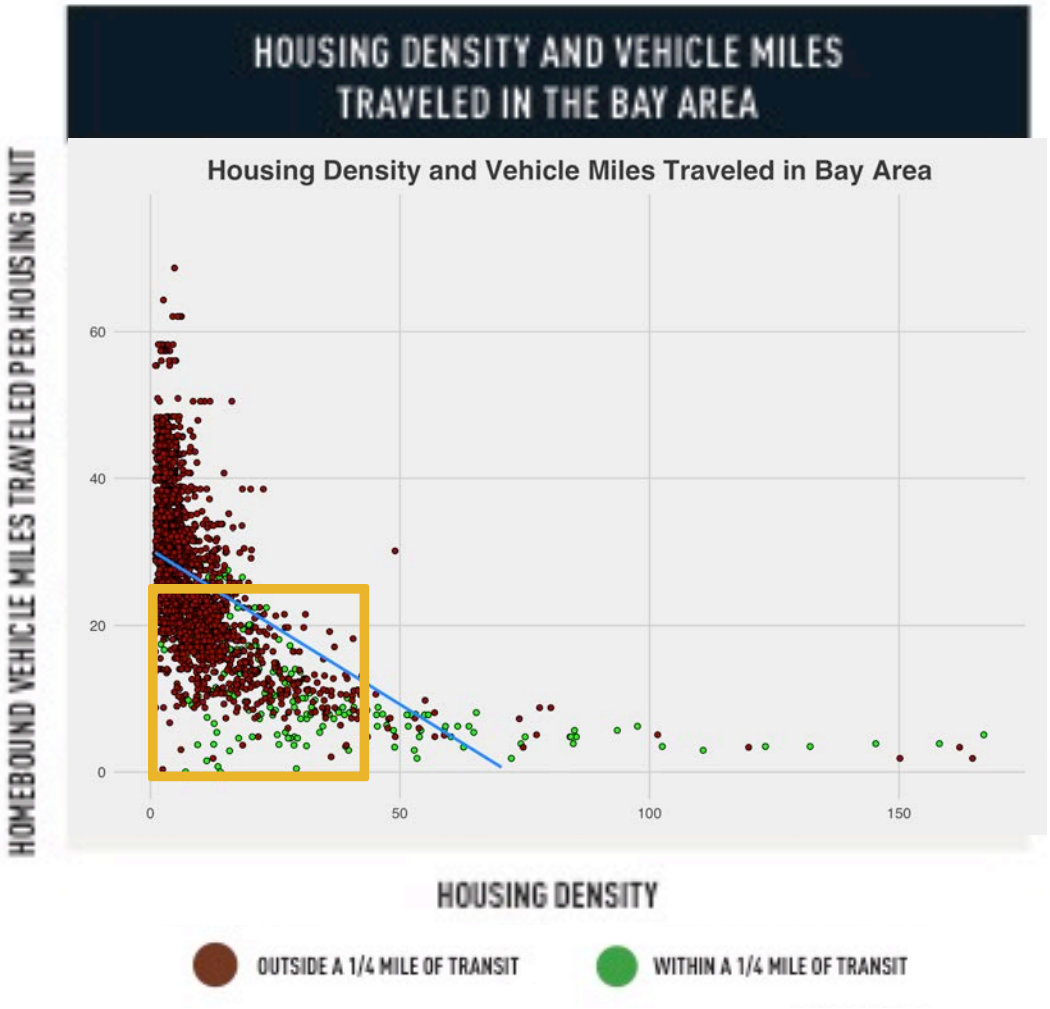
ENVIRONMENTAL IMPACT OF SMARTER GROWTH:
LOWER VEHICLE MILES TRAVELED



HOME-BASED VMT PER HOUSING UNIT

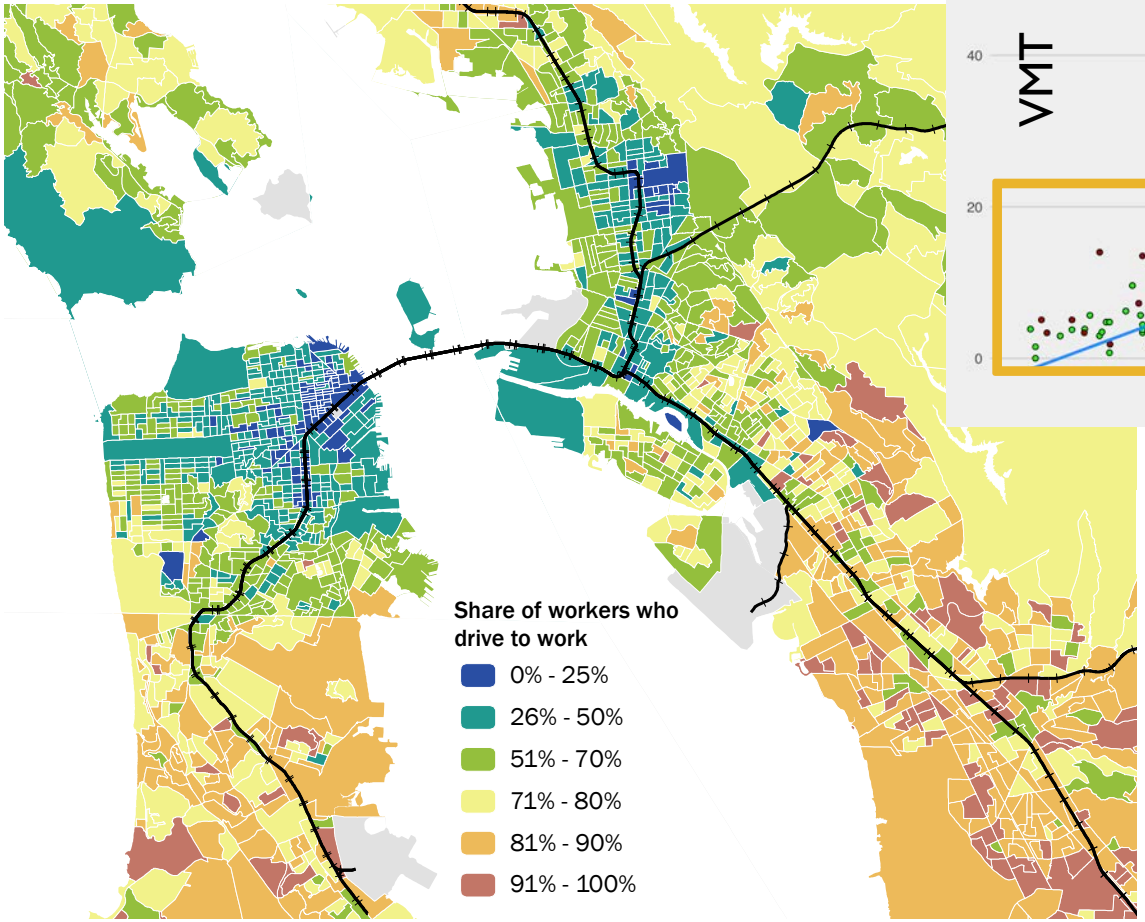
- Less Than 10
- 10-20
- 20-30
- 30-40
- 40-50
- Greater Than 50

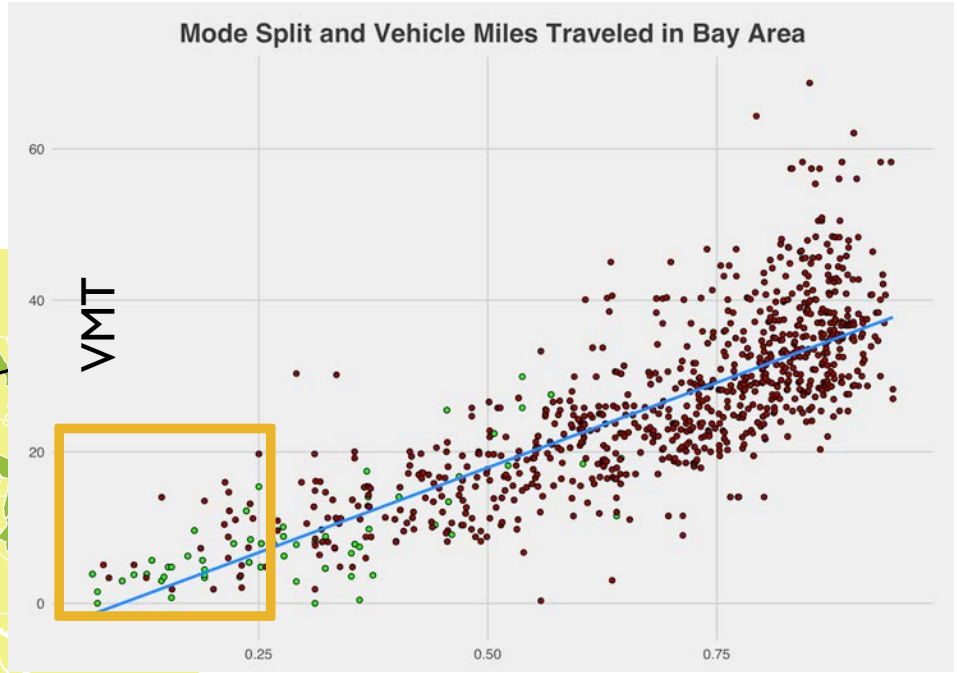
Housing Density vs. VMT in the Bay Area



IN THE BAY AREA		
	MEDIAN HOUSING DENSITY	99TH % HOUSING DENSITY
TRANSIT CORRIDOR	12	125
NON-TRANSIT CORRIDOR	5	43
	MEDIAN VMT	99TH % VMT
TRANSIT CORRIDOR	18	44
NON-TRANSIT CORRIDOR	28	57

Is car commute mode split a good proxy for VMT?





Smart Growth Benefit – Fewer Emissions and Cars

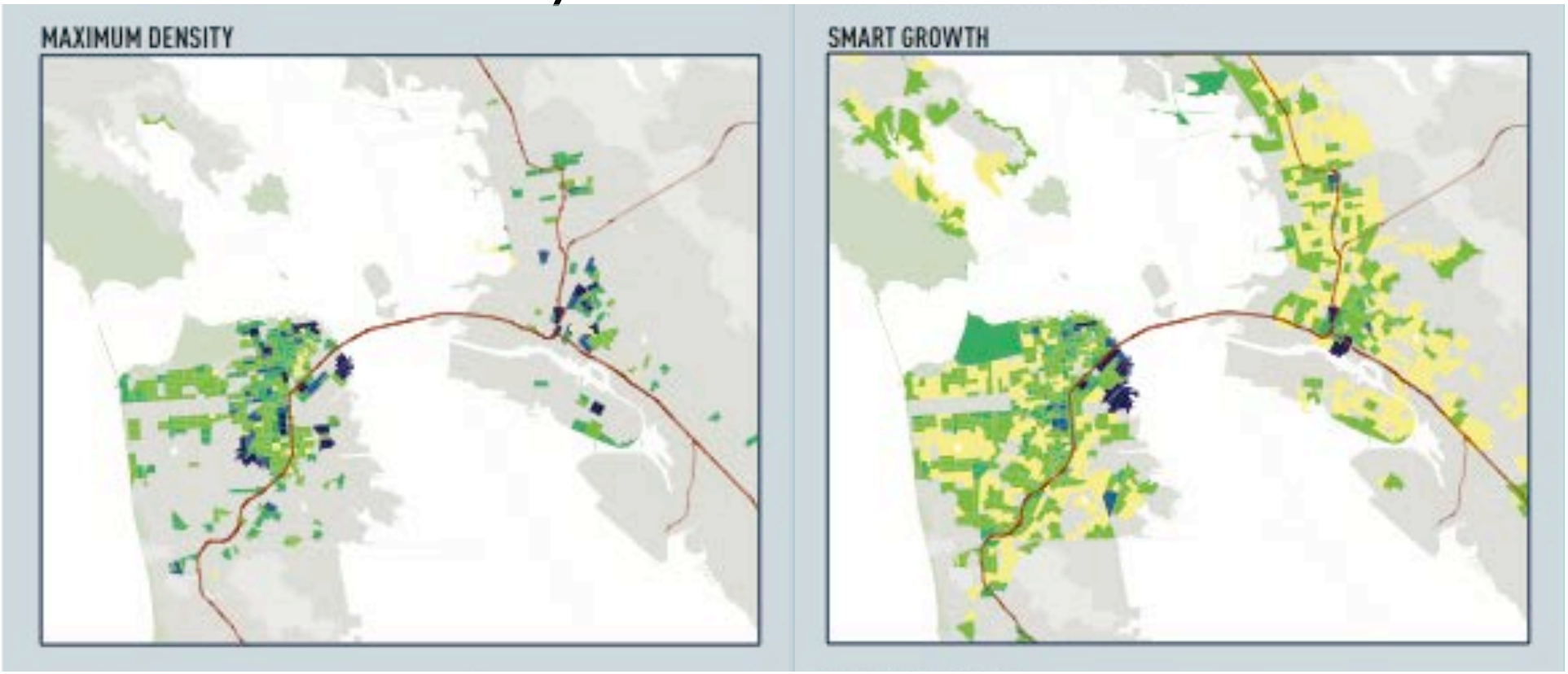
3.3 million units produced in California

	VMT per day	Cars per year
More of the Same	110 Million	3.6 Million
Smart Growth	72 Million	2.3 Million
Smart Growth Benefits	**38 Million** Miles per day	**1.3 Million** Cars per year

Growth Scenarios – Bay Area Example

Maximum Density

Smart Growth



Total Units Added

- Less Than 1,000
- 1,001-2,000
- 2,001-3,000
- 3,001-4,000
- 4,001 or More

167 UPA for tower
75 UPA for tower/podium
50 UPA for podium

Prioritize low VMT transit stops

300% increase within ¼ mile of transit

200% increase within ½ mile of transit

Process

- Task 1) Quantify Underproduction of Housing
- Task 2) Model growth scenarios
- **Task 3) Quantify economic and fiscal impacts**
- Task 4) Discuss national and local policy options

Impacts of Growth Scenarios

- If additional housing were built in each scenario (step 2) to meet underproduction amounts (step 1), what economic and fiscal impacts would be supported?

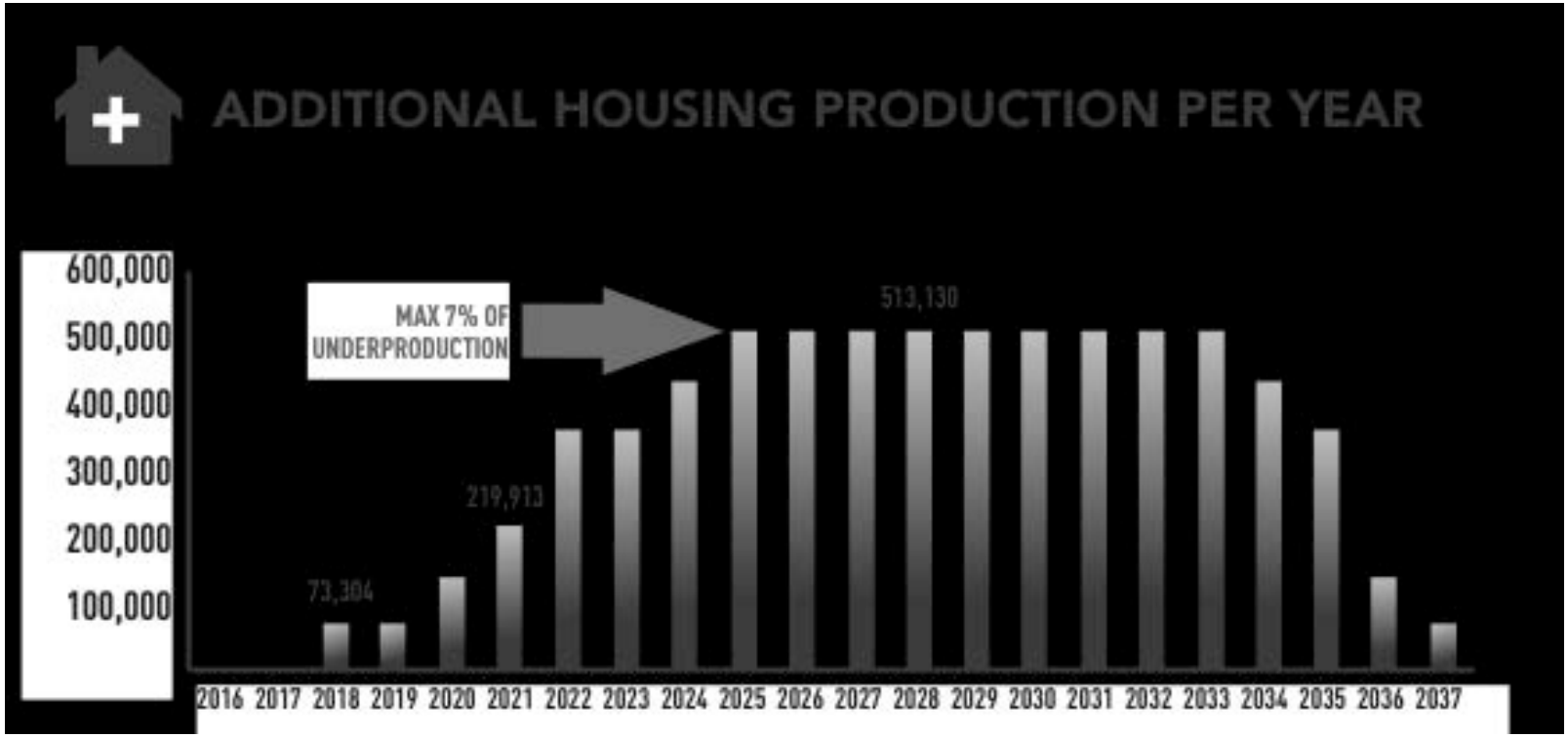
- Use REMI PI+ model to estimate impacts related to increased housing production

Impacts of Growth Scenarios

- How much does it cost to build these units?
  - Each scenario builds different numbers of single family homes, podiums, and towers
  - Each prototype has different costs of construction, infrastructure, and causes different environmental considerations
  - Each region has different costs of construction, different impact fee regulations, different building permits and fees, different tax rates, etc.
- How much would each state's economy, labor force, or personal income grow?

Modeling Additional Housing Production

- 1.18 Million Starts in 2016, 1 million average last 5 years
  - 1/20th of total underproduction is 366,000 units
  - Represents a 31% increase in current unit production
- Industry needs time to train labor to ramp up production
- Production in max year is less than previous cycle peak



REMI Model Assumptions

- **Hard construction costs**
  - Tower & Podium: start with historical data by prototype, use RS Means cost index to adjust by state
  - Single Family Homes: Census 2016 Permits and Values data
- **Soft construction costs**
  - 1.6% of hard costs for single family homes
  - 12.0% of hard costs for podium and tower
- **Infrastructure costs** (provided by Arup Engineering)
  - Scaled based on Smart Growth America Study to scenarios
  - Installation costs and ongoing operations & maintenance
  - Government sector pays for infrastructure through bond issuance
  - Offset by impact fee revenue estimated by state

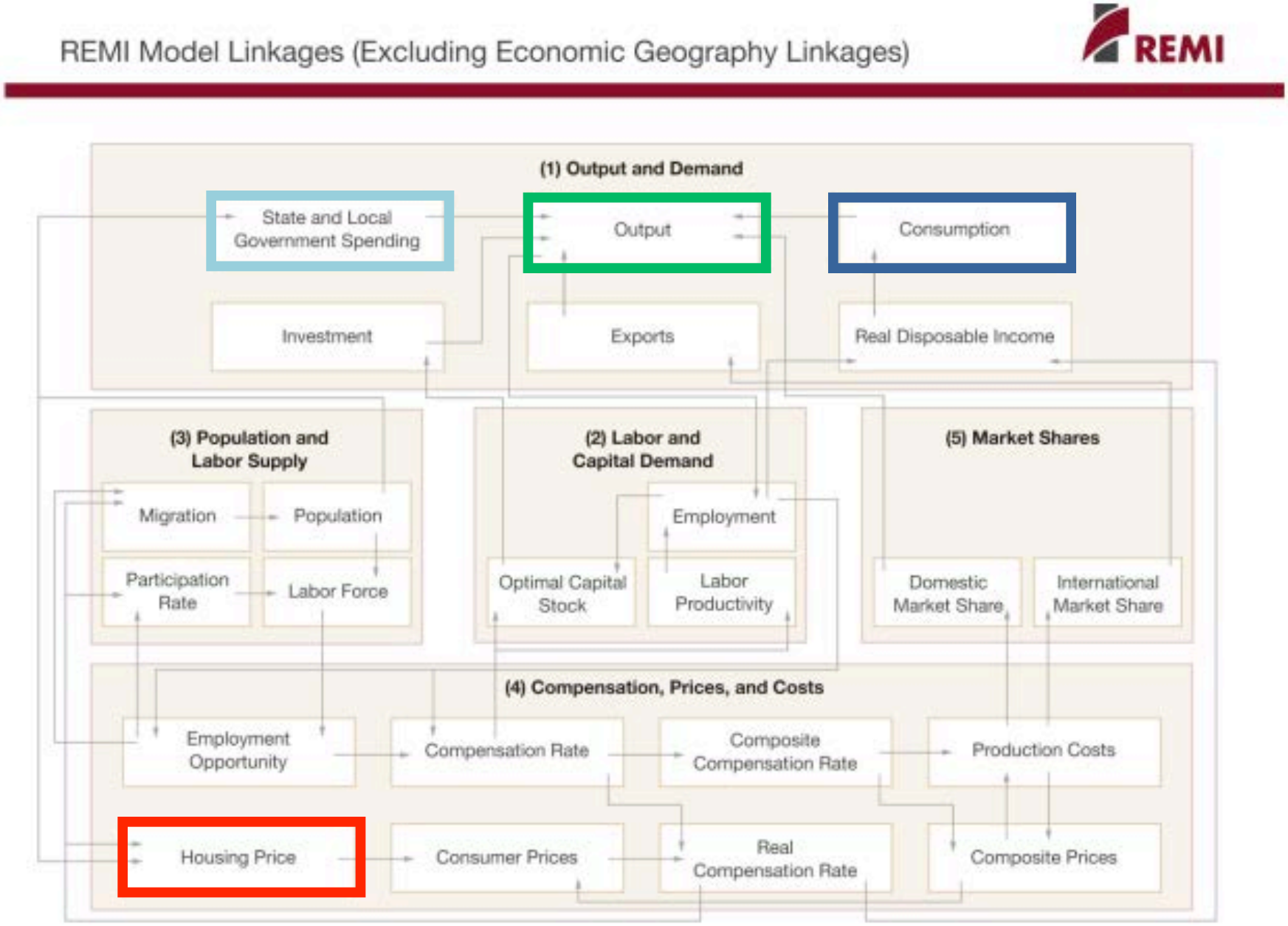
Robbing Peter to Pay Paul?

Housing prices adjusted (down) based on supply elasticity

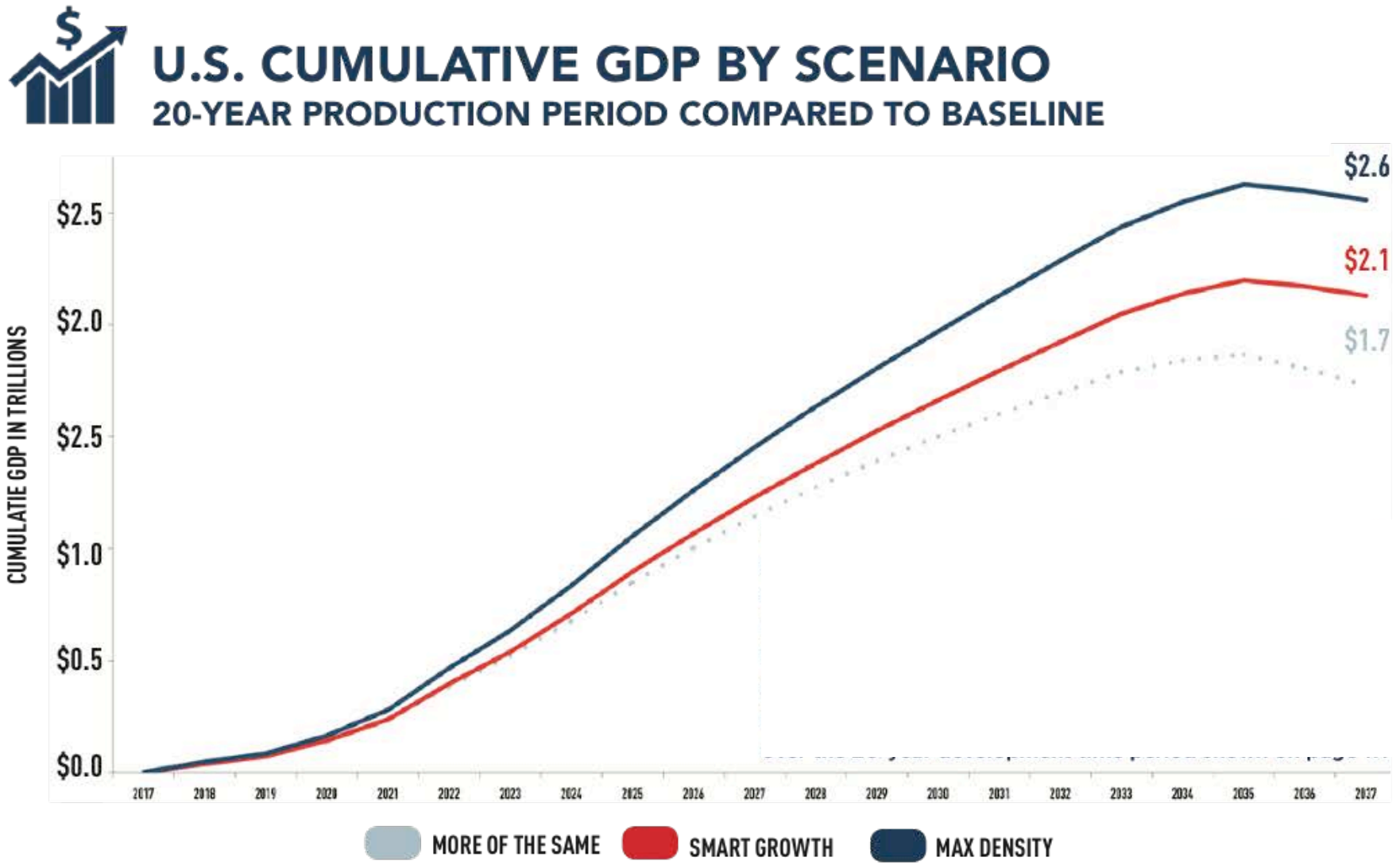
Household consumption reallocated to pay for new units

- Overall price of housing in the market decreases…however
- New housing costs more than the current stock
- Need to reallocate household consumption to account for increased costs of new units

Inputs into the model

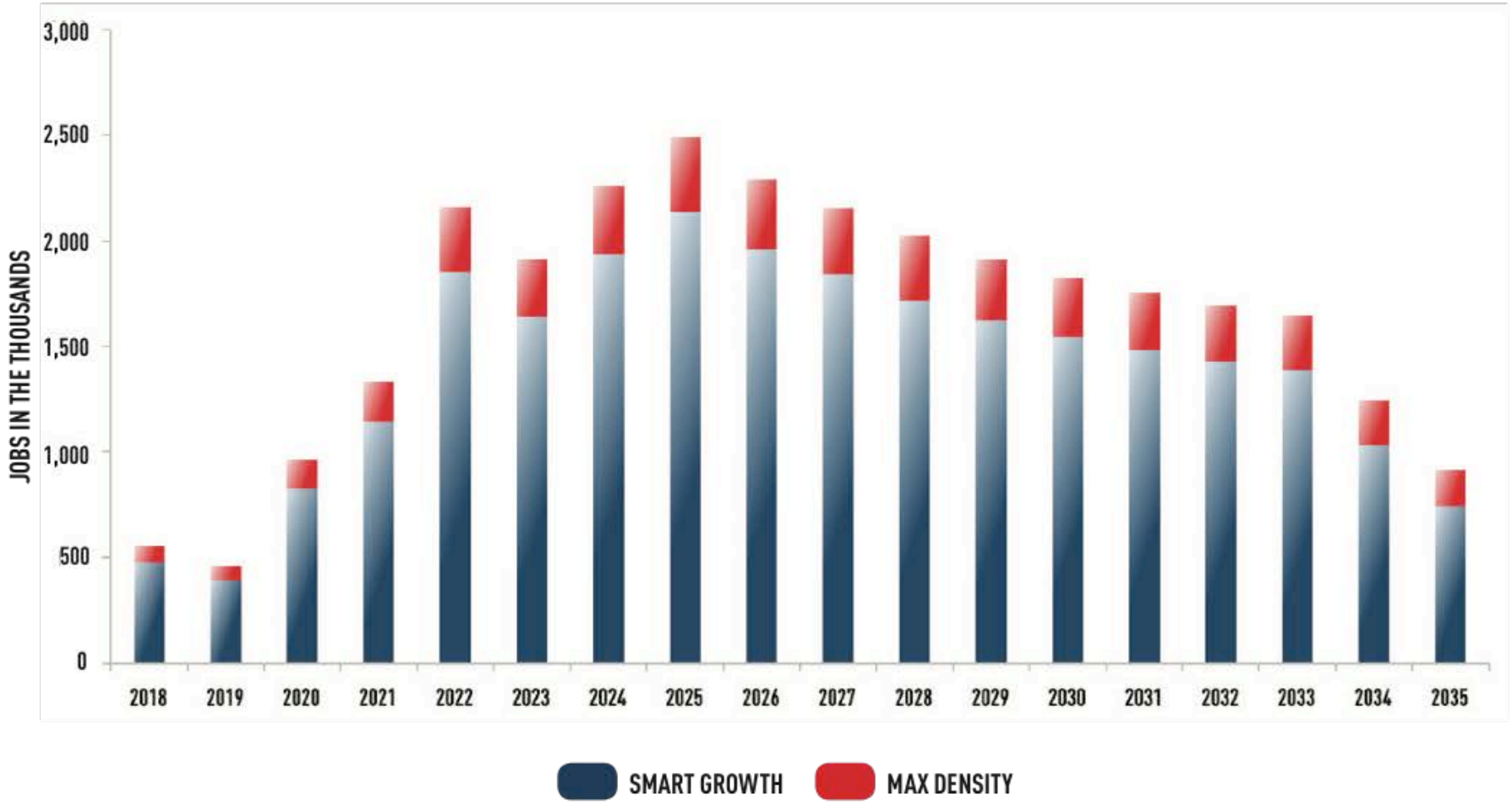


$ 2 trillion increase in cumulative GDP over 20 years

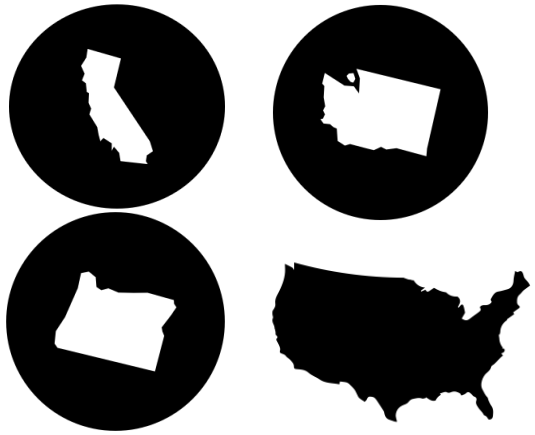


More than 2 Million jobs supported in peak year of production

ANNUAL U.S JOBS BY SCENARIO
20-YEAR PRODUCTION PERIOD COMPARED TO BASELINE



Study Utilized 2 REMI Model Specifications



4 Region Model

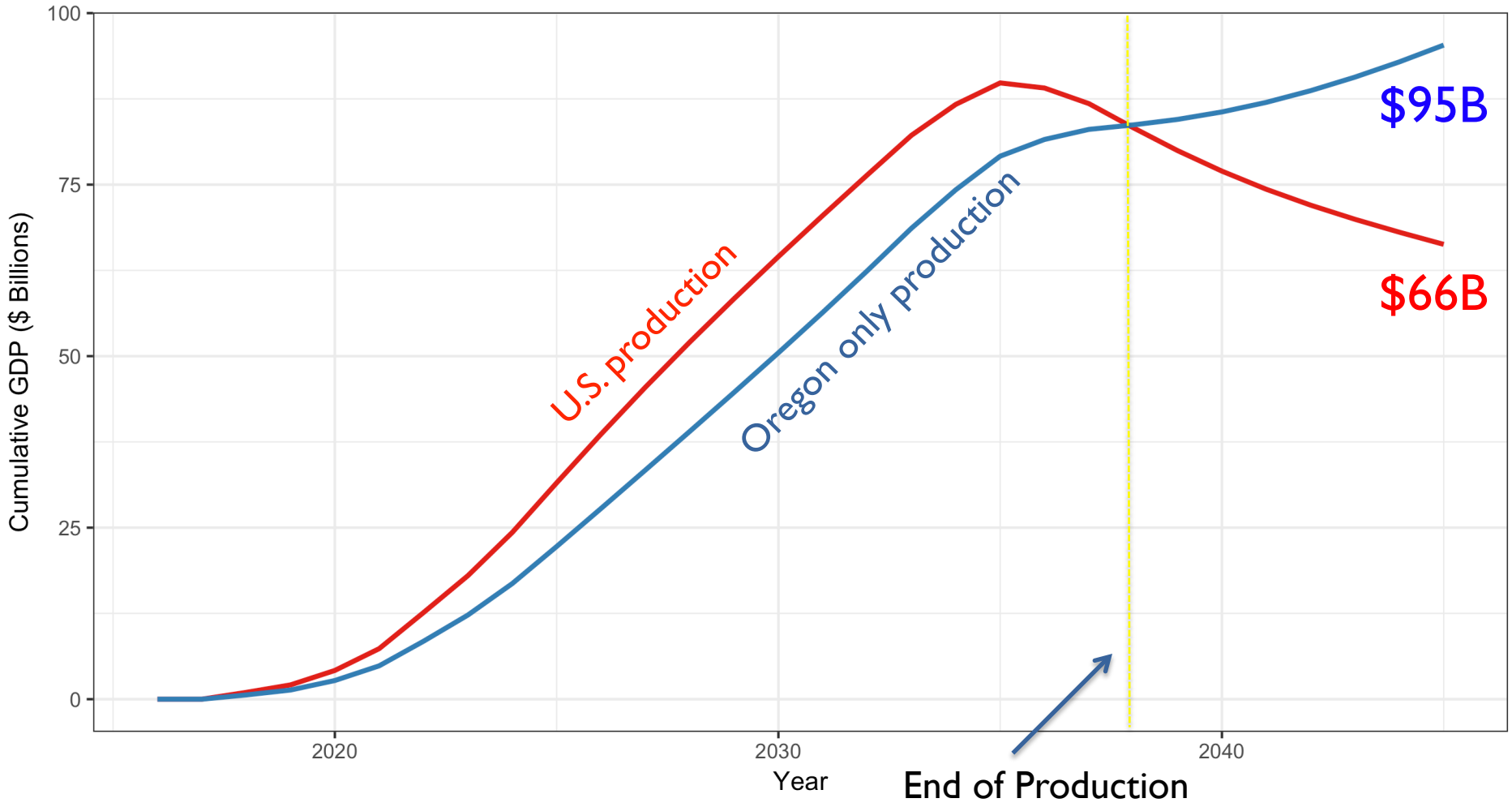
California, Oregon, Washington, and Rest of US

51 Region Model

Preferred model, selected for primary report results

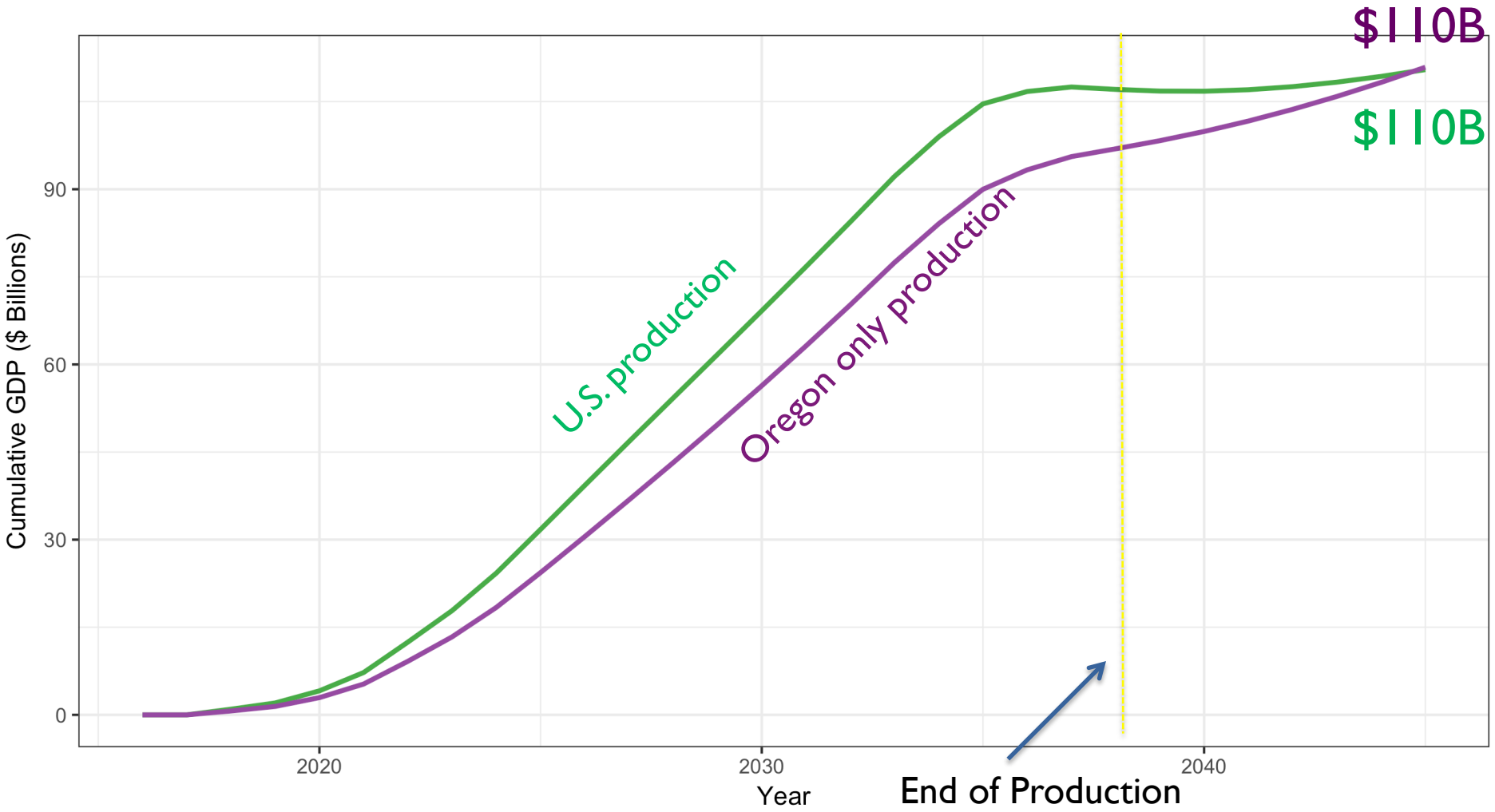
Comparing results from the 4 models – Oregon example

4 Region -- Cumulative GDP Impacts



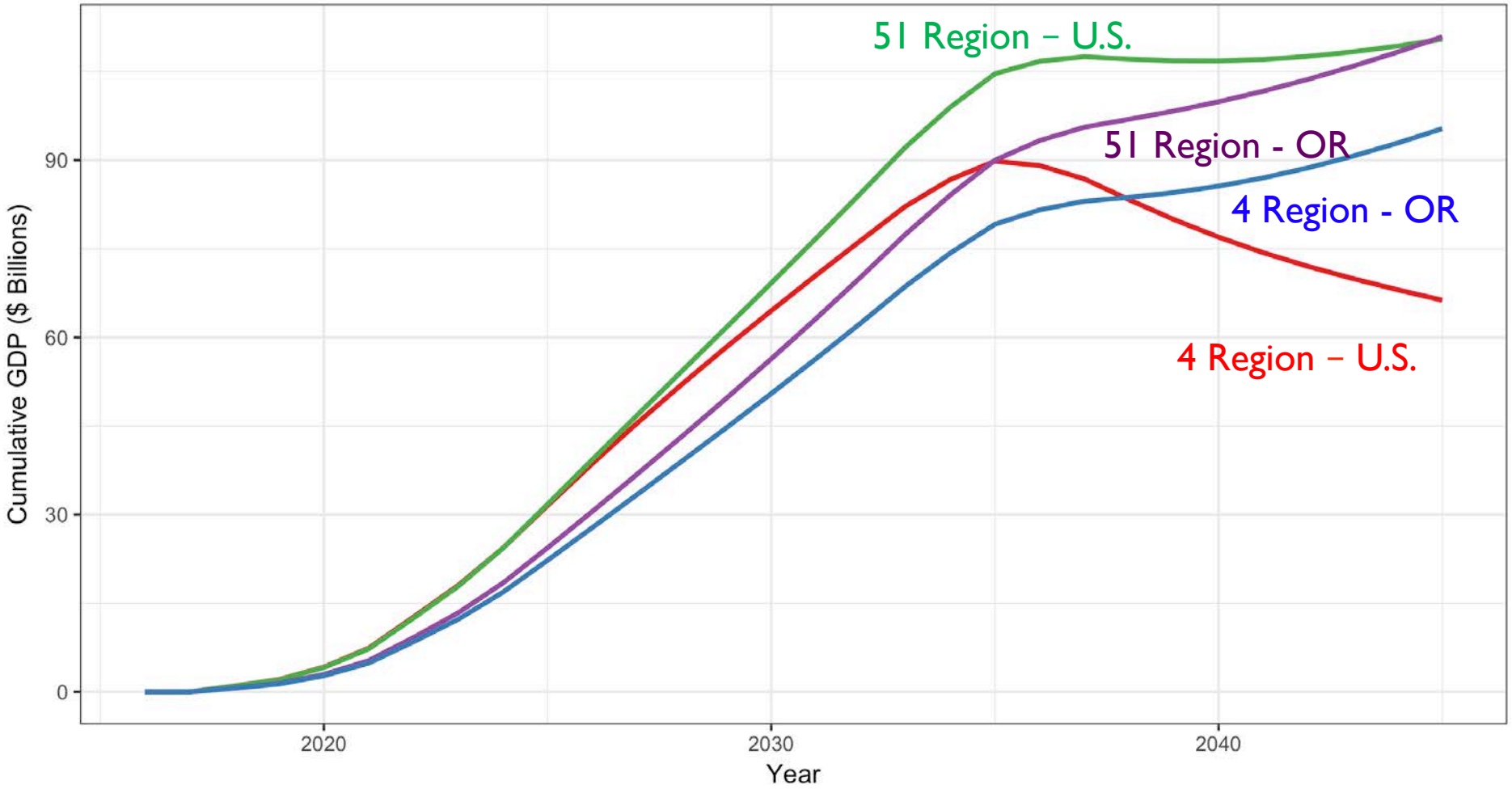
Comparing results from the 4 models – Oregon example

51 Region -- Cumulative GDP Impacts



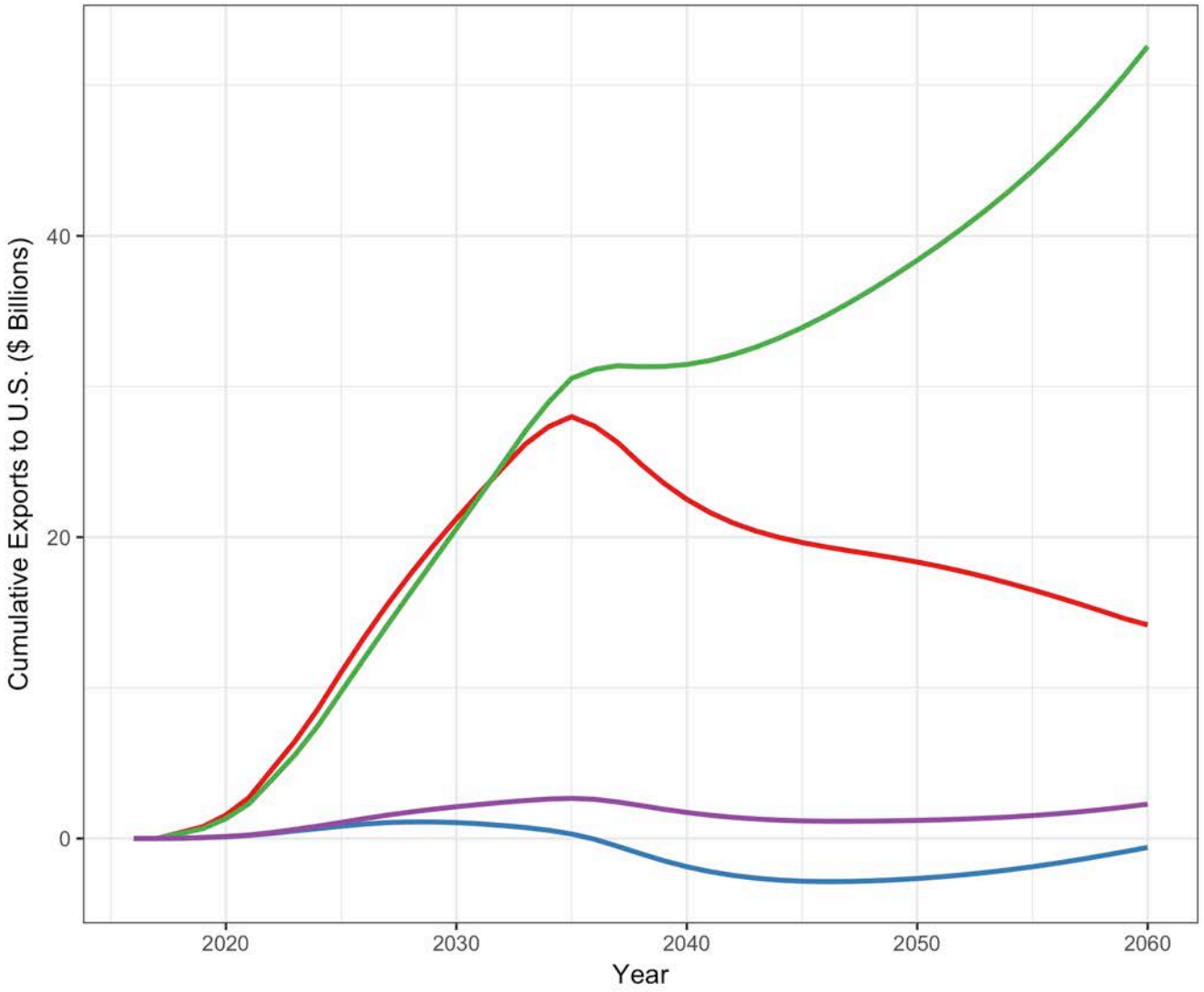
Comparing results from the 4 models – Oregon example

Cumulative GDP Impacts



Why does U.S. Production generate benefits for Oregon

Exports to rest of U.S. -- Larger for national models



51 Region – U.S.

4 Region – U.S.

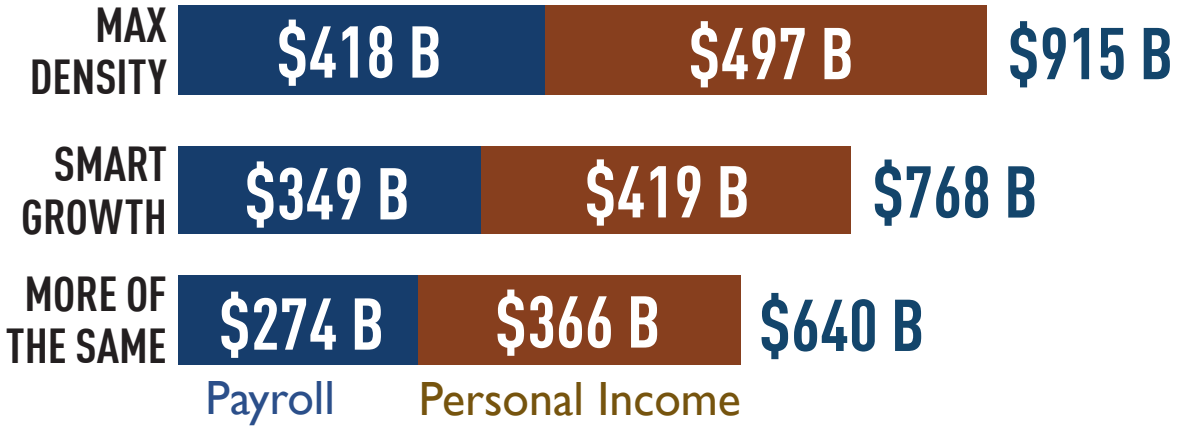
51 Region - OR

4 Region - OR

Federal Cumulative Revenue by Scenario through 20 years

CUMULATIVE FEDERAL FISCAL REVENUE

20-YEAR PRODUCTION PERIOD BY SCENARIO



The blue area represents cumulative payroll tax and the brown area represents personal income taxes. Corporate taxes and other federal revenue sources are not shows in these calculations.

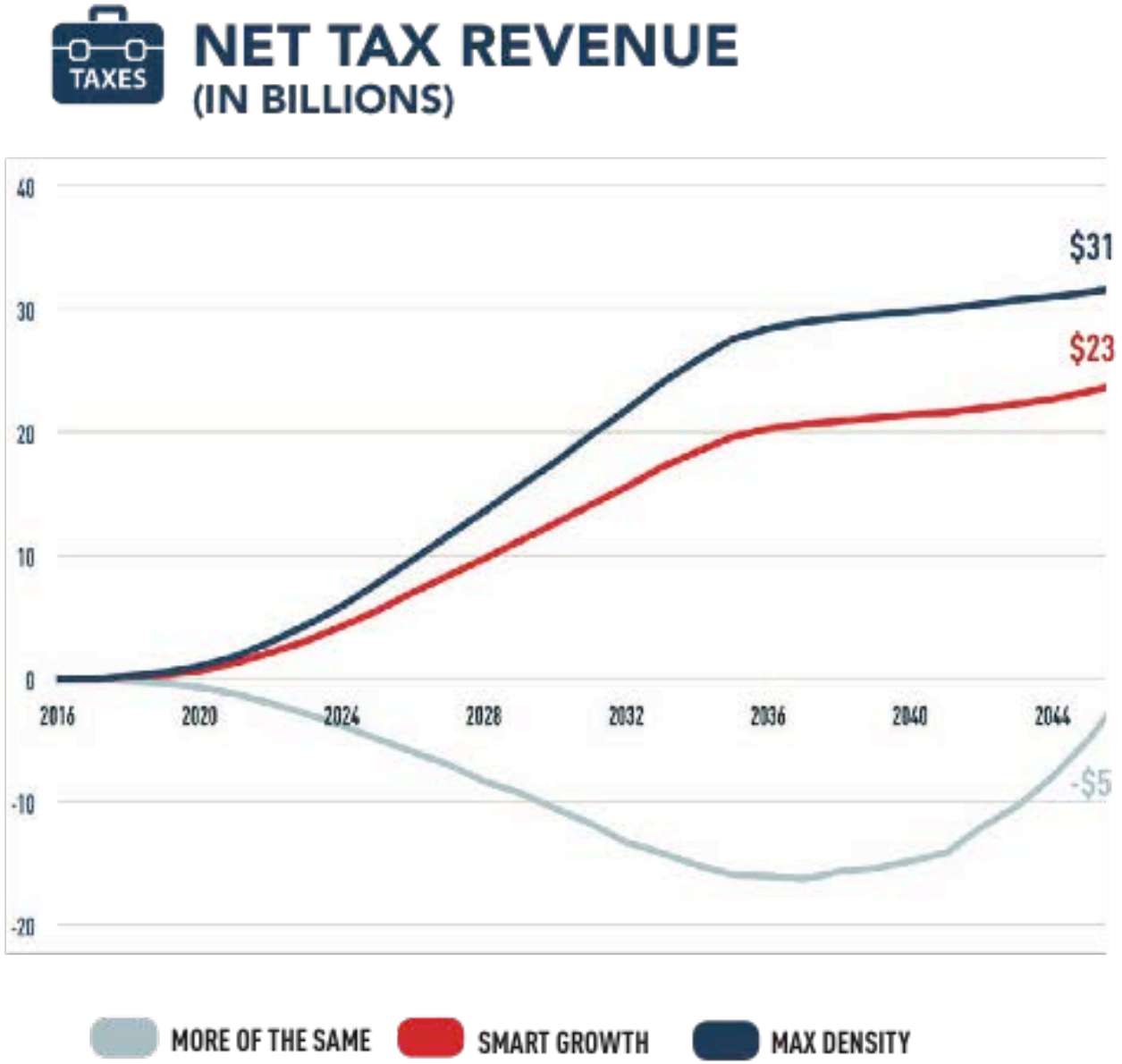
Net Local Fiscal Revenue through 2045

Cost of infrastructure is not supported by fiscal revenue in More of the Same

GROWTH SCENARIO	TOTAL ACRES REQUIRED	INFRASTRUCTURE IINSTALLATION COST	INFRASTRUCURE TOTAL O&M SPEND	TOTAL IMPACT FEES	PROPERTY TAX REVENUE	NET TAX REVENUE
MORE OF THE SAME	602,051[1]	$612,041,200,836	$14,223,456,016	$54,272,253,249	$204,353,021,677	$(367,639,381,926)
SMART GROWTH	148,442	$84,741,386,954	$3,506,937,451	$39,904,589,077	$225,193,796,354	$176,850,061,026
MAX DENSITY	40,082	$20,592,603,598	$946,926,147	$36,449,419,162	$271,694,738,442	$286,604,627,859

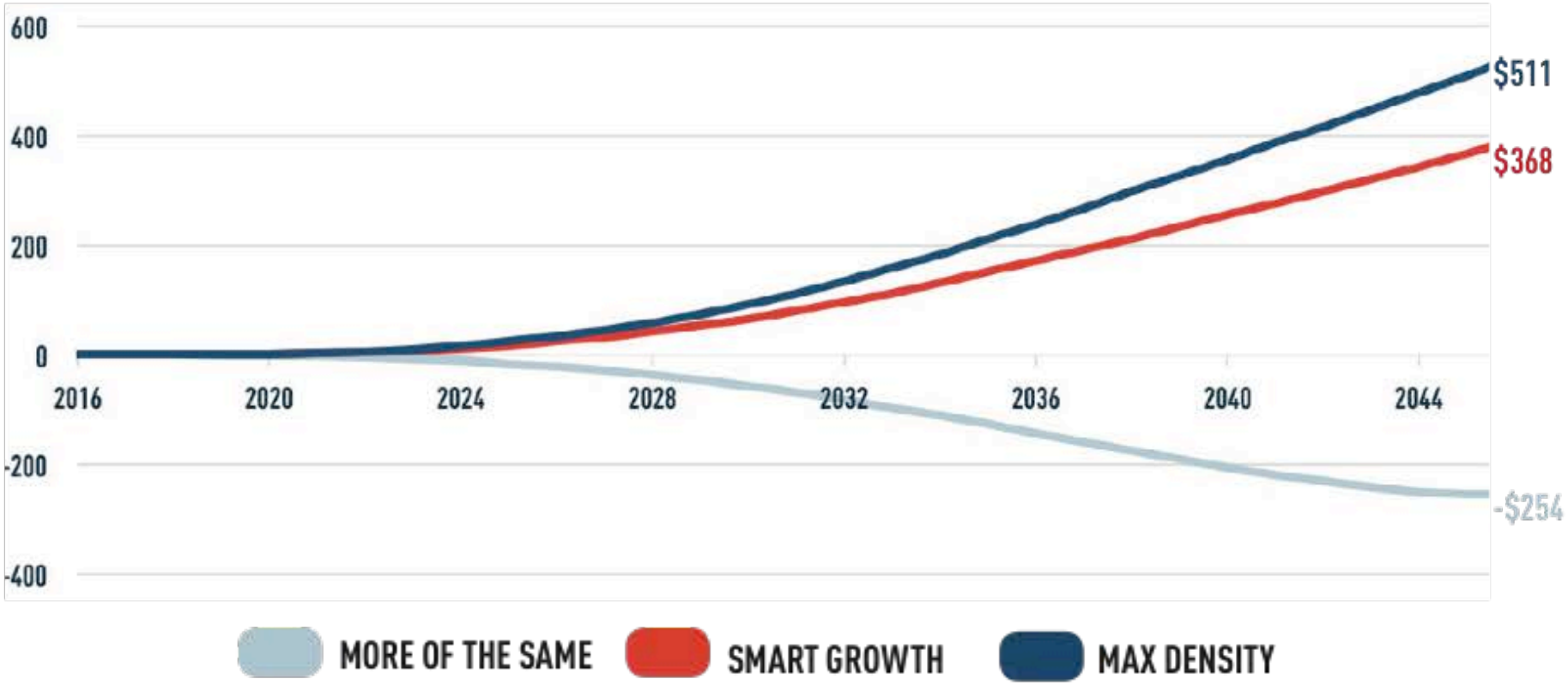
Smart Growth generates positive fiscal revenue

Local Fiscal Revenue By Scenario Nationally through 2045



More than $600 Billion difference in local revenue through 2045

CUMULATIVE NET TAX REVENUE
(IN BILLIONS)



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Policy Framework

1. BY-RIGHT APPROVAL

Establish "by-right" high-density residential development in a half-mile radius around a transit station (roughly 5 percent of a metropolitan region's land area);

2. IMPACT FEE RECALIBRATION

Recalibrate impact fees to reflect actual costs of infrastructure service for high-density development;

3. PROPERTY TAX ABATEMENT

Use 10-year property tax abatement as a gap-finncing tool for new affordable housing production;

4. VALUE CAPTURE

Establish mechanisms to capture value created through up-zones and tax abatement investments to be used as dedicated funding for a range of housing programs.

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