



U.S. Multifamily Investment Strategy & 2018 Outlook

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Today's Agenda

- Macroeconomic Outlook
- Demand Trends
- Commercial Real Estate Fundamentals
- Technology, Demographics, Migration and Immigration



The Yardi Matrix House View- November 2017

We have made a consistent positive case for US Multifamily Investment for several years- but it'll be a bit bumpy ahead

- US macroeconomic conditions, while not great, are solid and generating job growth of ~175-200K jobs per month
 - Enough to maintain MF occupancy and good, but decelerating, rent growth vs 2012-2015
- MF Demand is a big tailwind, both Short and Long Term
 - Job Formation, Demographics, Affordability, and Technological change are all combining for a positive perfect storm for the next 10-20 years- -the move to urbanized suburbs is beginning in earnest
- MF Supply is coming on more slowly than expected; forecast now **300,000 vs. 360,000 units** in '17- enabling continued slow rent growth, with the peak supply pushed out to 2018 at 360,000 units
 - Supply surge delay/smoothing driven by construction labor – avg. 5 month delay- from 20 mos. in Chicago to 5 mos. in Denver
 - Tighter regulatory oversight of banks has restricted new construction financing & raised the cost via use of private lenders
 - Housing is in shortage in mid-priced apartments- and the opportunity in value add has attracted institutional capital to such an extent that leading edge players are culling and waiting to lean back into Core assets
- Oil prices are range bound- \$40-\$60/bbl. with regional pain on the slow mend - Houston, OKC, & Pittsburgh
- Major Top 40 Non-gateway markets, and their growing intellectual capital nodes, are well positioned to benefit from domestic migration and lower costs vs. gateway cities...and largely insulated from national immigration policy
 - Opportunistic or yield investors need to move to “unloved” markets away from institutional investors
 - Value Add has good odds of success, on fundamentals- but asset price change has narrowed the opportunity recently

How Do Things Look Now?

The Outlook remains positive, but guarded for the next 18-24 months as supply gets absorbed; the extent of which remains based upon the balance of pro-growth vs. immigration/trade policy emphasis

- US Macro Conditions
 - USA today mirrors tensions in 1930's- slow growth , deep divisions- regionally, socially, economically, politically
 - Recent Eurozone economic growth is encouraging; increased geopolitical risk of a miscalculation by rogue/non-state players
 - Getting US GDP growth from 2% up to 3% is the heavy lift
 - Potential for Pro-Growth policies come in two forms:
 - Executive: loosening of regulations- which is coming as departments are being staffed
 - Legislative: (tax reform, education reform, health care re-reform, infrastructure spending) may take some time to play out
- Immigration and trade restriction policies impact is currently at the “margins” – but evident
 - The 6 Int’ l Gateway Cities are exposed the most; Other major cities benefit from domestic migration
 - Extractive (mining) and transformative (manufacturing) regions may benefit slightly vs. tech—but long term wealth creation is still intellectually based– in all its forms
 - There are ripple effects in the construction trades, raising costs/delaying completions—now in evidence
- Yet, in a still low yield Environment Where Can An Investor Find Yield?
- Monetary Policy, and the Debt Surge it has engendered in the Gov’t & Publicly Traded corporate sector, has reached its limits (or very near its limits)— Pro-growth Fiscal policy *is* the way forward
- US Multifamily, and US Commercial Real Estate, is still the place to be, but the ride is going to be bumpy

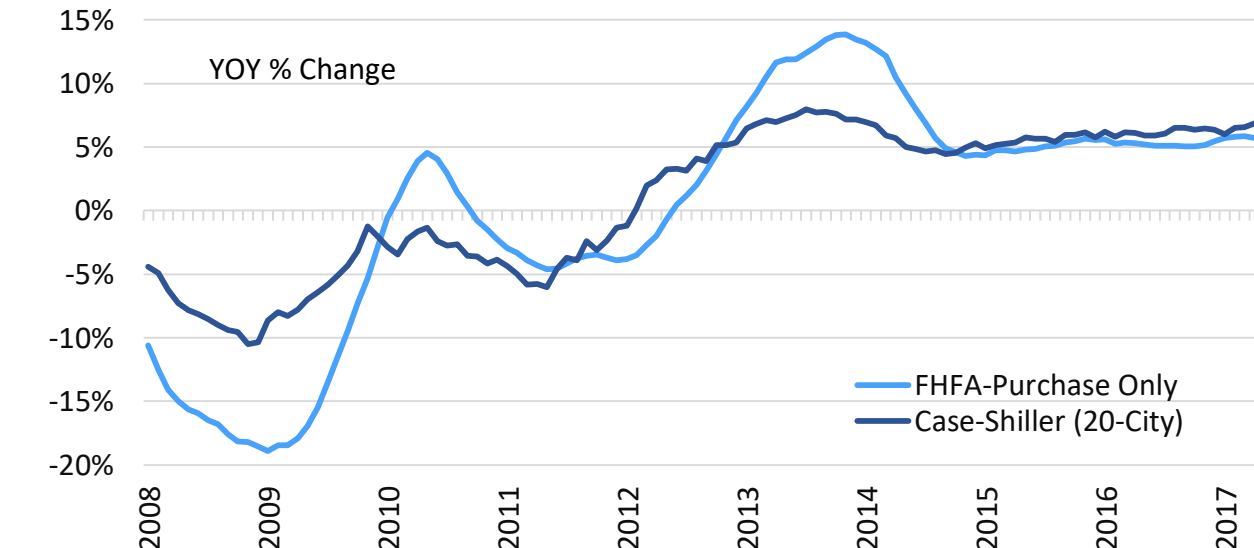
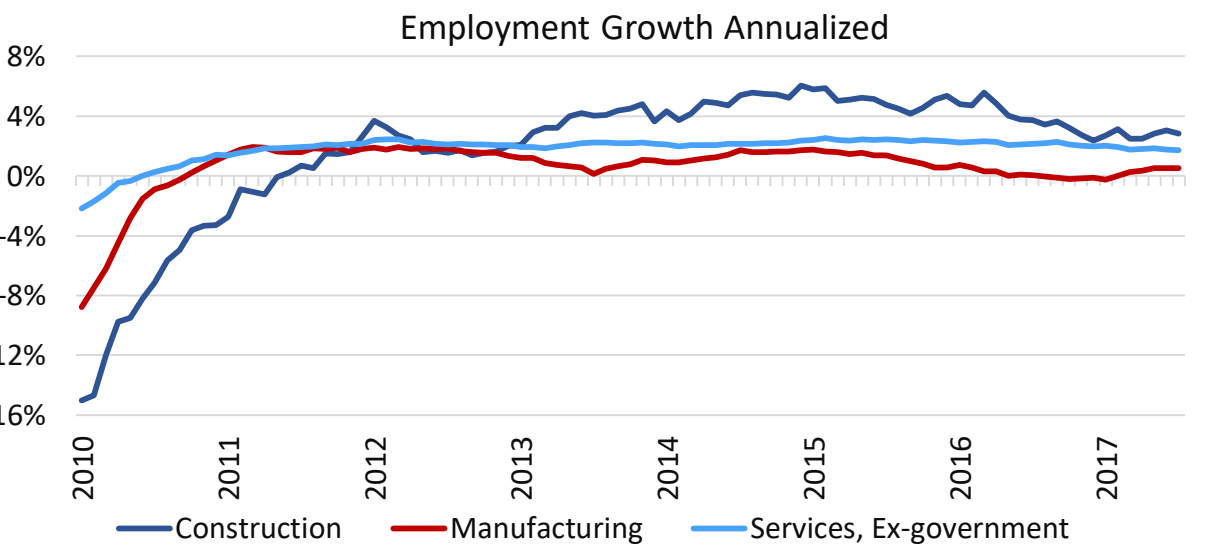
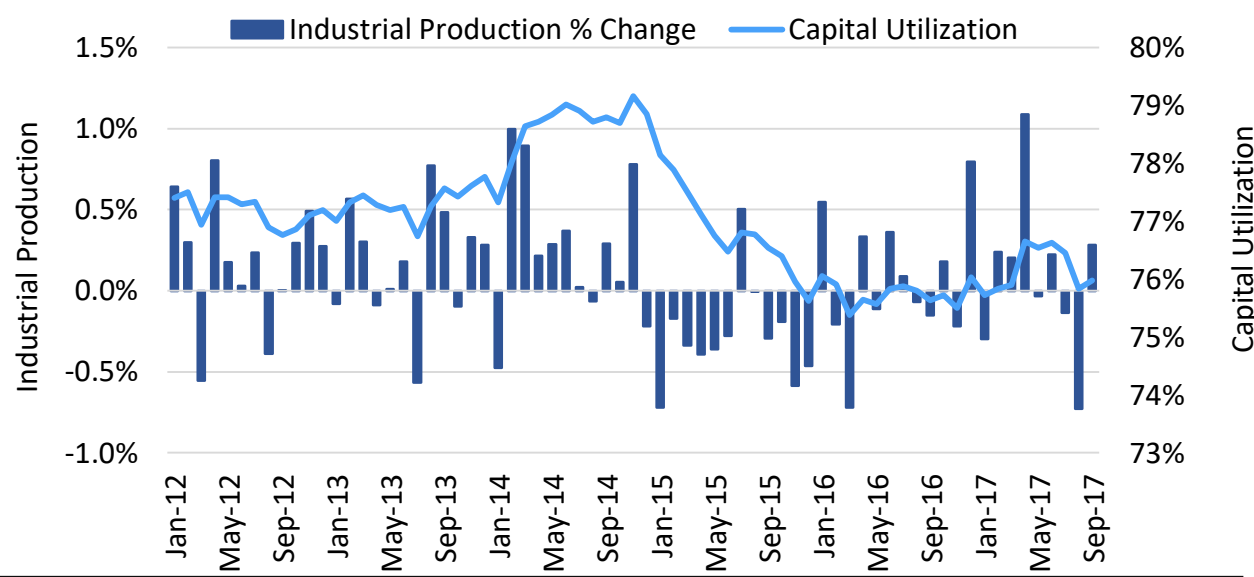
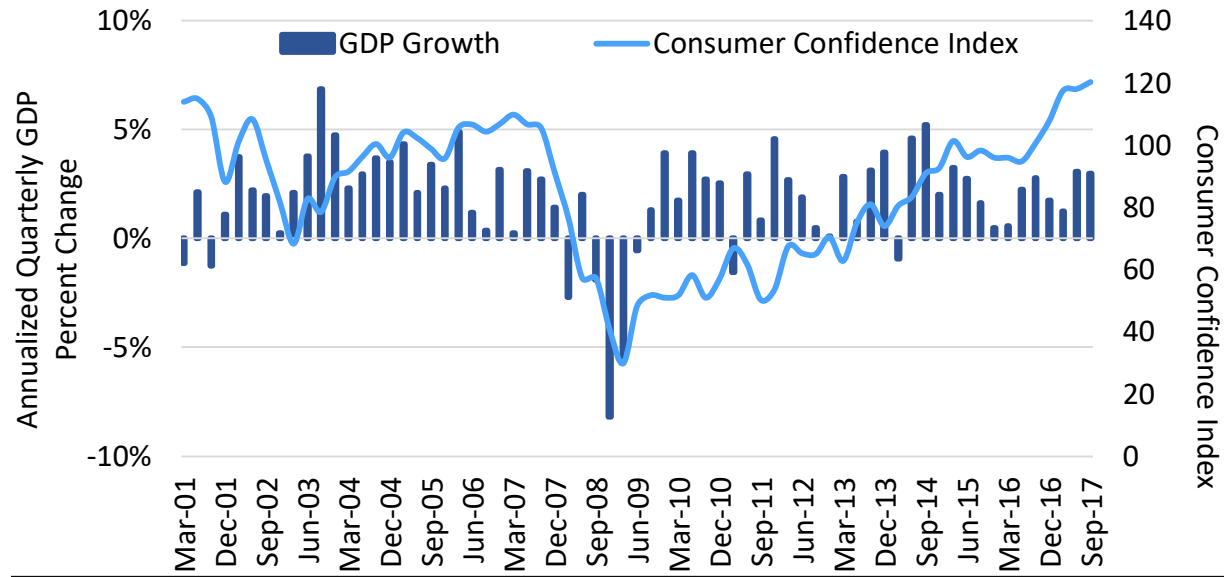
How Do Things Look Now?

The Outlook remains positive; the extent of which is based upon the balance of pro-growth vs. immigration/trade policy emphasis

- Apartment market conditions
 - High occupancy on stabilized properties, but sliding; Mkts/Sub-mkts with new supply impacted the most
 - Decelerating rent growth- ~2-3% ; muted new supply impact has provided a pleasant summer surprise in rent growth
 - Structural components of demand are still big tailwinds as before
 - Wage pressures in the US are growing, finally catching up to rent increases in some US Markets
 - Supply is peaking now in '18- 2017; 300K, 2018: 360K, 2019; 300K
- Dislocation in Comm'l Real Estate Debt Markets, driven by regulatory influences, is restraining growth in new construction financing
 - Dislocations in Bank and CMBS debt markets will extend the apartment rental growth up-cycle
 - Debt availability and cost is more tied than ever to global financial markets, despite the steadying influence of the GSEs (50% debt market share, and able to do more with Green/Affordable/Small Balance/ Variable Rate Programs).
 - Long-term rates are not moving at the same pace that is expected in short-term rates
 - Yield Curve shape bears close watching;
- Asset Value growth will be restrained, but not stopped, due to these cross-current
 - Depends on pace of income growth relative to upward interest rate movements
 - But watch out below if fiscal policy stalls, and job growth stalls with it in the next 24 months
- Long Term Technology Revolutions in Energy & Transportation are now within the 10 yr. investment horizon
 - Time to put it on your radar screen

Macroeconomic Outlook

U.S. Economic Growth is OK

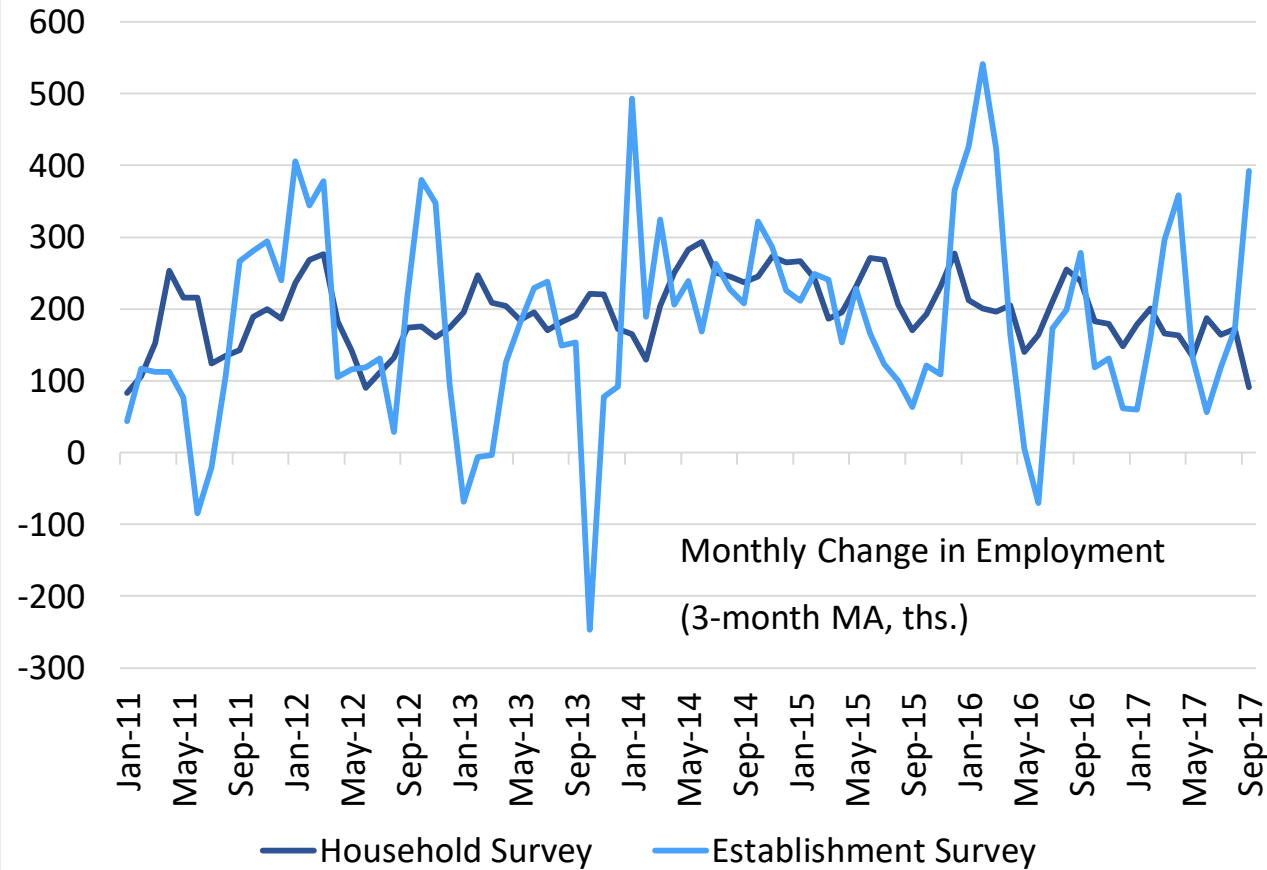


Source: Moody's Analytics; Bureau of Labor Statistics (BLS); S&P Dow Jones Indices LLC; CoreLogic, Inc; Federal Housing Agency (FHFA); Freddie Mac; Fannie Mae; U.S. Bureau of Economic Analysis (BEA); U.S. Board of Governors of the Federal Reserve System (FRB); Investing.com

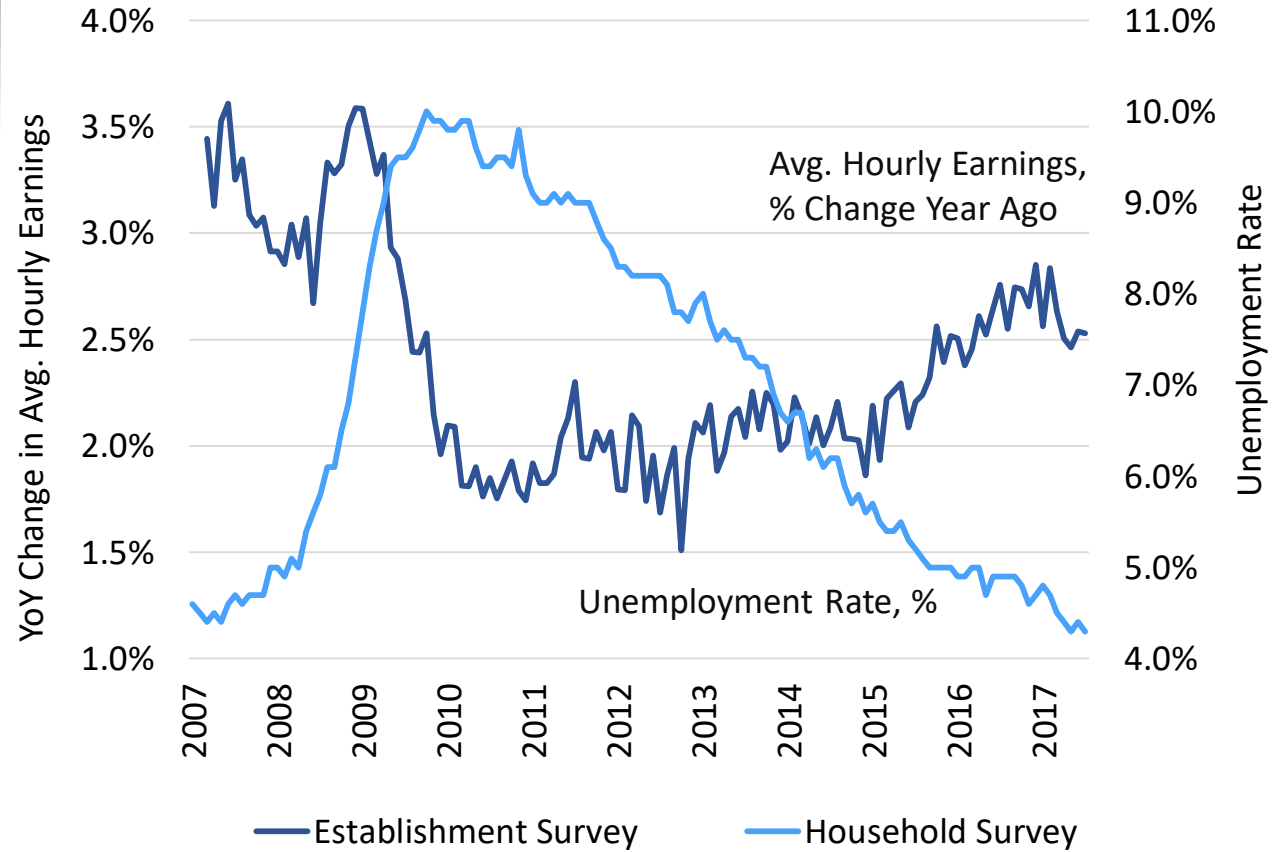


Job Growth and Wage Growth

Job formation good, but more volatile



U.S. Wage Pressure Increasing



Earnings Are Being Artificially Held Down

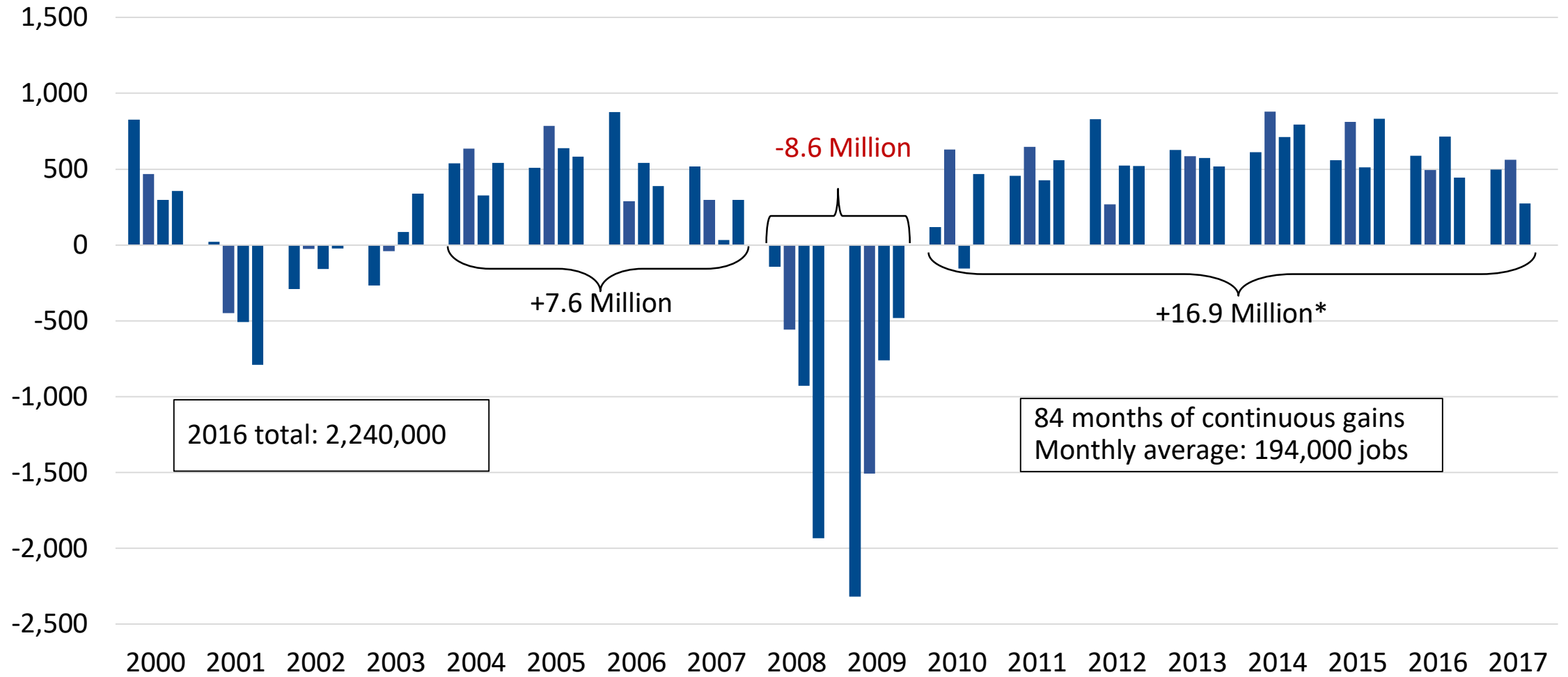
The Good News on Wage Growth

The San Francisco Fed Aug 14, 2017

The overall exchange of new workers for new retirees is holding earnings down by a little under 2 percentage points. Median weekly earnings actually rose in 2Q to +4.2% y/y, according to the U.S. Department of Labor. That's the fastest pace since 2007. Adjust for baby boomers and that would rise to +5.2%.



Quarterly Job Growth



2016 total: 2,240,000

+7.6 Million

-8.6 Million

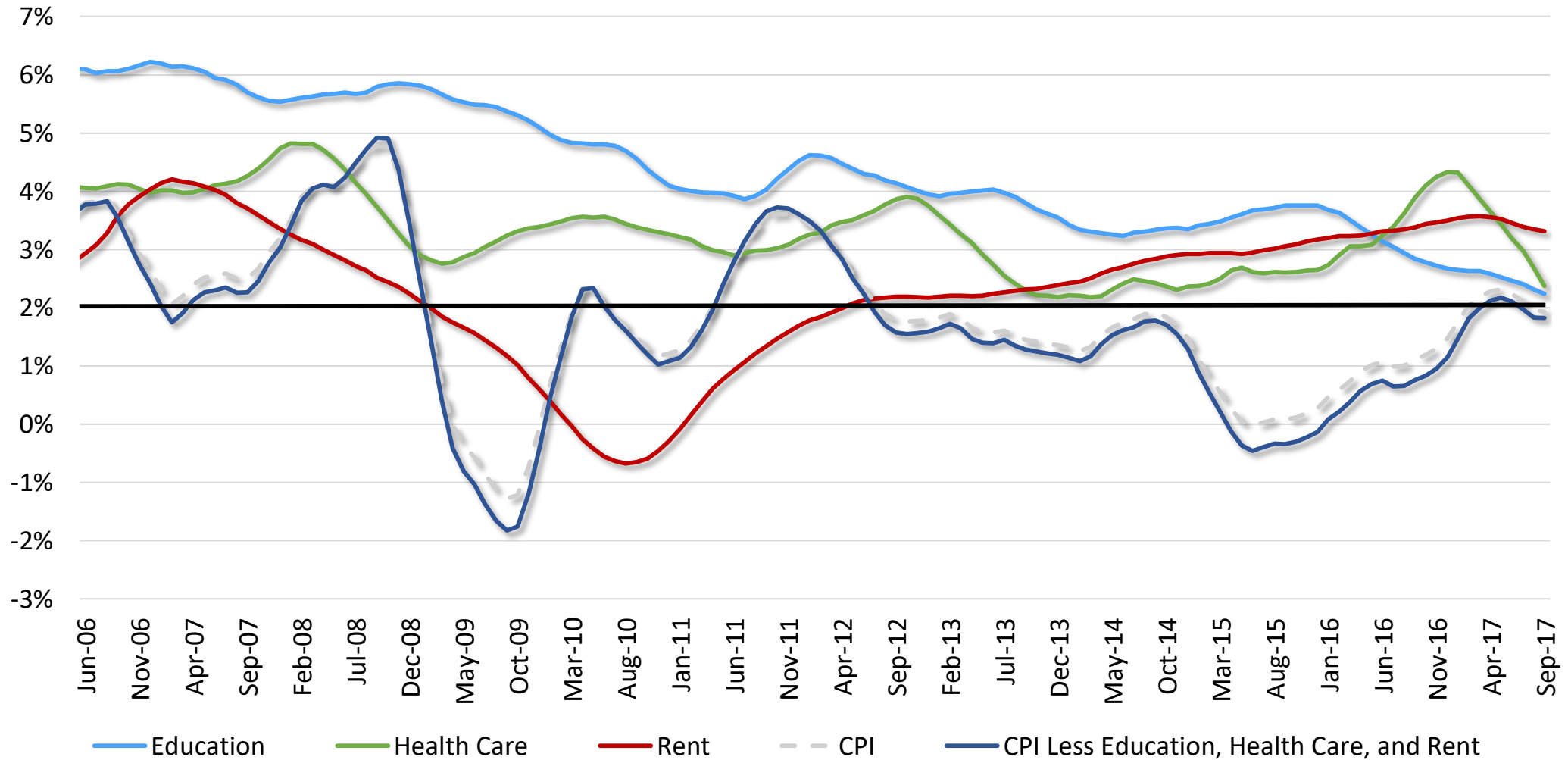
+16.9 Million*

84 months of continuous gains
Monthly average: 194,000 jobs

*Through September 2017

Source: Bureau of Labor Statistics (BLS)

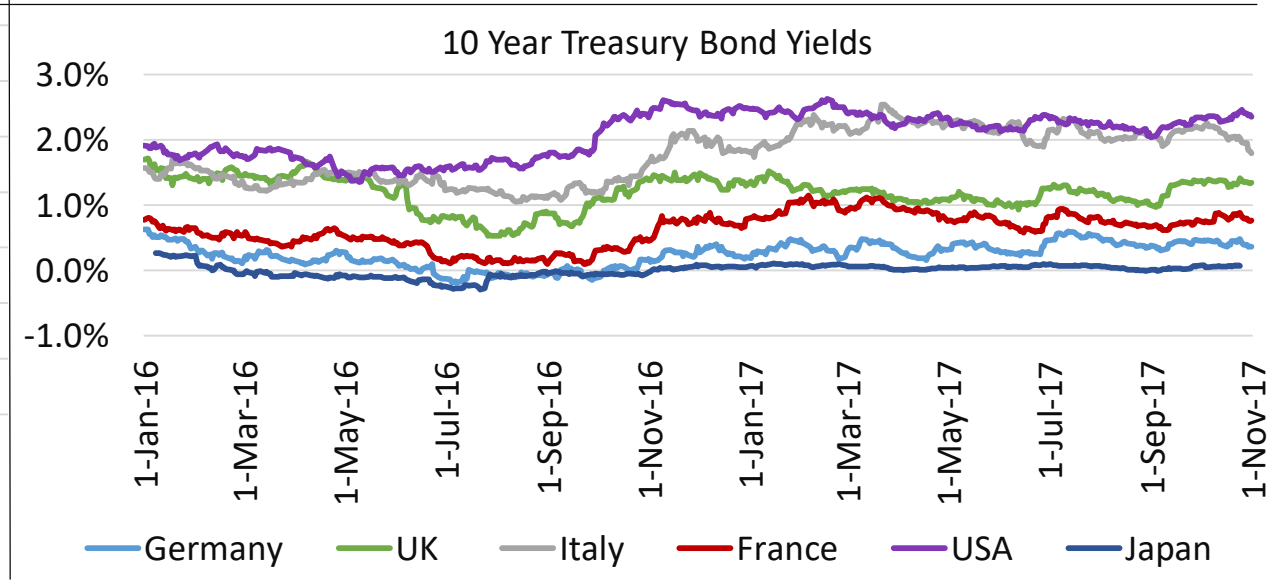
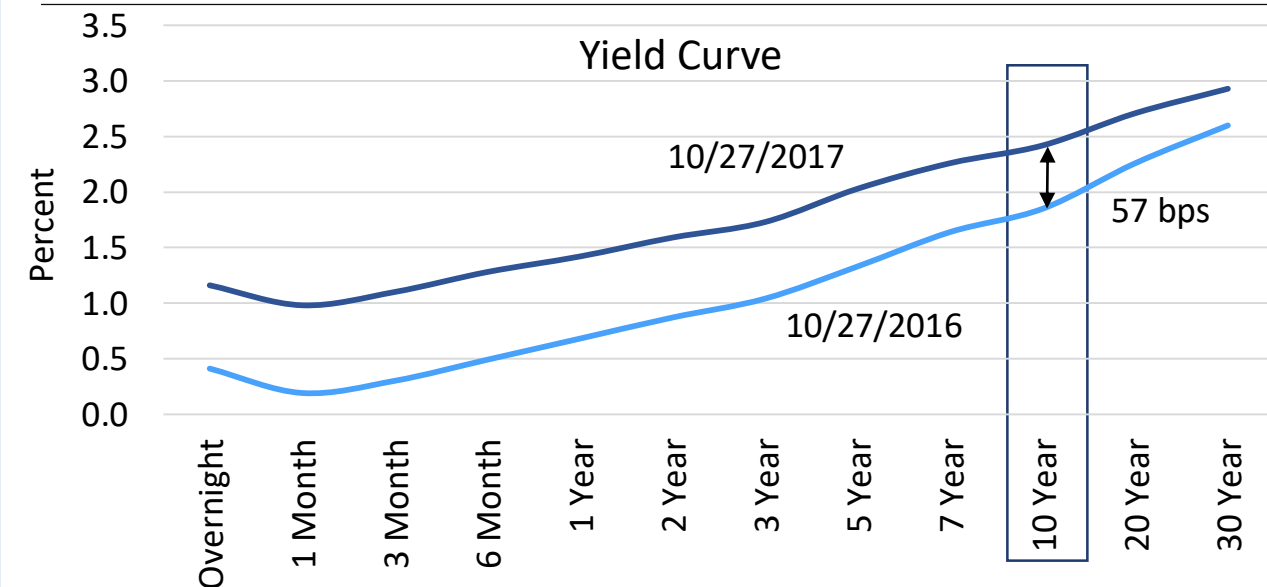
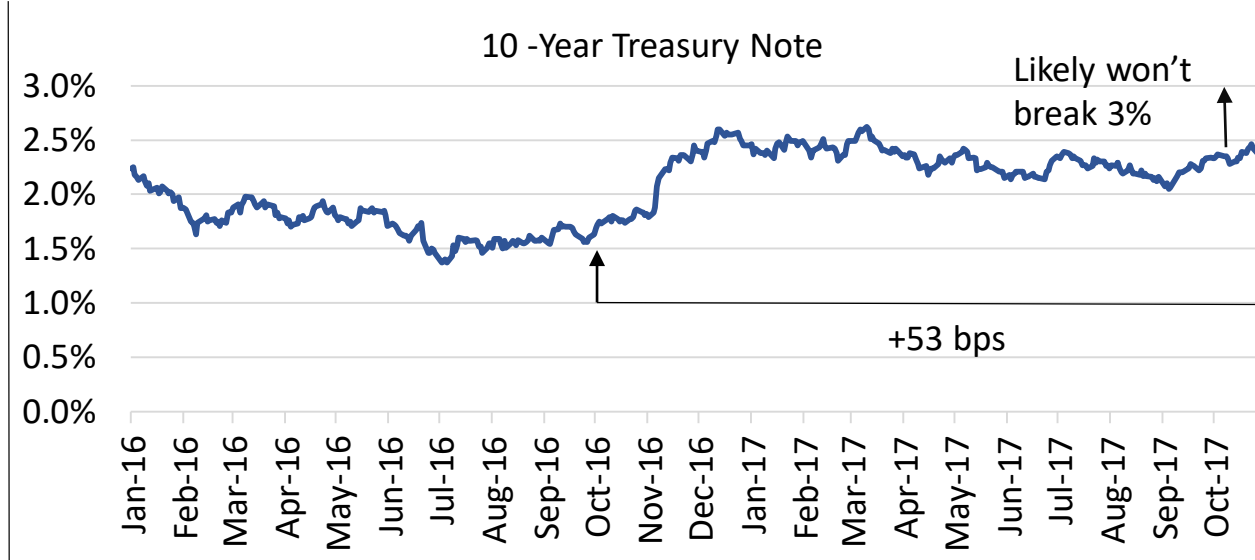
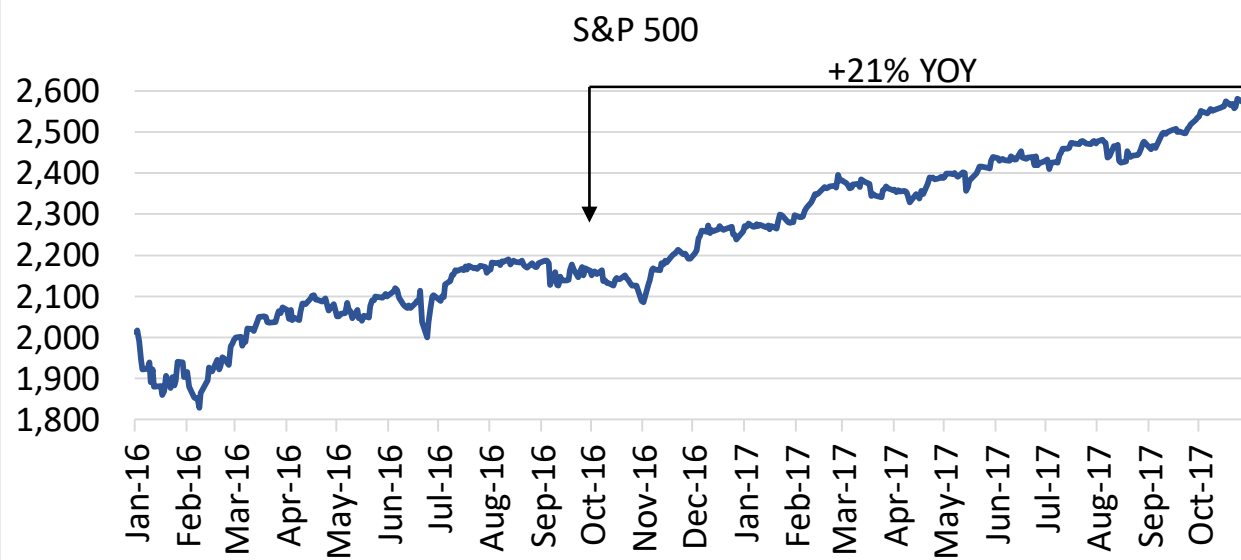
Inflation Rising, But Unlikely to Break Out >2.5%



*Growth numbers are YOY 6 month moving averages. CPI Less Health Care, Education and Rent is an estimate using the BLS document "Math calculations to better utilize CPI data"

Source: Moody's Analytics; Bureau of Labor Statistics (BLS)

U.S. and International Financial Market

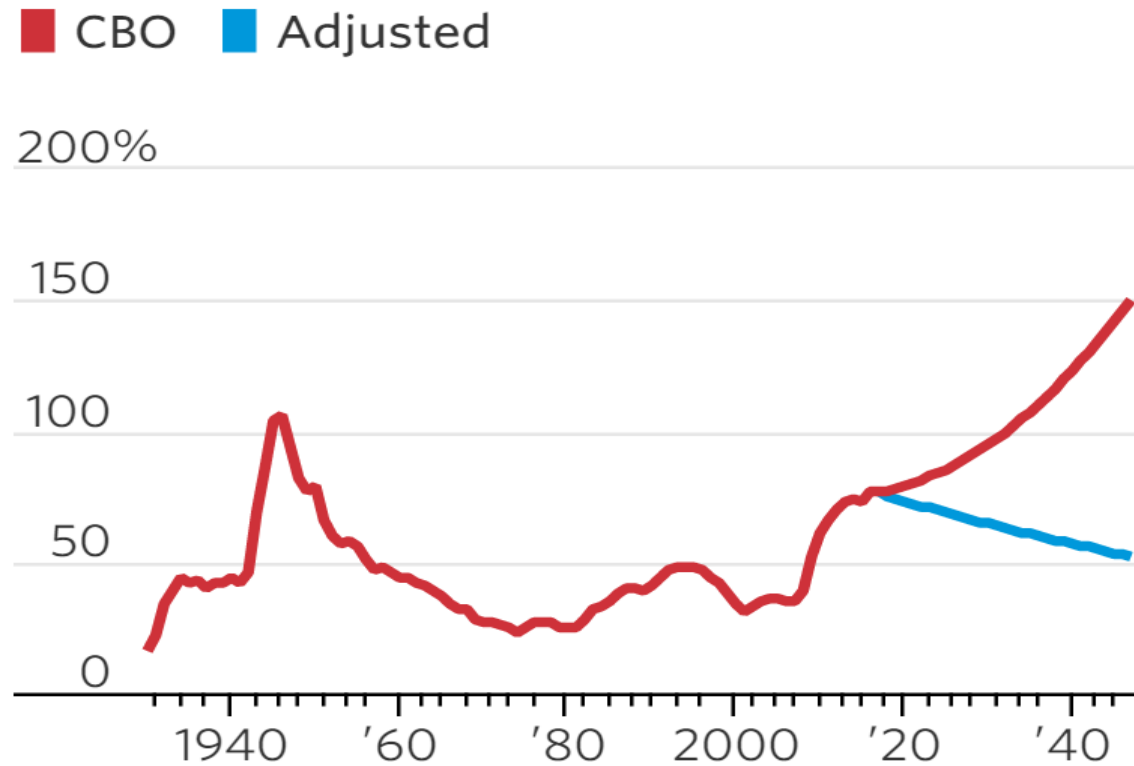


Source: Moody's Analytics; Investing.com



It's Not All Sunshine and Roses...

- Raising long-term GDP growth from 2% to 3% drives just about everything
 - US government debt, equity markets, corporate debt, etc.
 - That's what matters



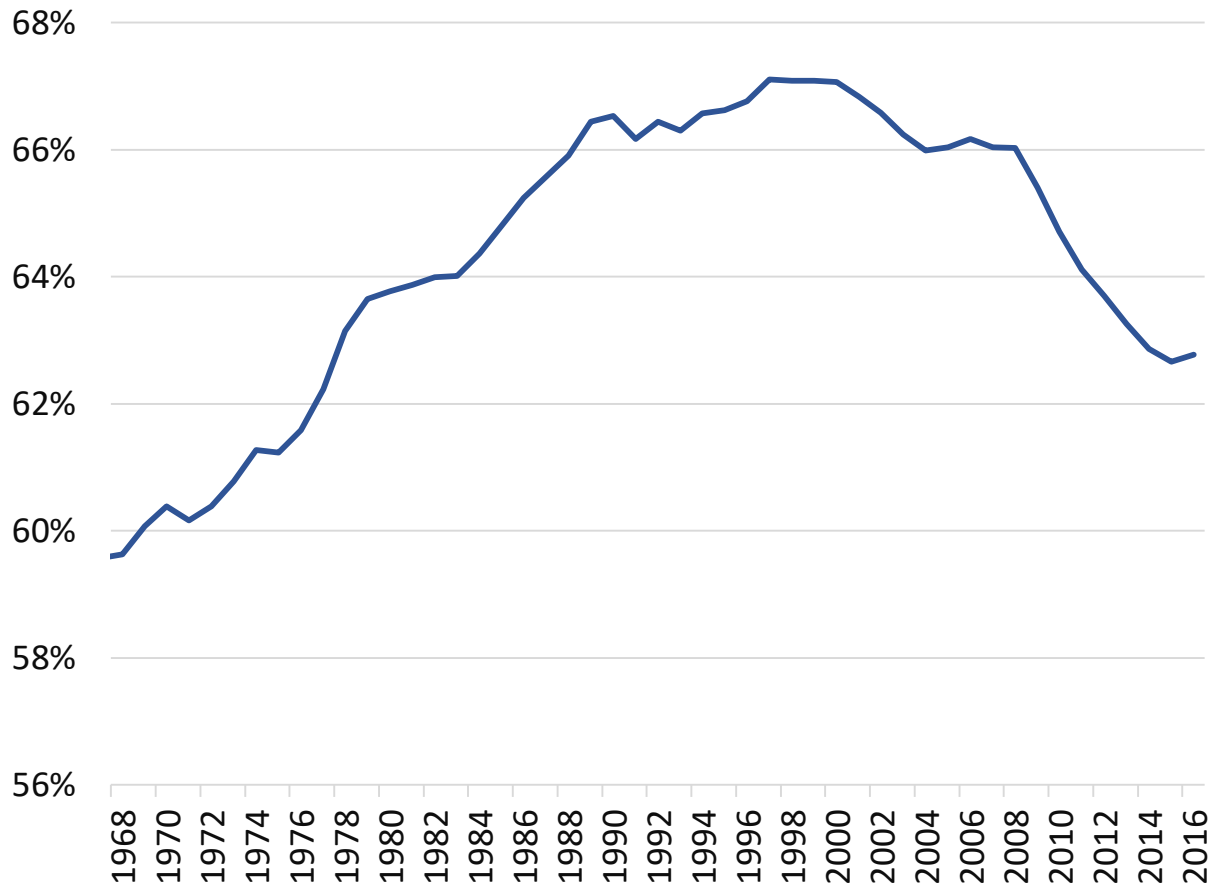
How do we get there? 3 Levers to Pull

1. Population Growth = +0.8%
 2. **Labor Force Participation Rate = +1.4%**
(if rate grows from 62.9% to 64%)
 3. Productivity Growth = +1.3%
- Real GDP Growth =>3.0%

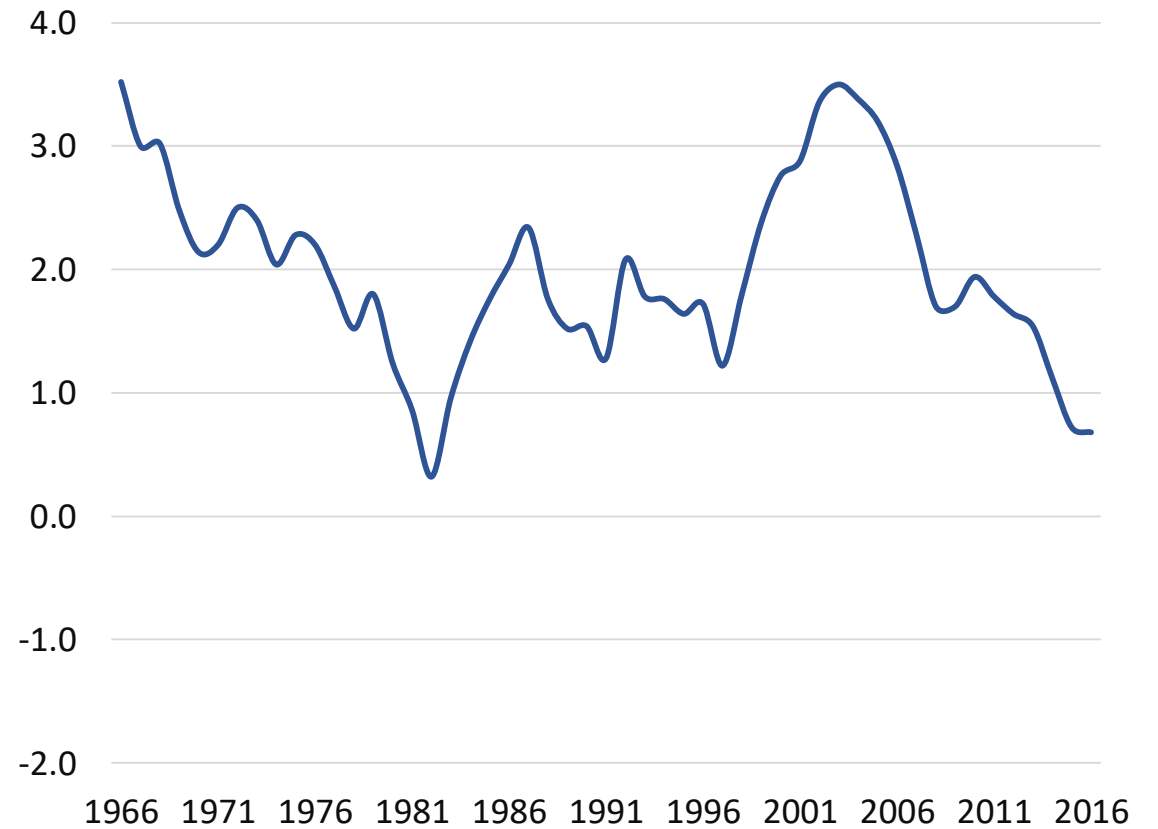
Getting U.S. GDP to Grow Means Swimming Upstream

Where will U.S. GDP growth come from?

Labor Force Participation Rate



Labor Productivity Annual Change
Nonfarm Business Sector

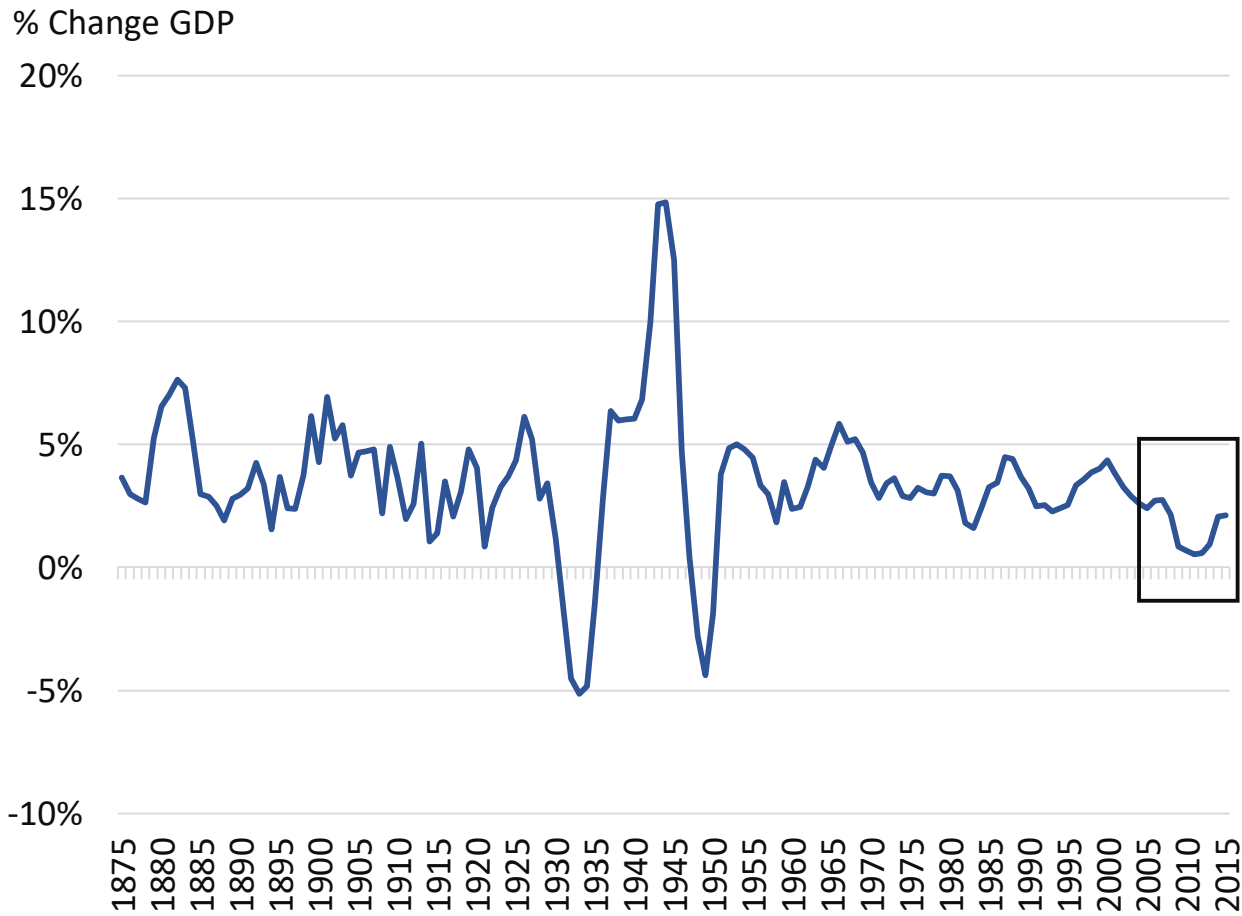


*Through December 2016

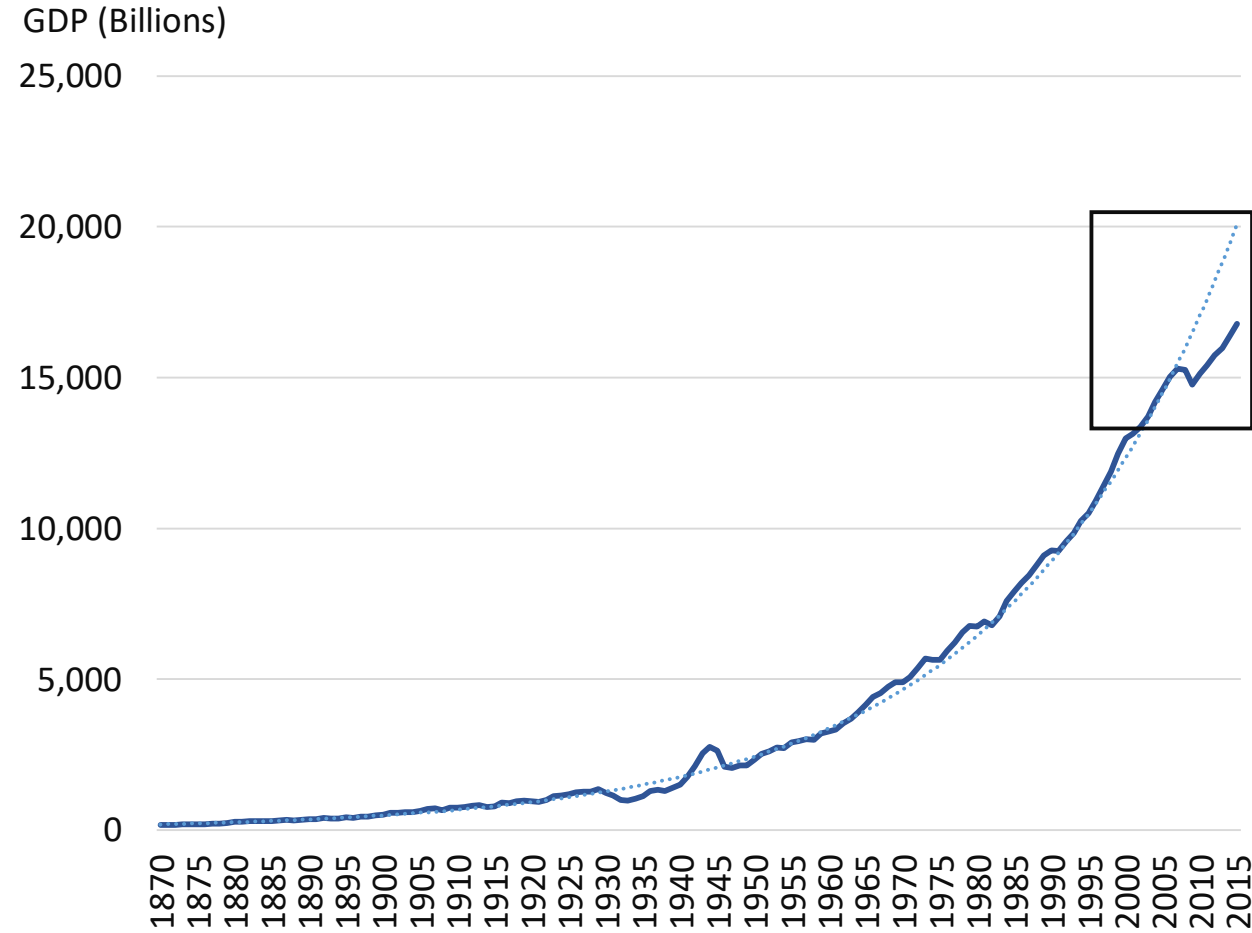
Source: Moody's Analytics; Bureau of Labor Statistics (BLS)

GDP Has Been Slow to Recover, Feels Like the 1930's

Currently in a Slow-Recovery Period

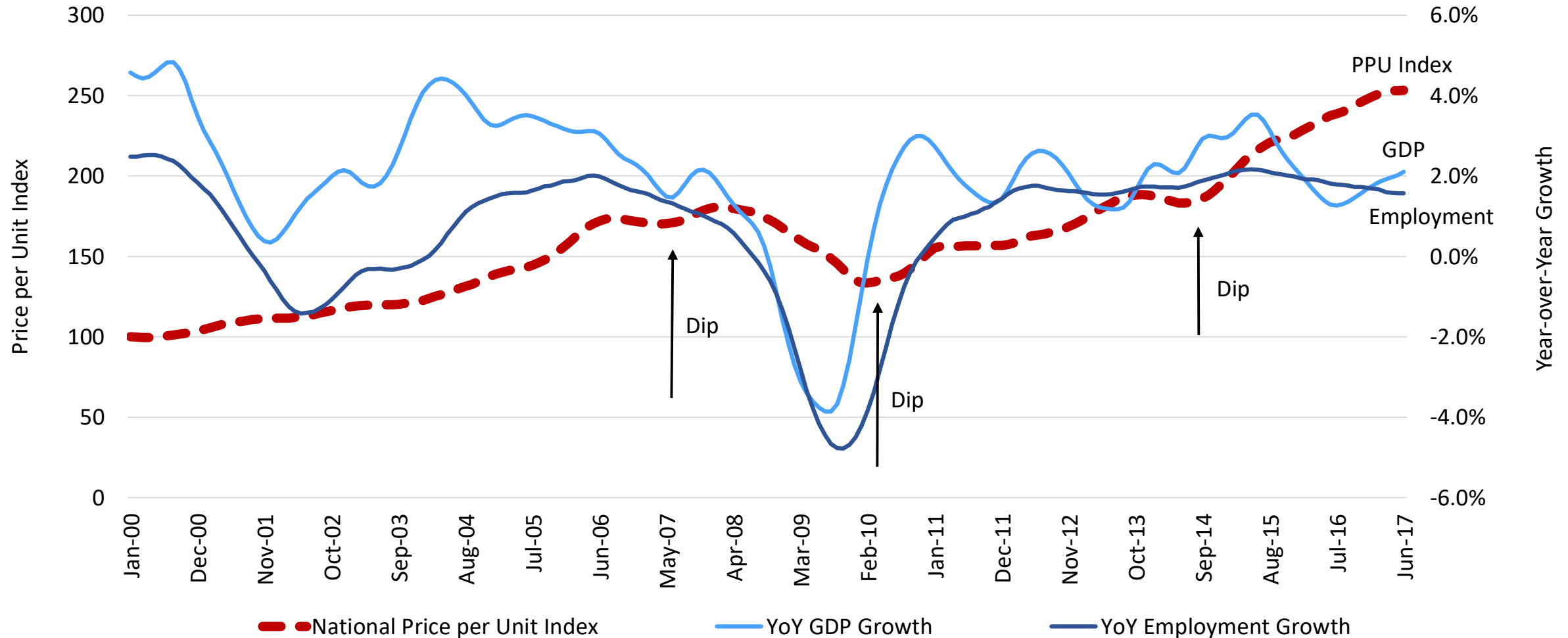


GDP Falls Short of Trend line



*Percent change GDP figures are YOY 5-year moving averages

GDP and Employment: Precursors to Multifamily Values

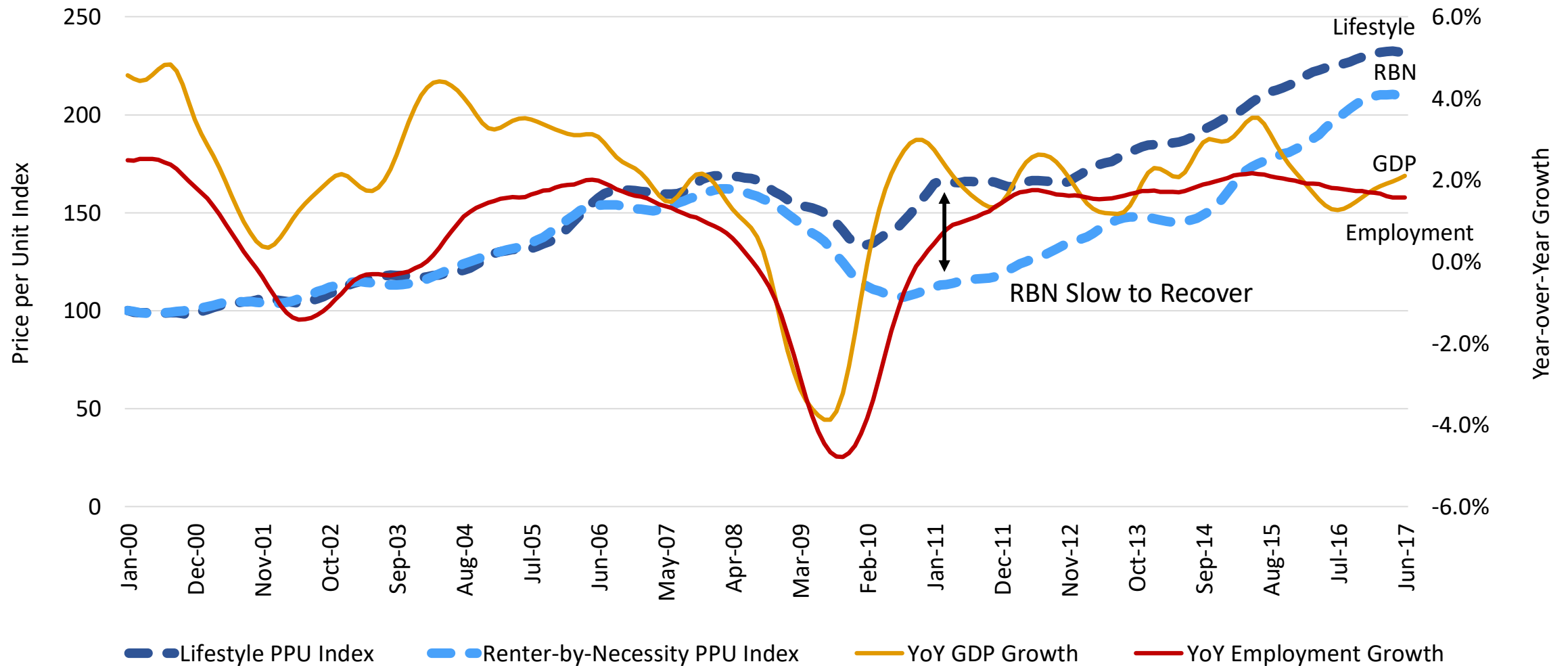


*Variables above are 6-month rolling averages

*Multifamily sales price per unit-index 2000 = 100

Source: Moody's Analytics; Yardi®Matrix

Lower Asset Classes Most Affected by Economic Factors



*Variables above are 6-month rolling averages

*Multifamily sales price per unit-index 2000 = 100

Source: Moody's Analytics; Yardi®Matrix

Economic Structure Transition Problems

Composition of recent job gains enabled by duration of expansion

GOOD:

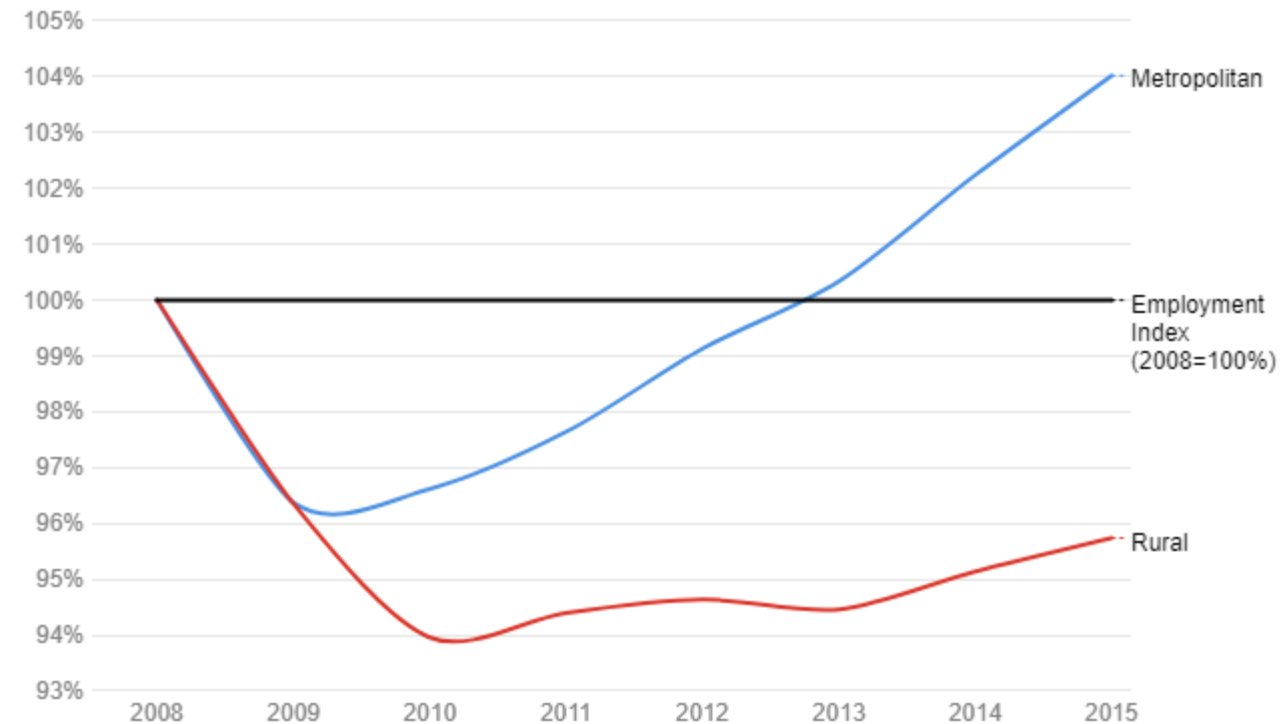
- Coming from the lower-end
- Pulling people off the sidelines

BAD:

- Heavily concentrated around large metros with intellectual capital nodes
- Isolating rural Americans, leading to rural poverty

Job growth in America

Since 2008, job growth in metropolitan areas has outpaced that in rural areas.

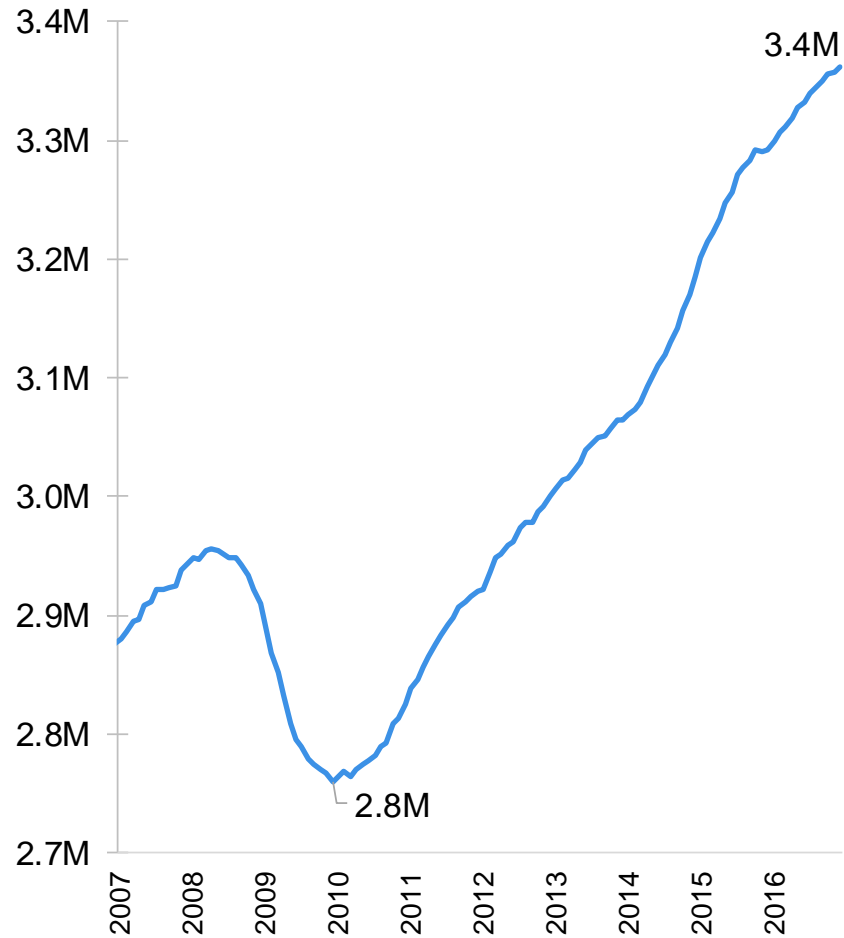


The Conversation, CC-BY-ND

Tech Employment Up, But Growth is Slowing

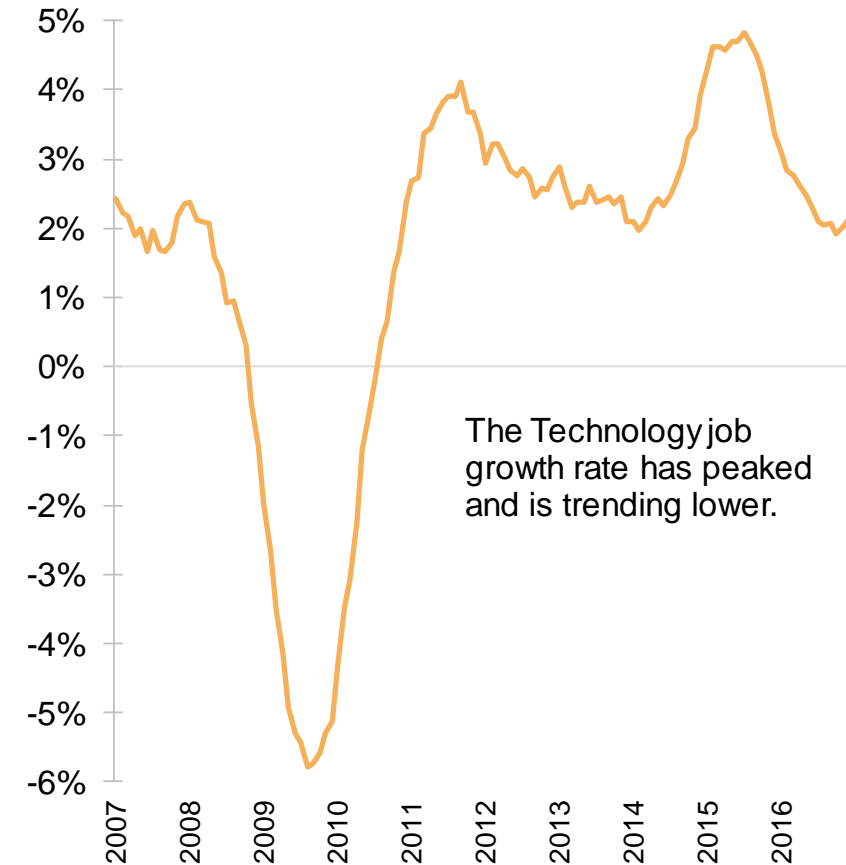
Employment up since bottoming in late 2009, but job growth is slowing

Technology Sector Employment



Technology Sector Employment

YOY growth



The Technology job growth rate has peaked and is trending lower.

*Technology jobs are defined as Bureau of Labor Statistics (BLS) NAICS codes:

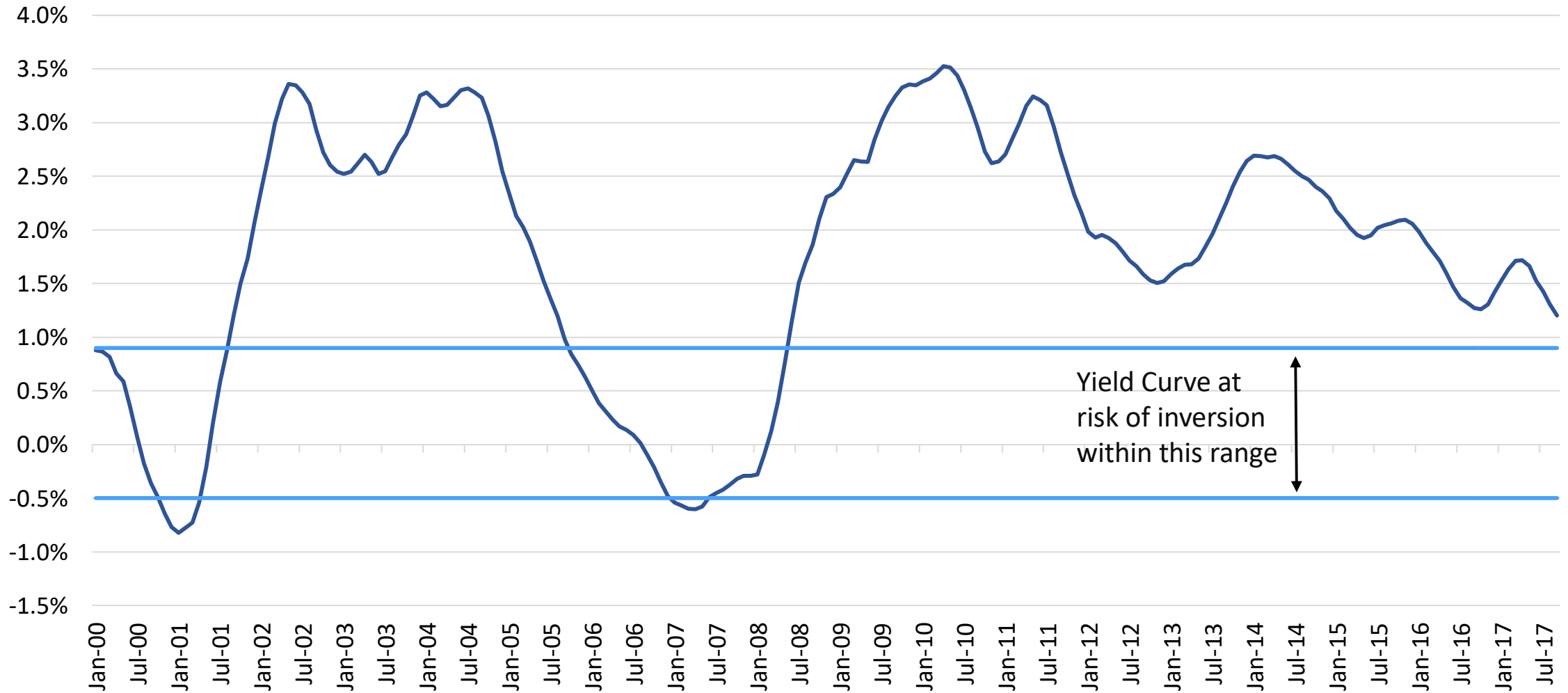
Computer and Electronic Products, Data Processing & Hosting, Computer Systems Design and Related Services

Source: John Burns Real Estate Consulting, LLC; Bureau of Labor Statistics (BLS) (Data: Dec-16, Pub: Feb-17)

Watch for These 5 Signs that Presage a Recession

1. Average Hourly Earnings Growth goes from 2.5% to 4.0%
2. Cyclical Sector Share of GDP moves from 24% to 28% of GDP
3. GDP Deflator moves from <2.0% to 2.5%
4. Operating Capacity Utilization Rate moves from 76% to 80%
5. Yield Curve Inverts (10 Yr treasury rate less Fed Funds Rate) from +90bp to >-50bp

Until the Yield Curve Inverts, No Need to Worry



*Data is based on 6-month rolling averages

— Spread Between 10-Yr Treasury and Federal Funds Rate (%)

Source: Moody's Analytics; U.S. Board of Governors of the Federal Reserve System (FRB)

U.S. Federal Policy Mix is Mildly Pro-Growth

Pro-Growth

- Regulatory Relief
- Executive Orders
 - Energy
 - Finance
 - Labor Costs



Generally Positive
Progress

Pro-Growth but Slow

- Tax Reform
- Healthcare Reform
- Infrastructure
- Education Reform
- German Model



Progress in Tone,
but Not Yet
Substantive

Anti-Growth

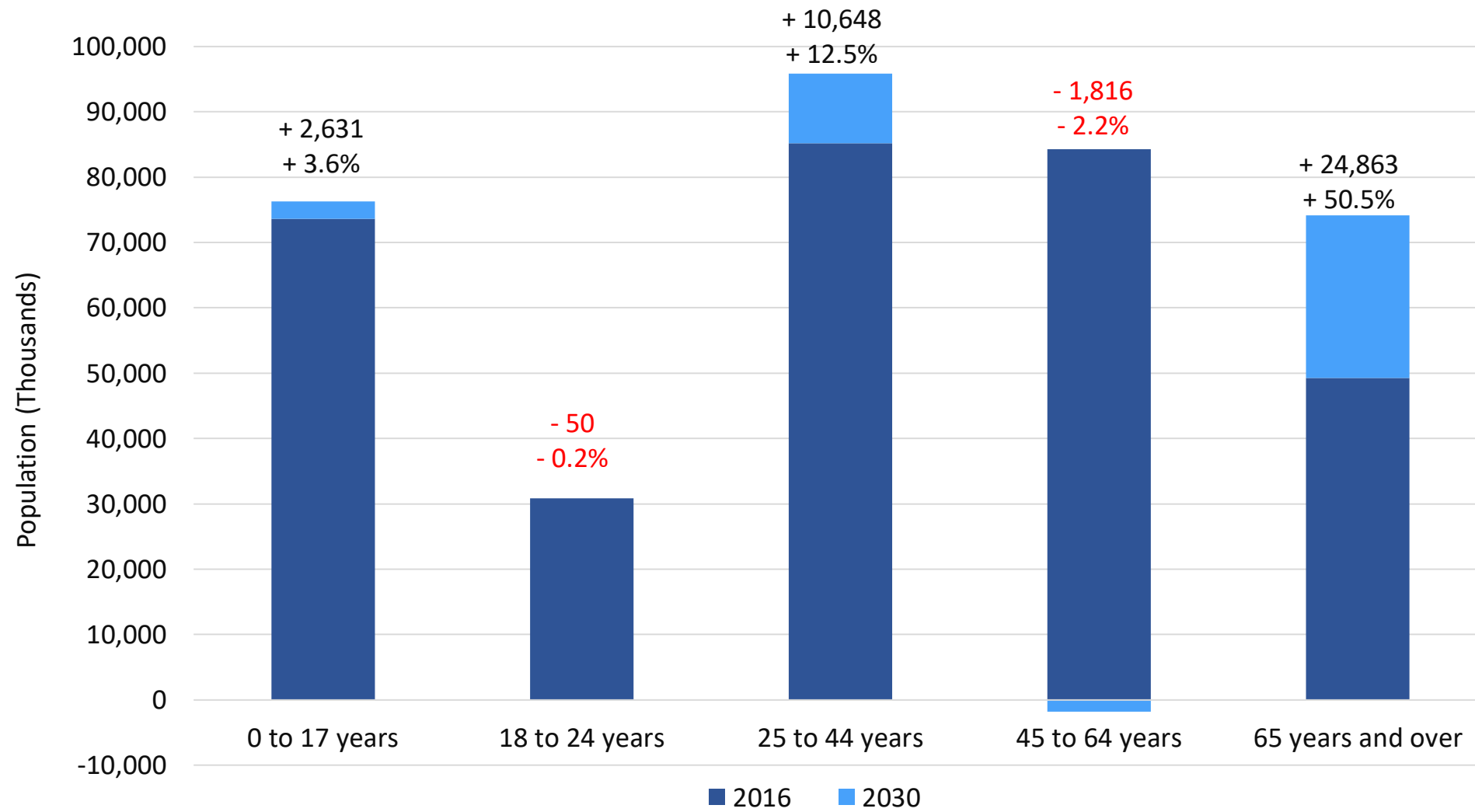
- Immigration Control
- Trade Renegotiation



Noise but Some
Derivative Impacts

Demand Trends

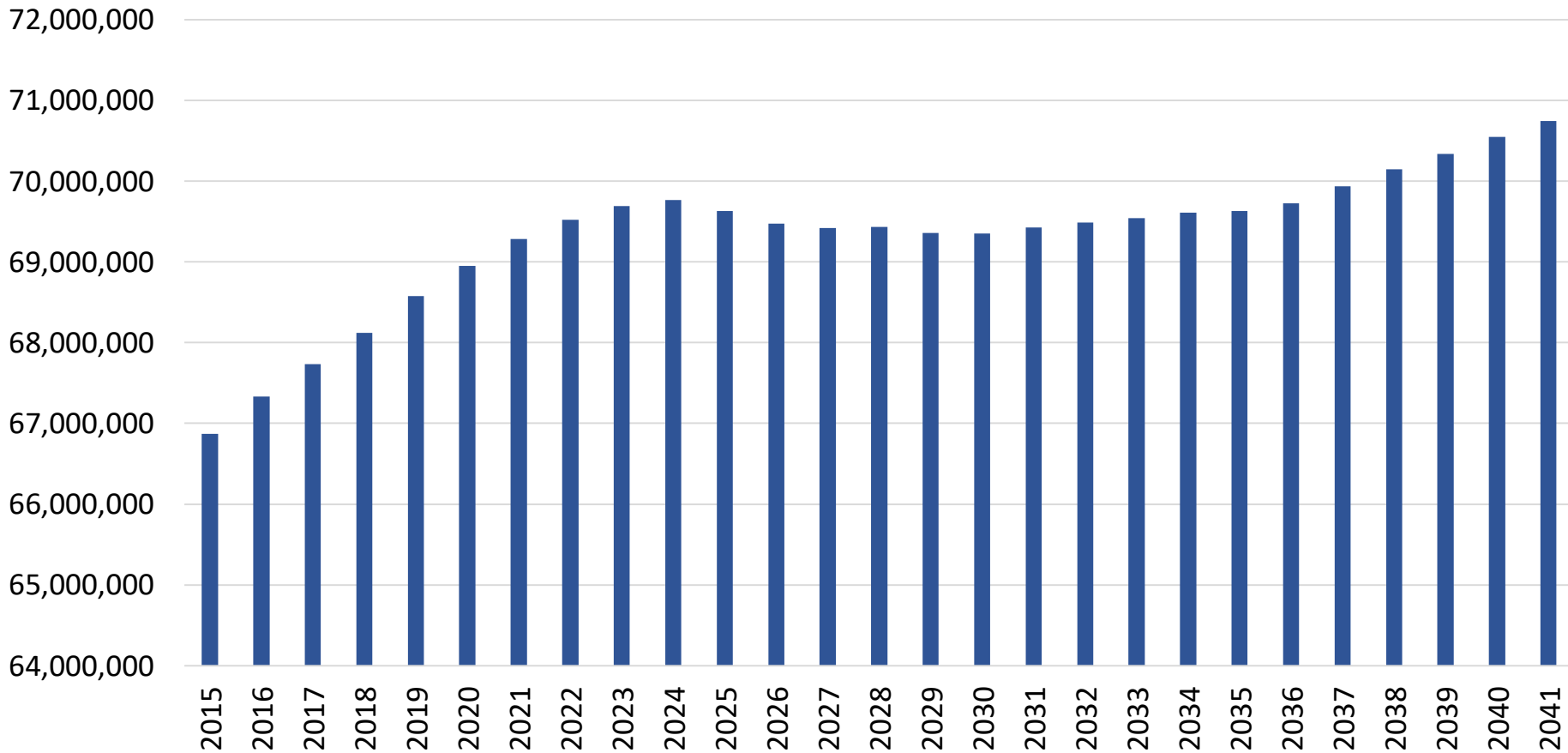
Age Cohorts Today vs 2030



Renter Population is Expected to Grow

Demographics are in multifamily's favor over the long-term, especially in the younger aged cohort...

U.S. Renter Population: Age 20-34 Cohort

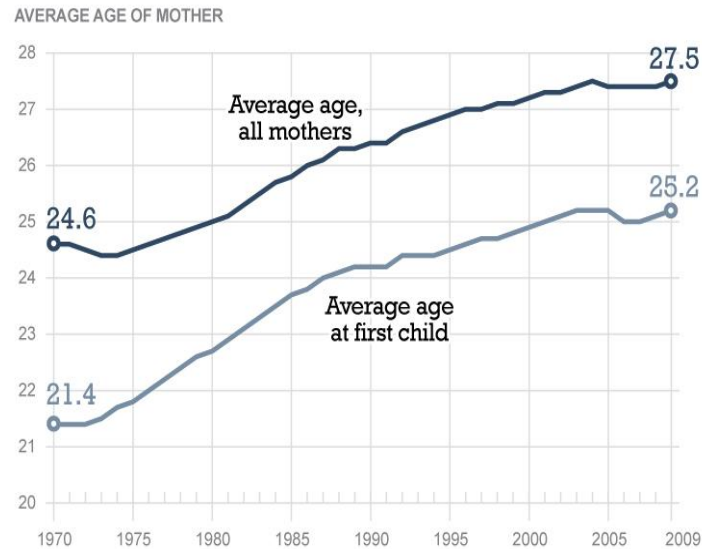


Millennial Tailwinds

FACT:

The average age of first-time mothers has steadily increased

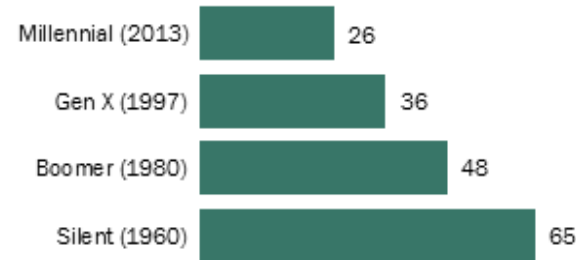
Since 1970, the average age of mothers giving birth to their first child has increased from 21 to 25. For all births, the average age of the mother has increased by about three years over this same period.



Source: National Center for Health Statistics, National Vital Statistics Reports, 2011.

The Decline in Marriage Among the Young

% married at age 18 to 32, by generation

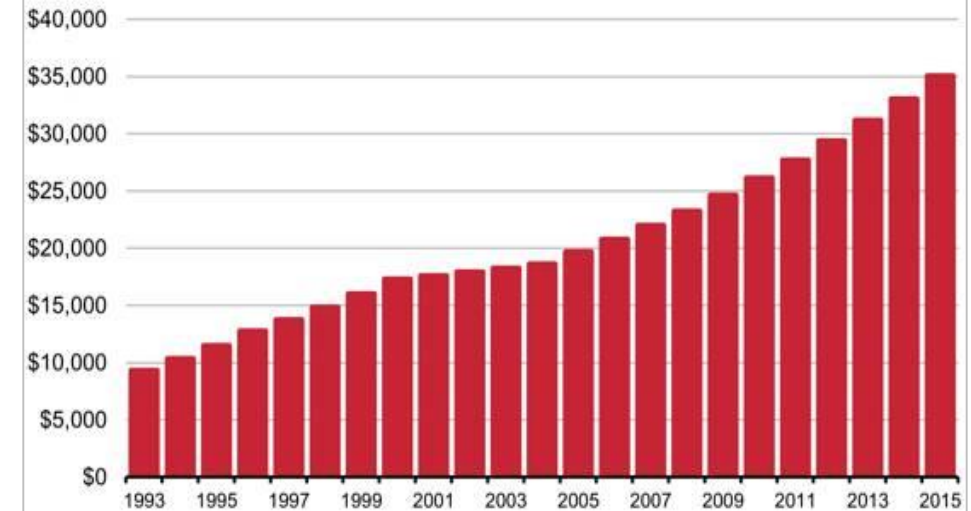


Source: Data from 1980, 1997 and 2013 are from the March Current Population Survey, 1960 data are from the 1960 Census

PEW RESEARCH CENTER

Head of the Class

Average debt per borrower in each year's graduating class



Source: Mark Kantrowitz | WSJ.com

CAGR Comparison

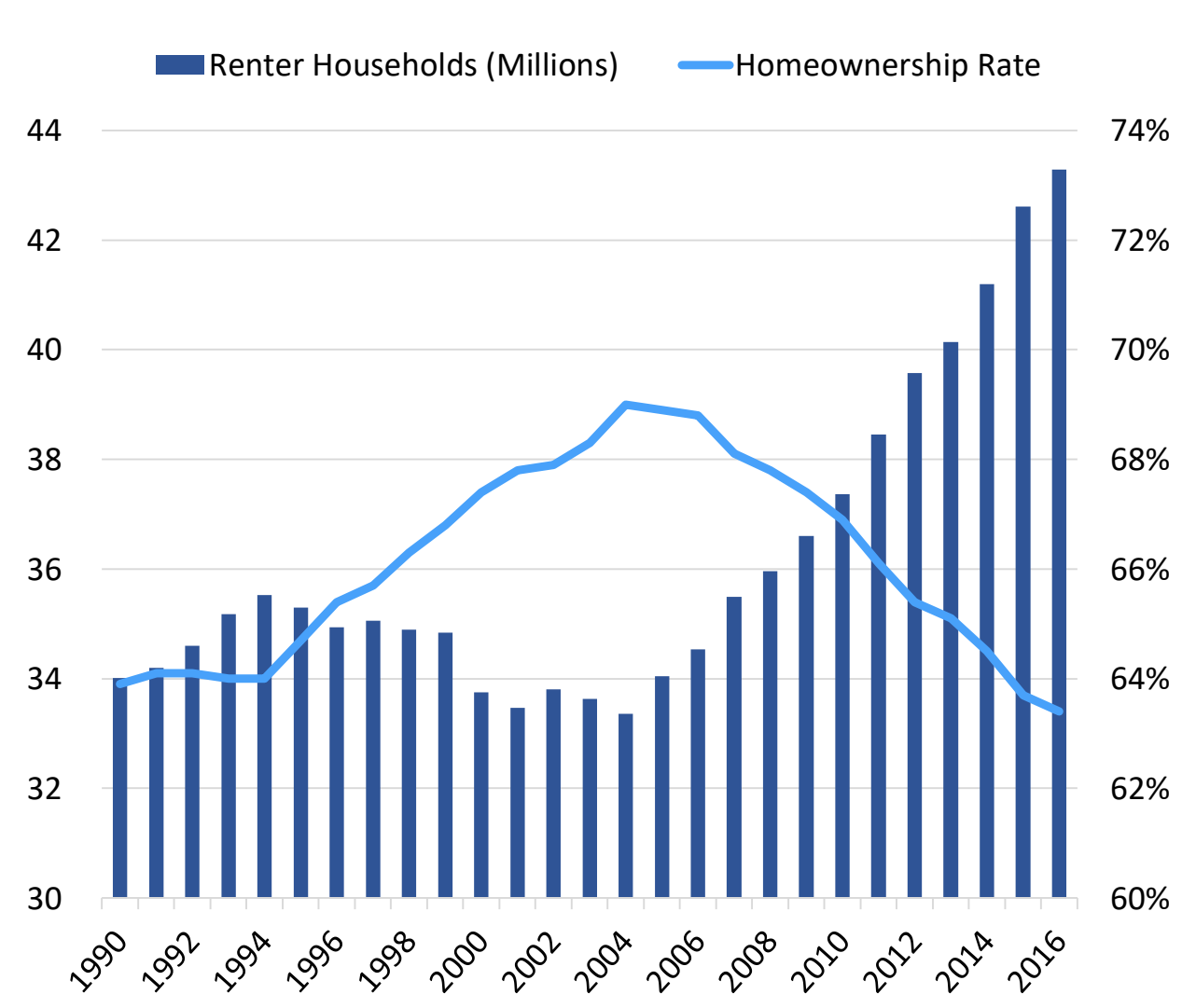
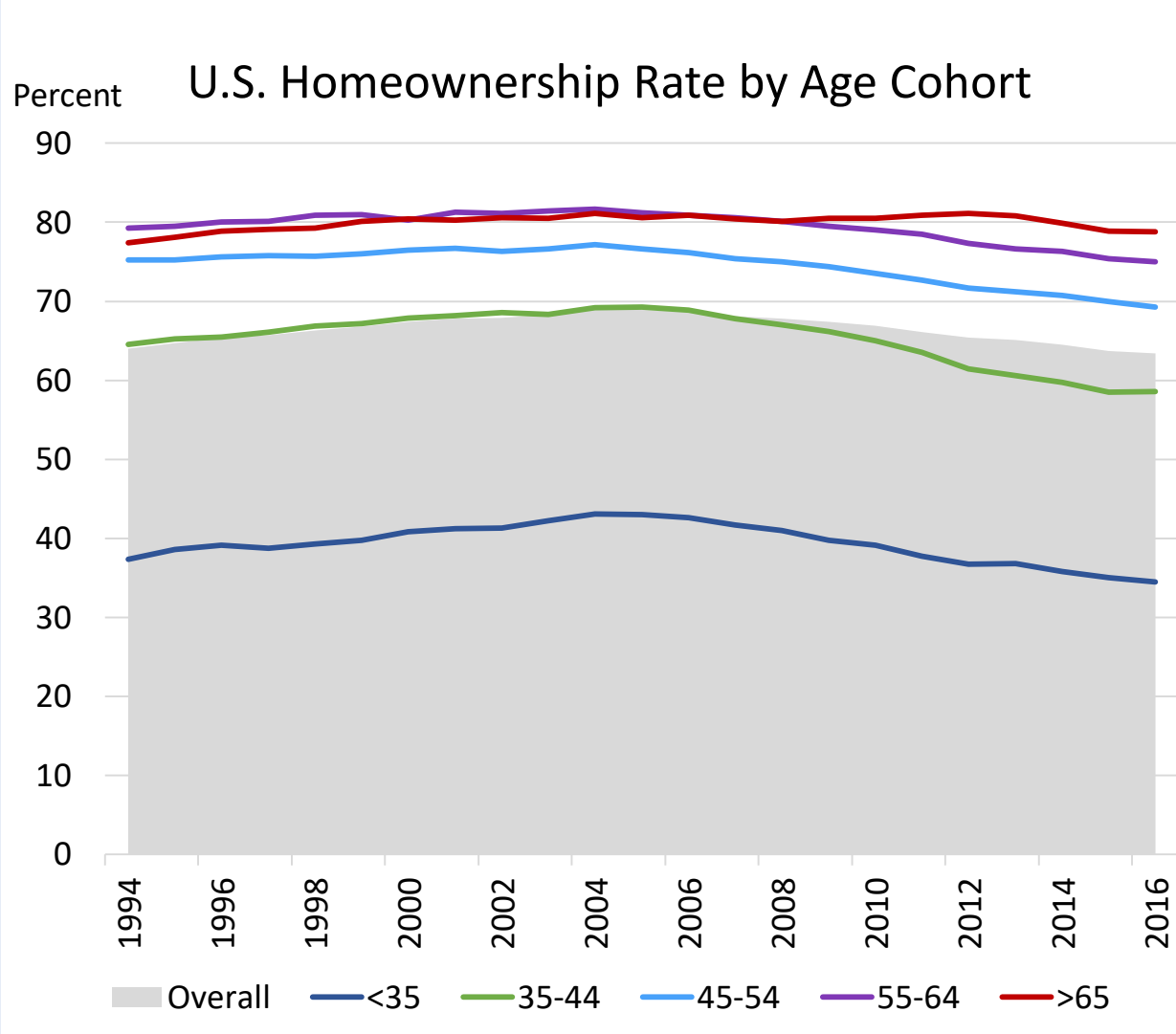
Student Debt Med HH Income*

5.8%

0.1%

*College Educated

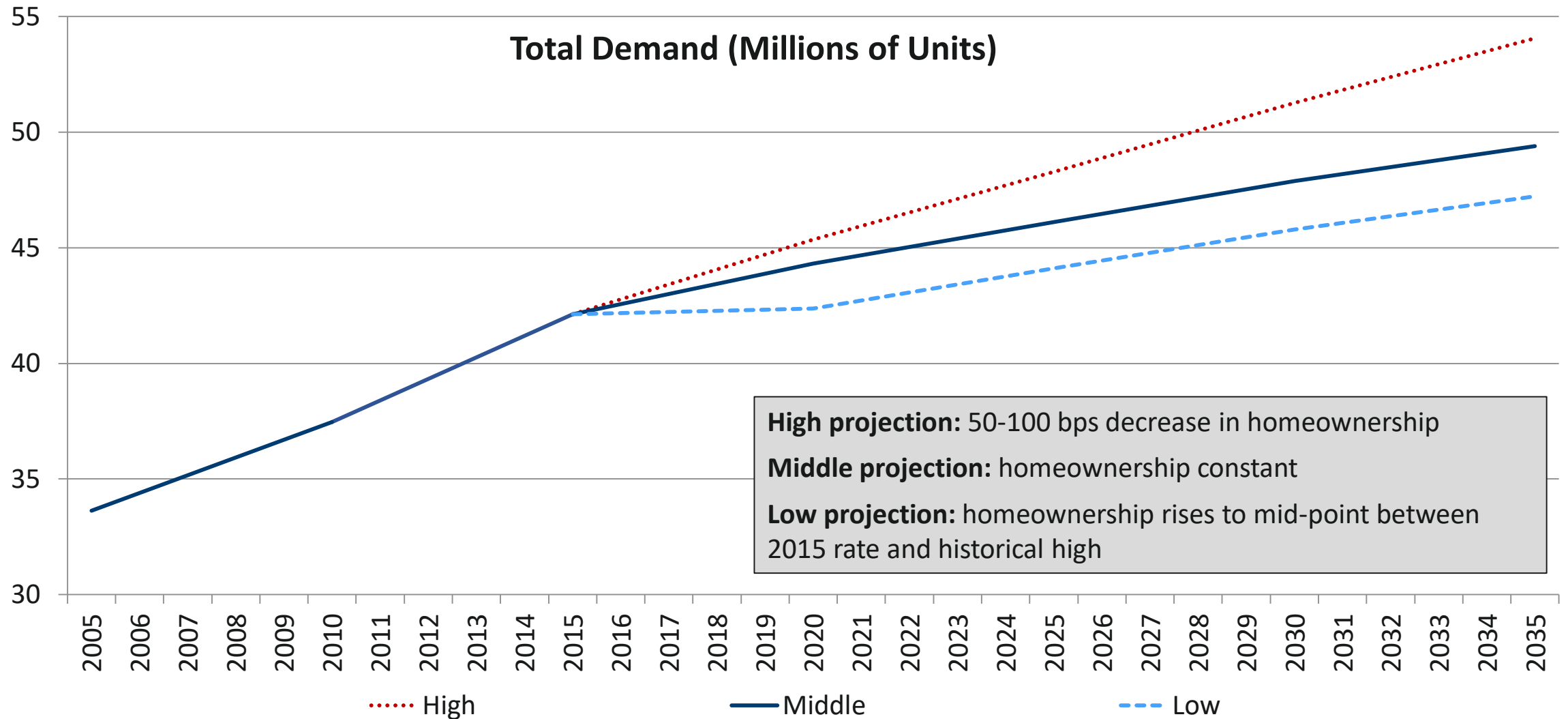
Homeownership Rates Leveling Off



*Beginning in 2000, renter household data are the revised, consistent-vintage counts. 2000-09 counts are 2010 vintage, 2010-15 are 2014 vintage



Future Rental Demand Looks Strong

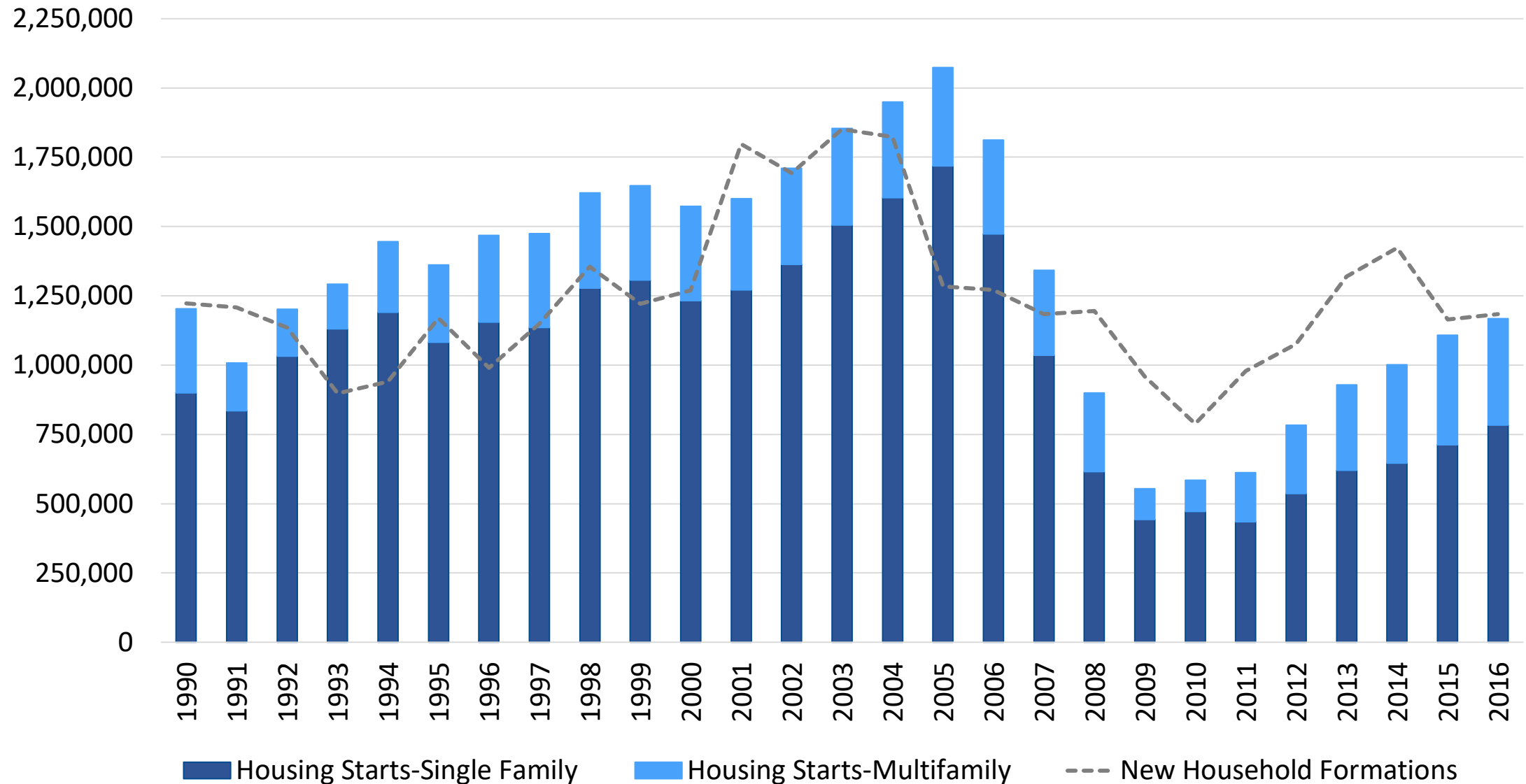


So What? Economy & Federal Policy

- Job growth overall looks good and reasonably steady – demand shock unlikely
- Inflation is range bound and unlikely to break out – either up or down
- Near term (12-24 months) pressures are building in the sectors that led us out of the last recession:
 - Technology and Healthcare – could be mitigated by pro-growth fiscal policy
- Coincides with current multifamily supply increase in some markets
- Long term demographics still look great
- Positive public policies can extend the expansion

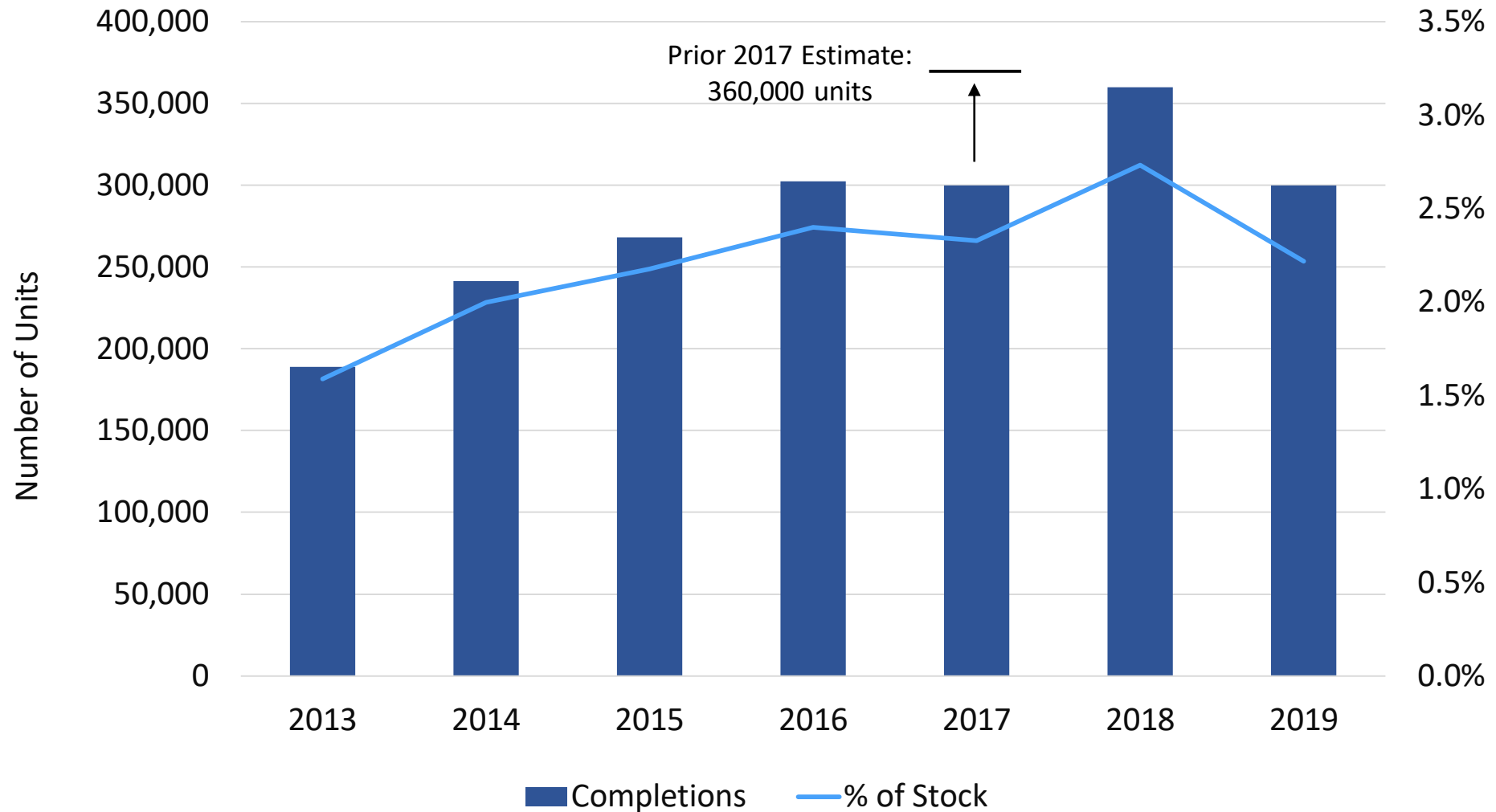
Commercial Real Estate Fundamentals

Total Housing Supply Still Lags Demand Since Recession

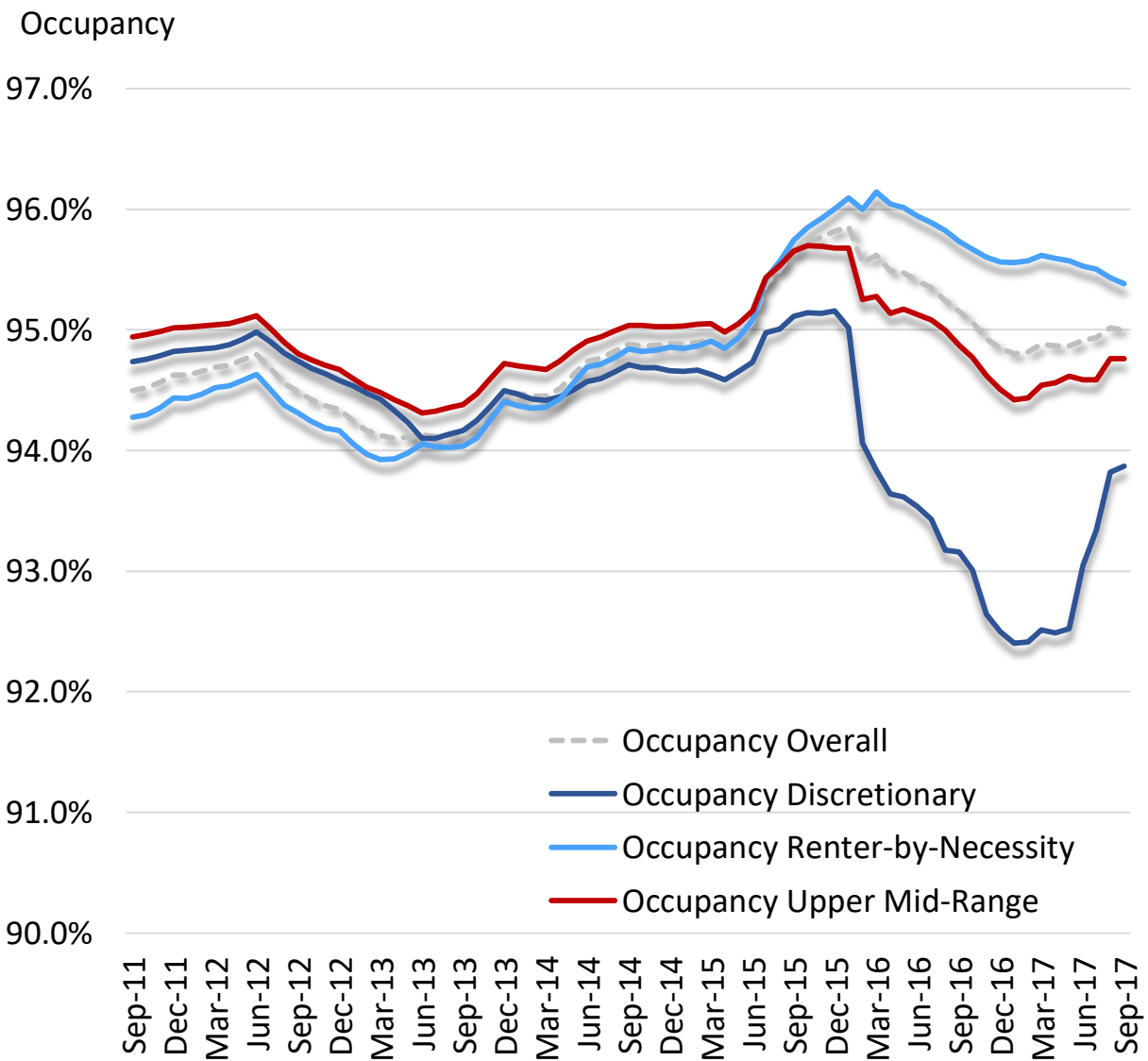
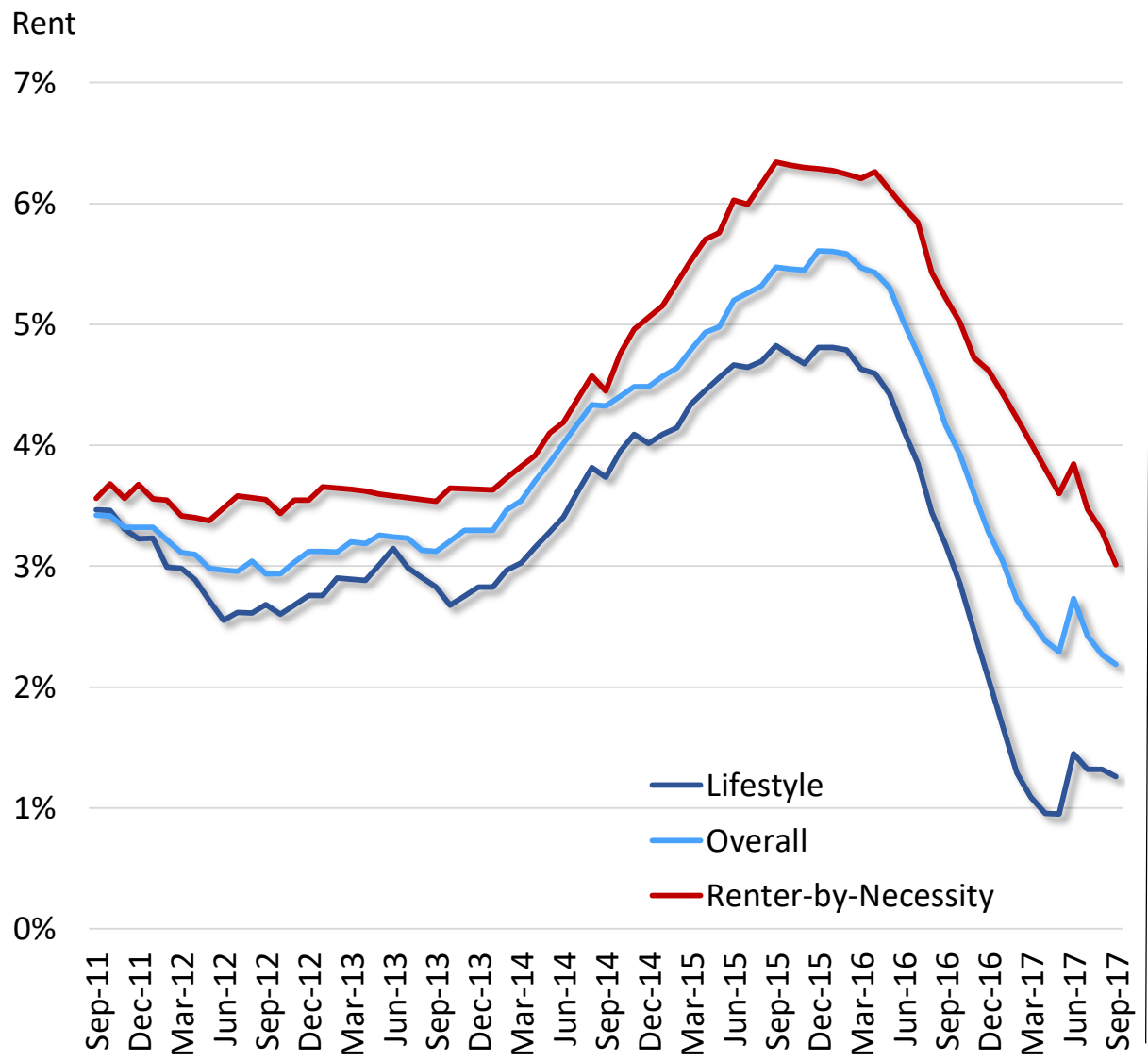


Source: Moody's Analytics; U.S. Census Bureau (BOC)

Supply Continues to Grow, but Has Leveled Due to Construction Delays



Rent Growth is Falling While Occupancy Recovers

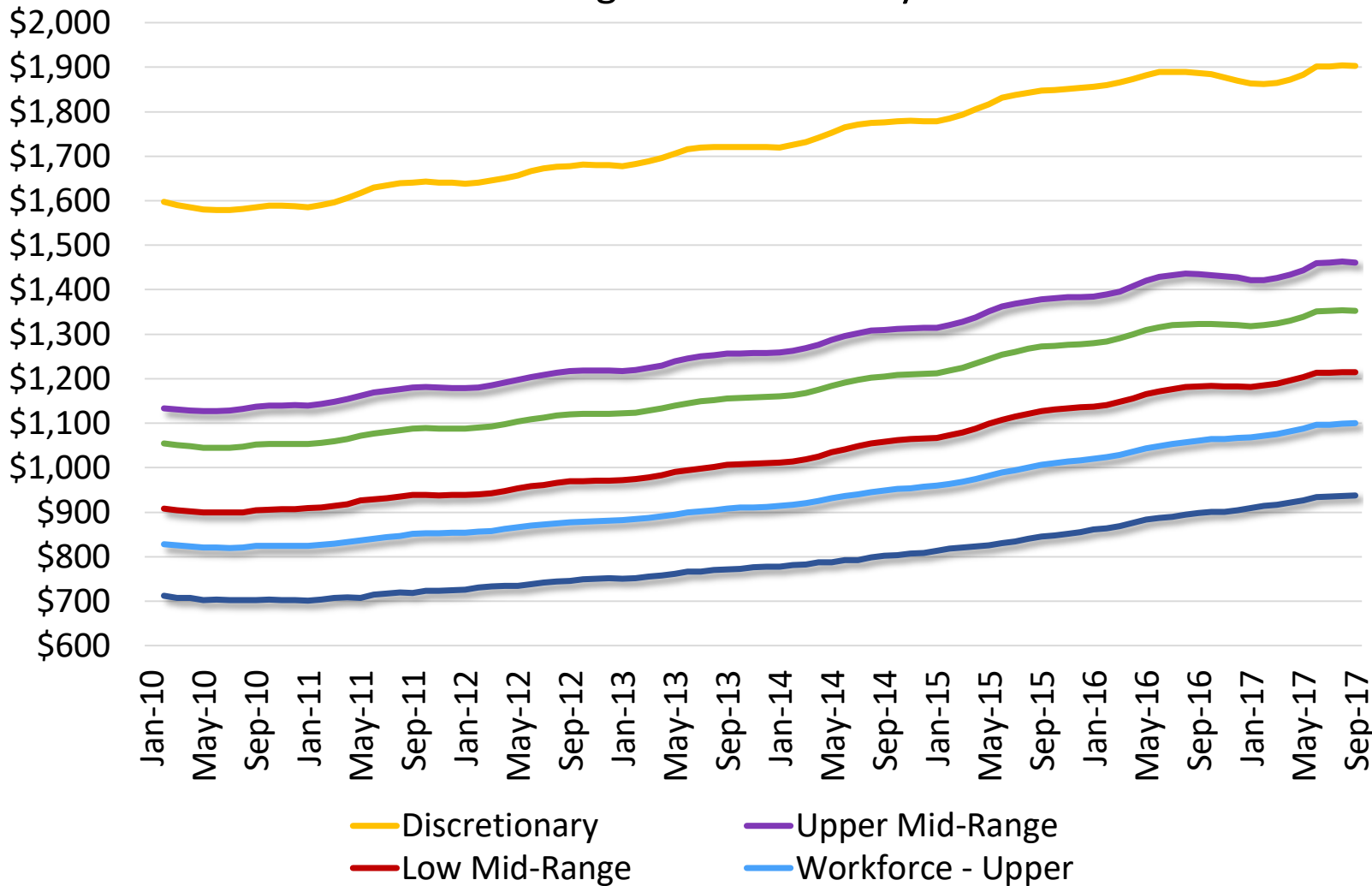


Source: Yardi®Matrix



Rent Spreads Have Rebalanced to Historical Norms

Average Rental Rate by Asset Class

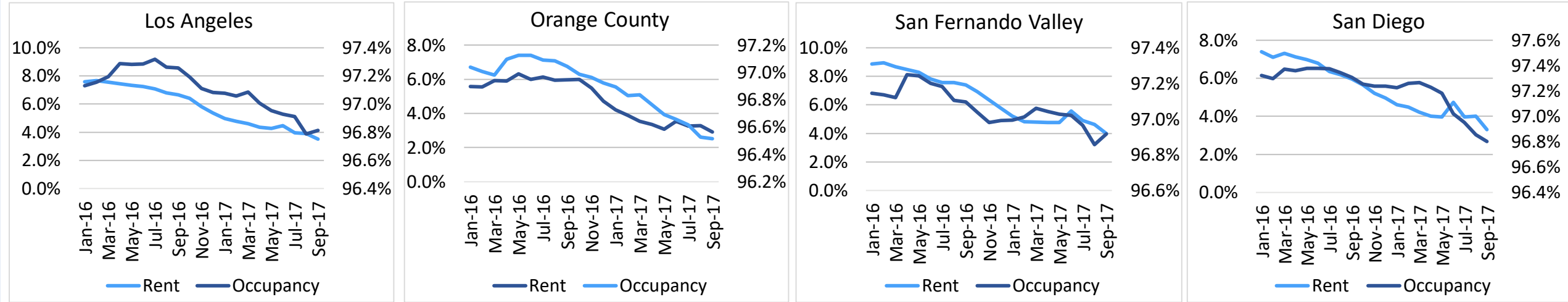


2010-2017 CAGR	
3.0%	Discretionary
4.3%	Upper Mid-Range
5.0%	Low Mid-Range
4.8%	Workforce - Upper
4.7%	Workforce - Lower
4.2%	Overall

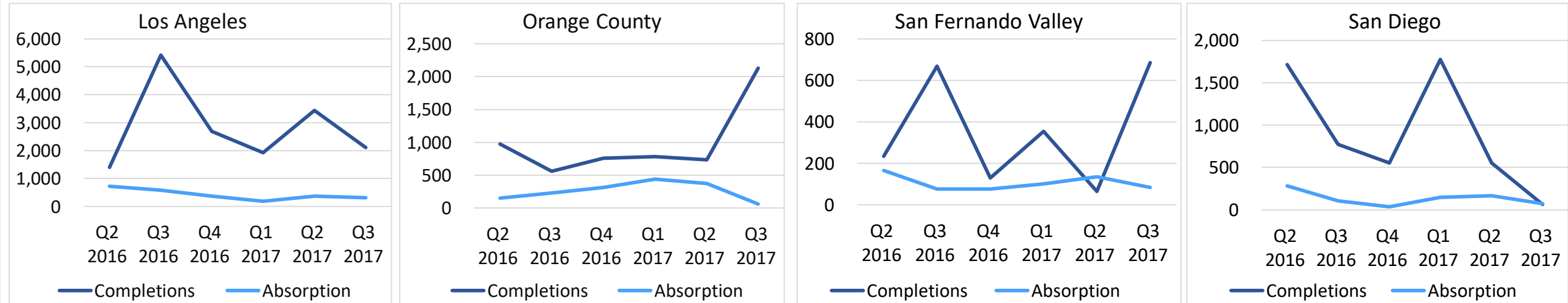
	Sept. 2010	Sept. 2017
Discretionary-Upper-Mid	\$448	\$442
Discretionary-Lower-Mid	\$680	\$688

Rent and Occupancy Trends: Southern California

Rent Growth and Occupancy

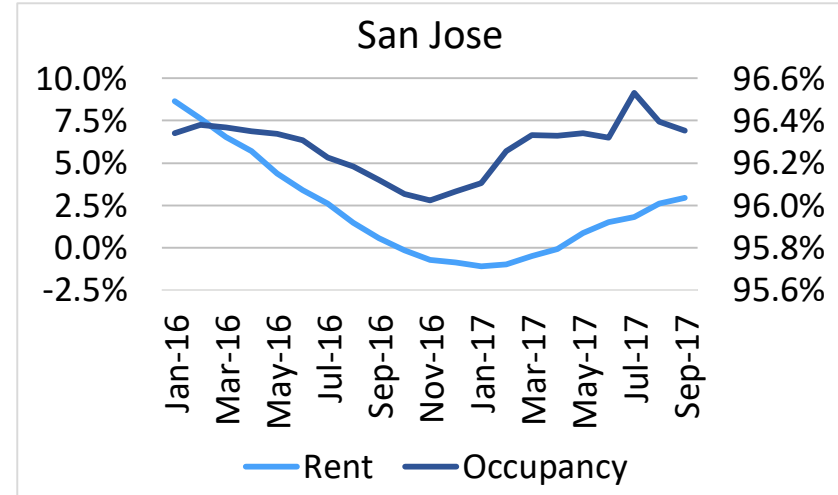
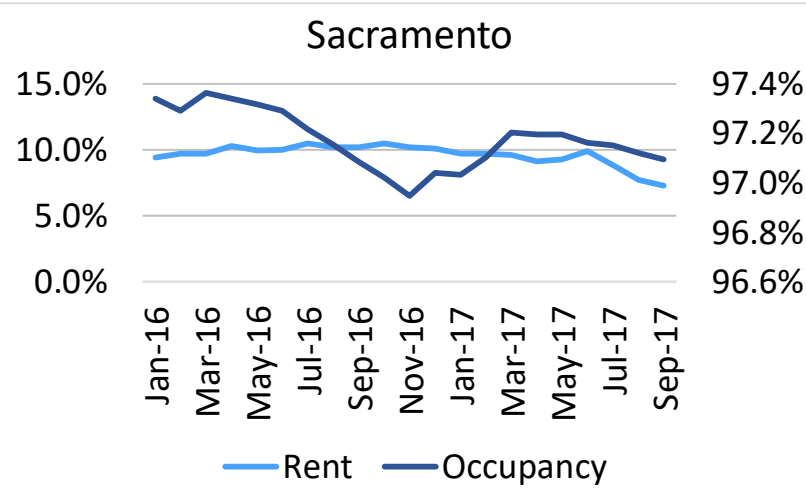
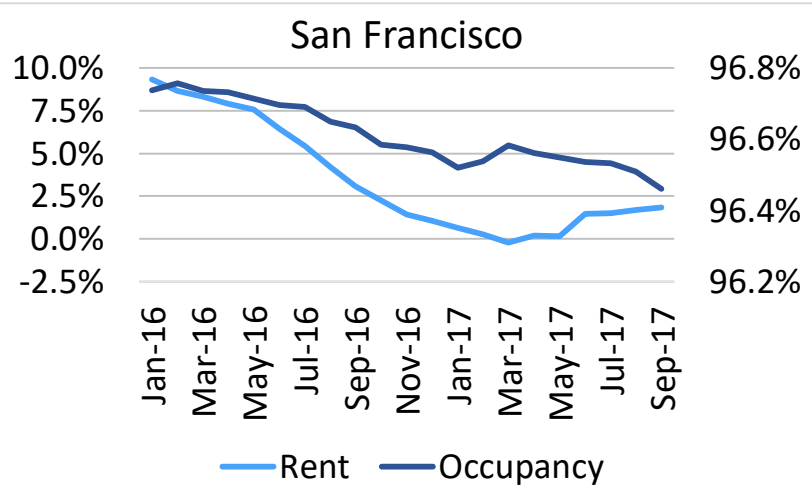


Pre-Lease Occupancy

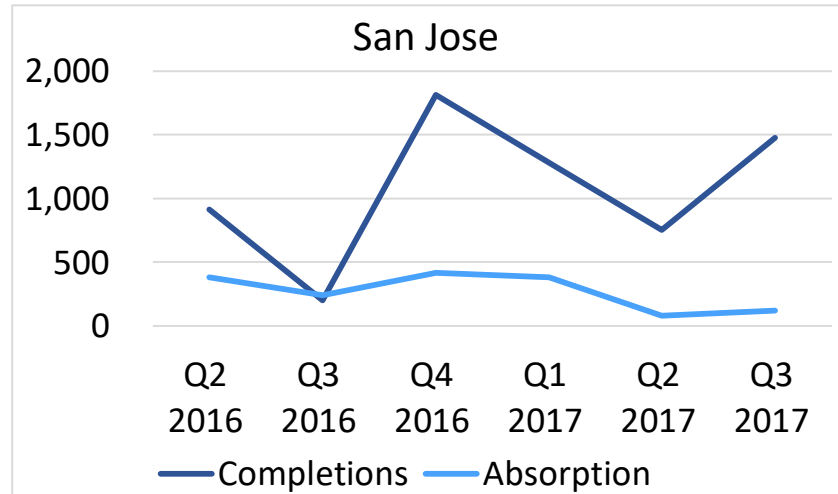
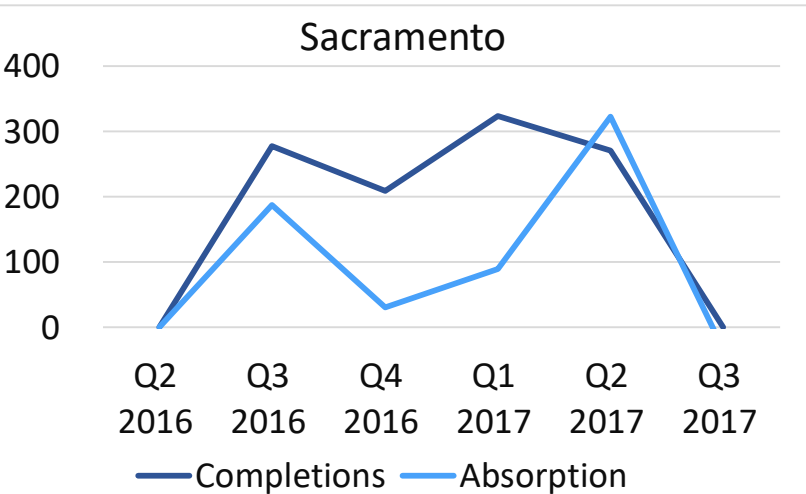
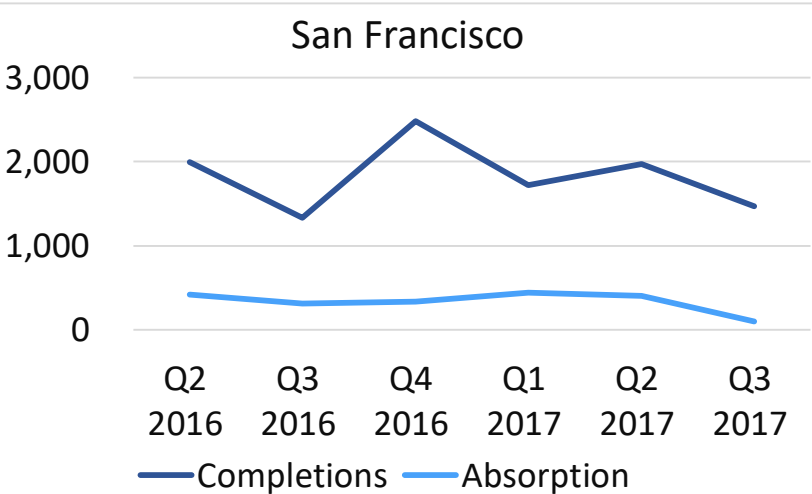


Rent and Occupancy Trends: Northern California

Rent Growth and Occupancy

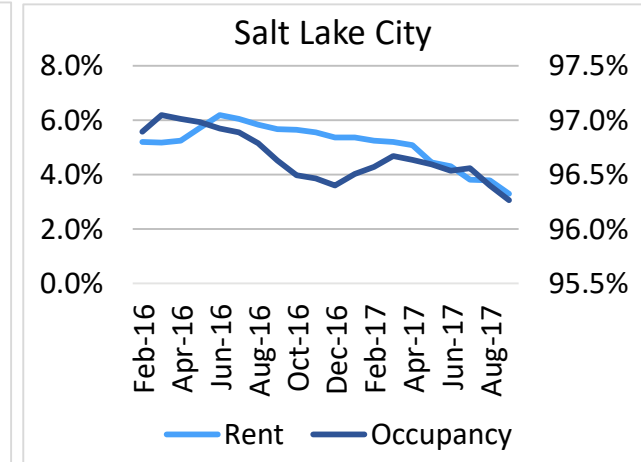
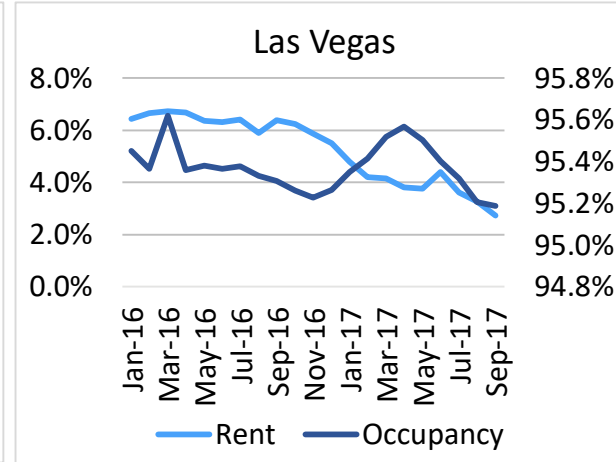
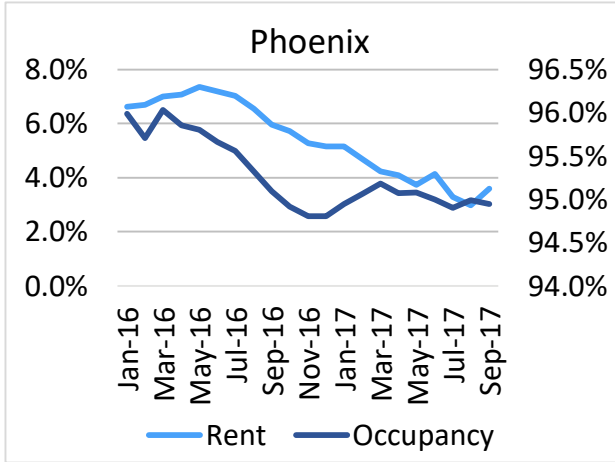
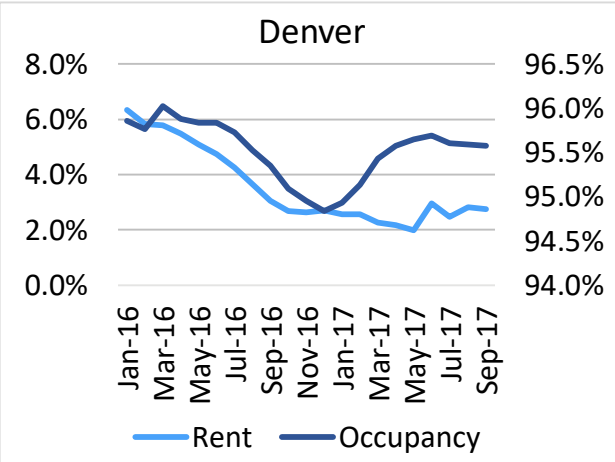


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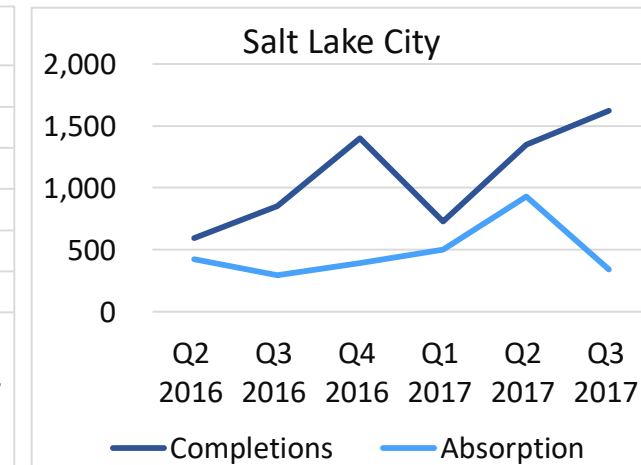
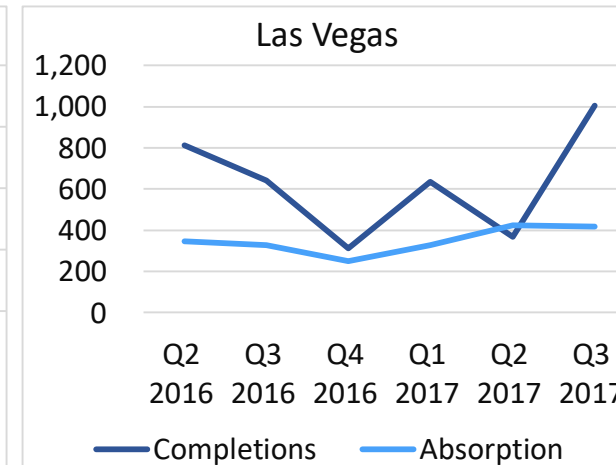
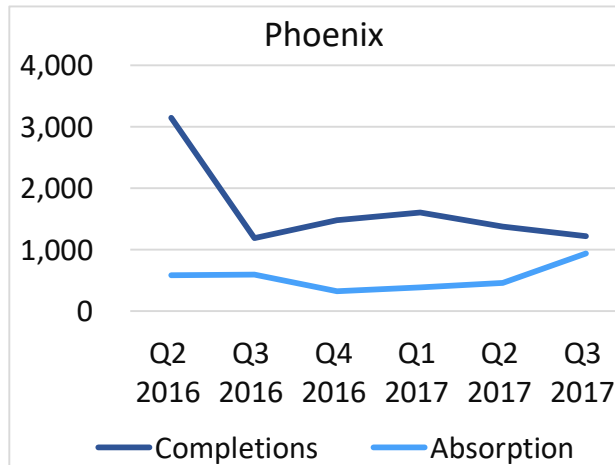
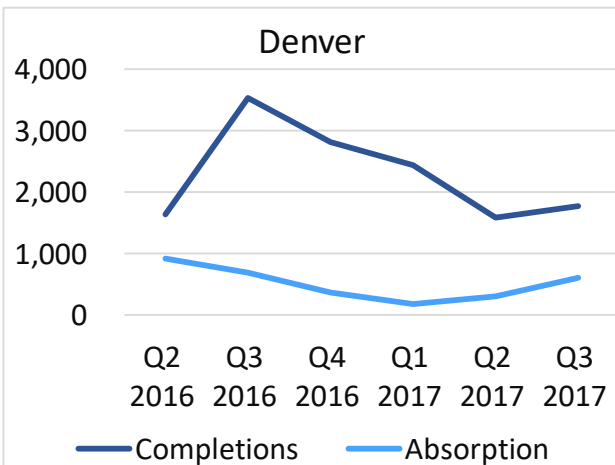


Rent and Occupancy Trends: West

Rent Growth and Occupancy

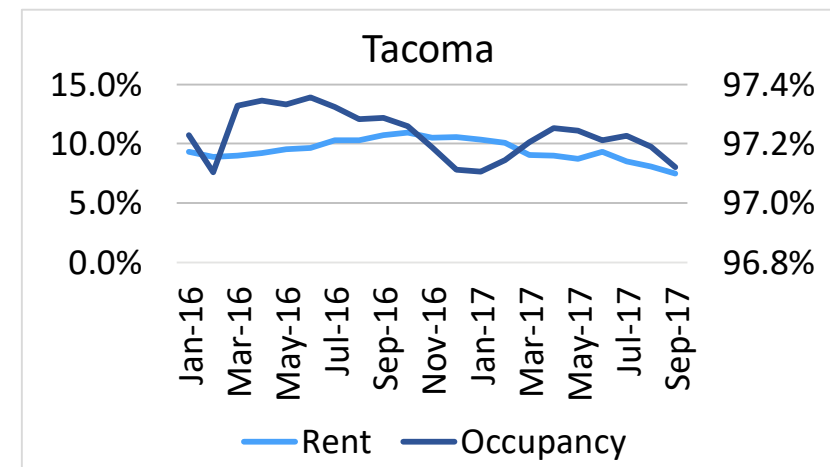
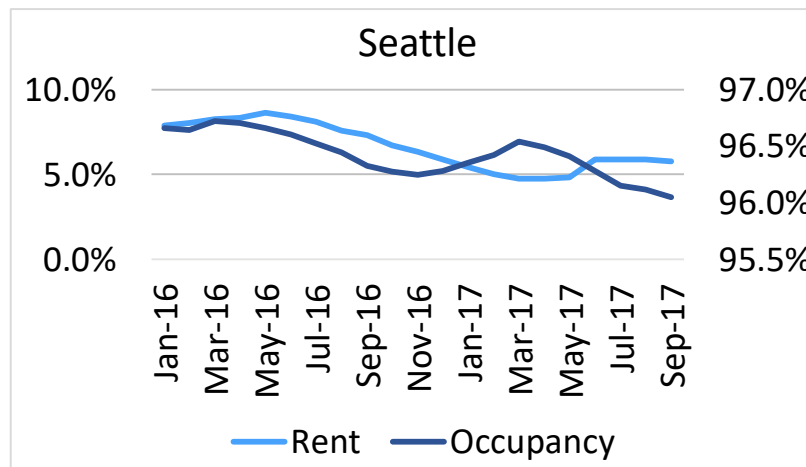
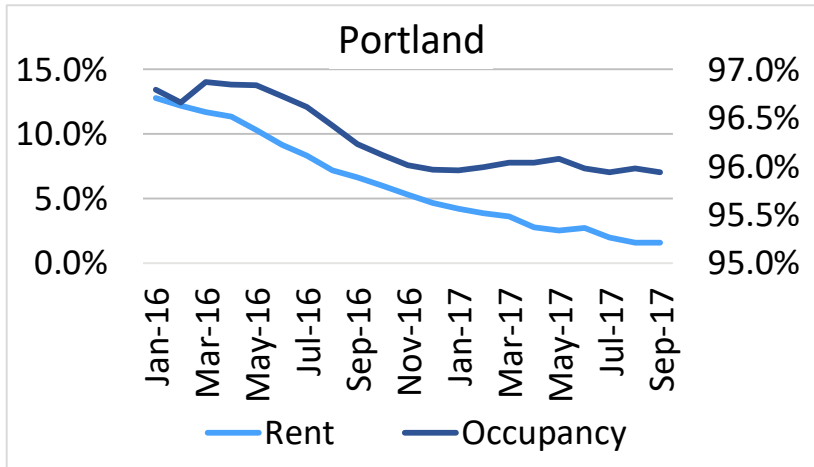


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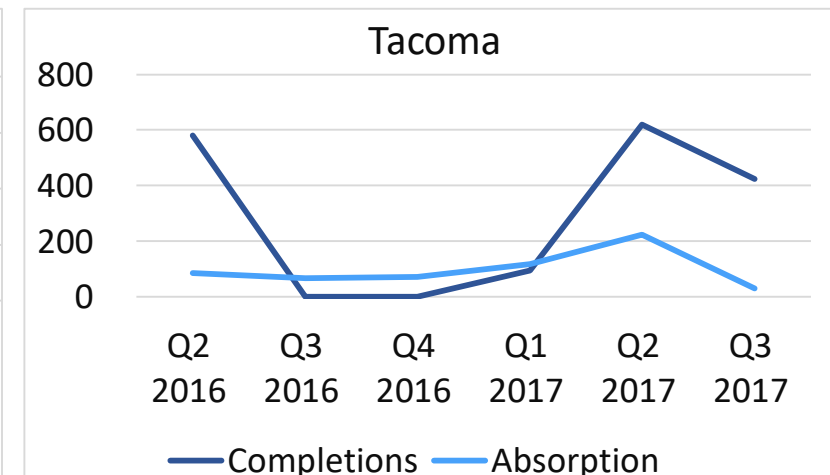
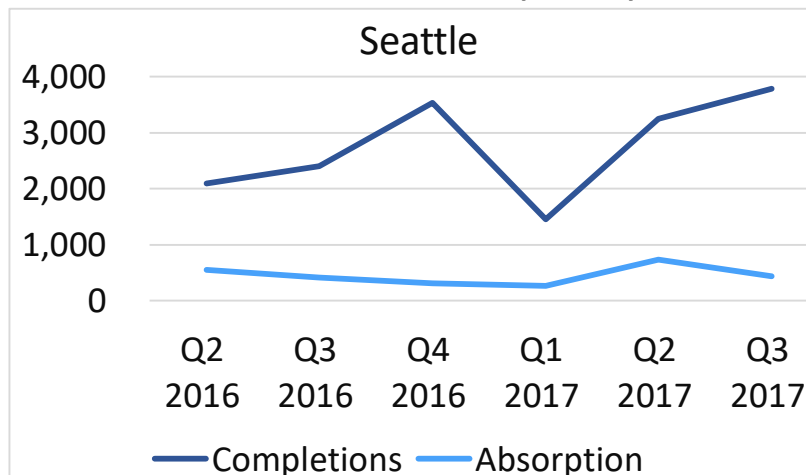
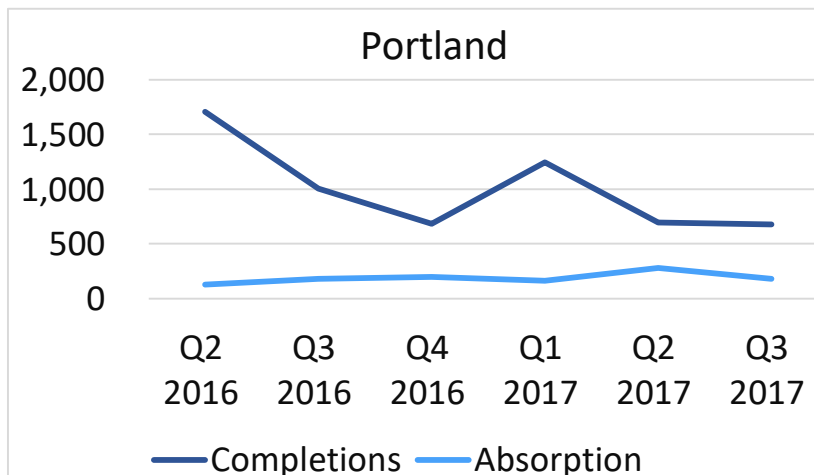


Rent and Occupancy Trends: Pacific Northwest

Rent Growth and Occupancy



Pre-Lease Occupancy



Rent Growth Forecasts – Top 20 Markets

Market	YOY 2017	2018	2019	Market	YOY 2017	2018	2019
Reno	11.3%	9.5%	8.2%	Inland Empire	4.7%	4.9%	4.6%
Sacramento	8.2%	7.2%	6.5%	Salt Lake City	4.9%	4.9%	4.7%
Tacoma	7.7%	6.6%	5.9%	Las Vegas	6.5%	4.8%	4.1%
Colorado Springs	7.7%	6.5%	4.0%	Suburban Dallas	4.2%	4.8%	4.5%
Eastern Los Angeles County	5.3%	6.0%	5.0%	North Central Florida	3.8%	4.5%	4.0%
Spokane	6.2%	5.7%	5.2%	Orlando	5.3%	4.5%	4.2%
Central Valley	6.0%	5.7%	5.2%	Fort Worth	5.2%	4.4%	4.5%
Boise	5.1%	5.0%	4.5%	Columbus	5.1%	4.3%	3.6%
Eugene	5.1%	5.0%	4.8%	Seattle	4.9%	4.3%	4.1%
Phoenix	5.1%	5.0%	4.0%	Suburban Atlanta	4.7%	4.2%	3.8%

National

YOY 2017	2018	2019
2.3%	2.5%	2.7%

*Data ranked by 2018 values. YOY 2017 data as of 10/1/17

Rent Growth Forecasts – Bottom 20 Markets

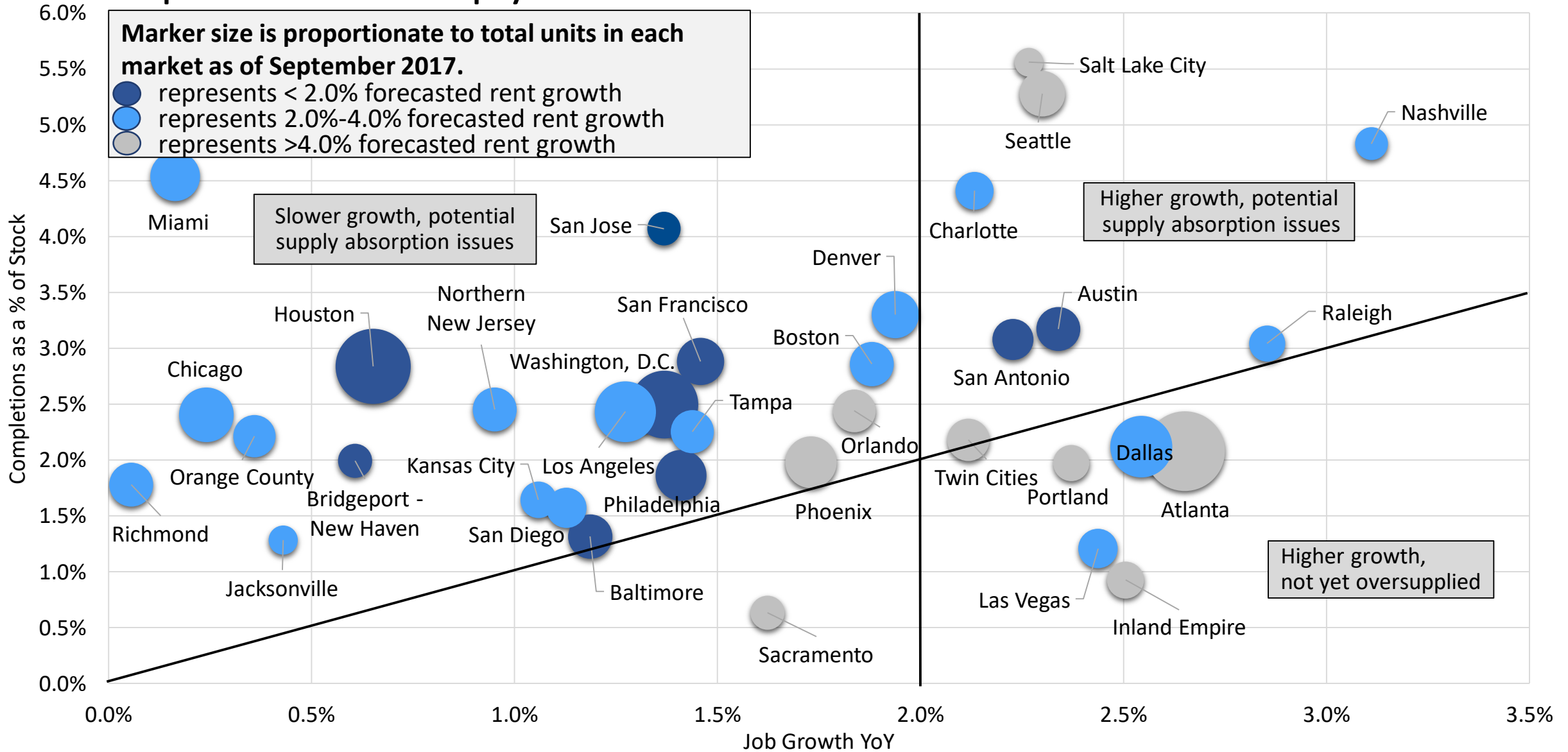
Market	YOY 2017	2018	2019	Market	YOY 2017	2018	2019
Manhattan	-3.4%	-1.0%	0.8%	Tulsa	0.3%	1.2%	1.3%
Amarillo	-0.3%	0.4%	0.6%	Mobile	0.2%	1.2%	1.6%
El Paso	0.5%	0.7%	0.6%	New Orleans	0.6%	1.4%	1.8%
McAllen	-0.2%	0.8%	1.0%	Portland	1.2%	1.5%	2.0%
Oklahoma City	0.4%	0.8%	1.3%	Baltimore	2.0%	1.5%	1.3%
Corpus Christi	1.1%	0.8%	0.5%	Omaha	1.5%	1.5%	1.5%
Baton Rouge	0.0%	0.9%	1.5%	Washington DC	1.0%	1.5%	1.6%
Central East Texas	0.8%	1.0%	1.2%	Wichita	0.4%	1.6%	1.7%
Northern Virginia	0.5%	1.1%	1.0%	Austin	0.2%	1.6%	2.1%
Columbus GA	0.9%	1.1%	1.2%	West Houston	1.2%	1.7%	1.9%

National

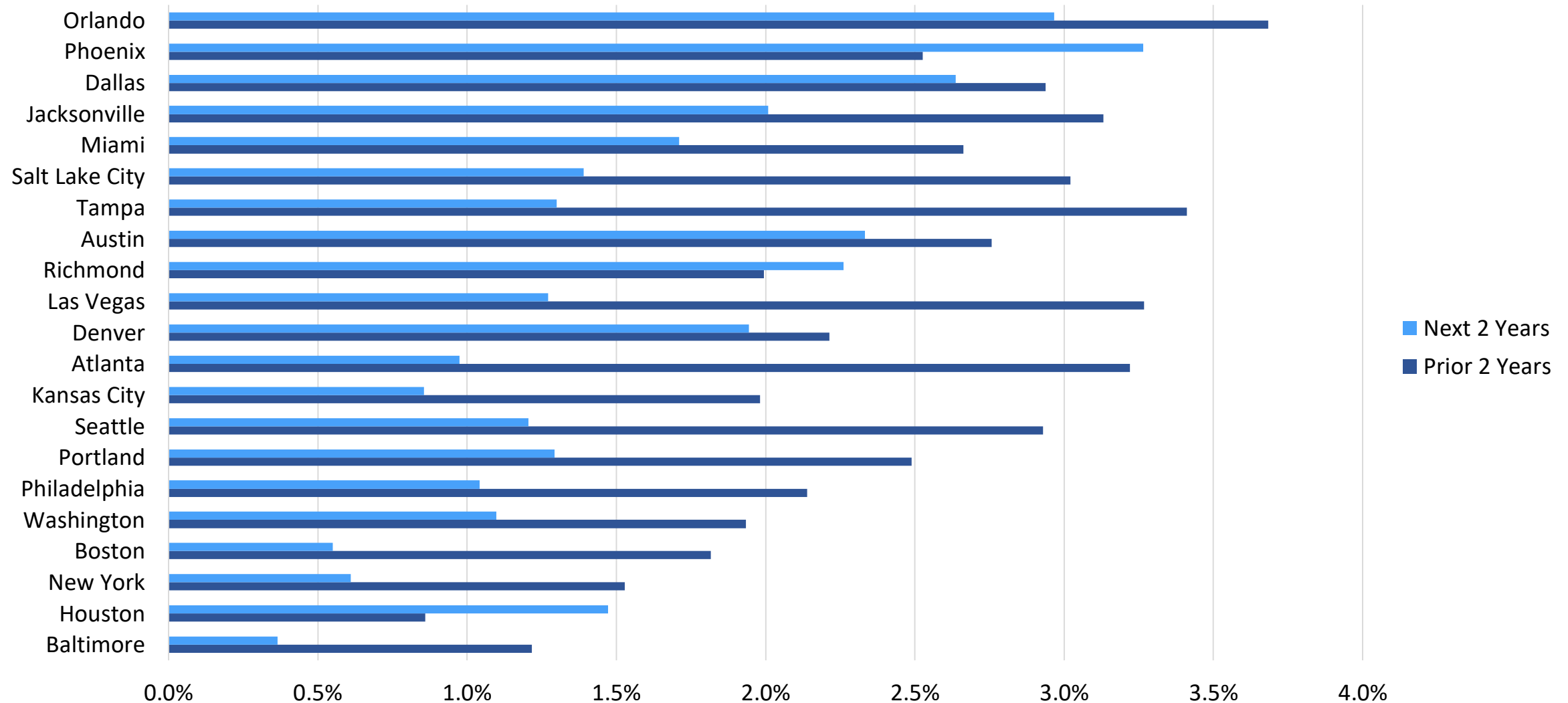
YOY 2017	2018	2019
2.3%	2.5%	2.7%

*Data ranked by 2018 values. YOY 2017 data as of 10/1/17

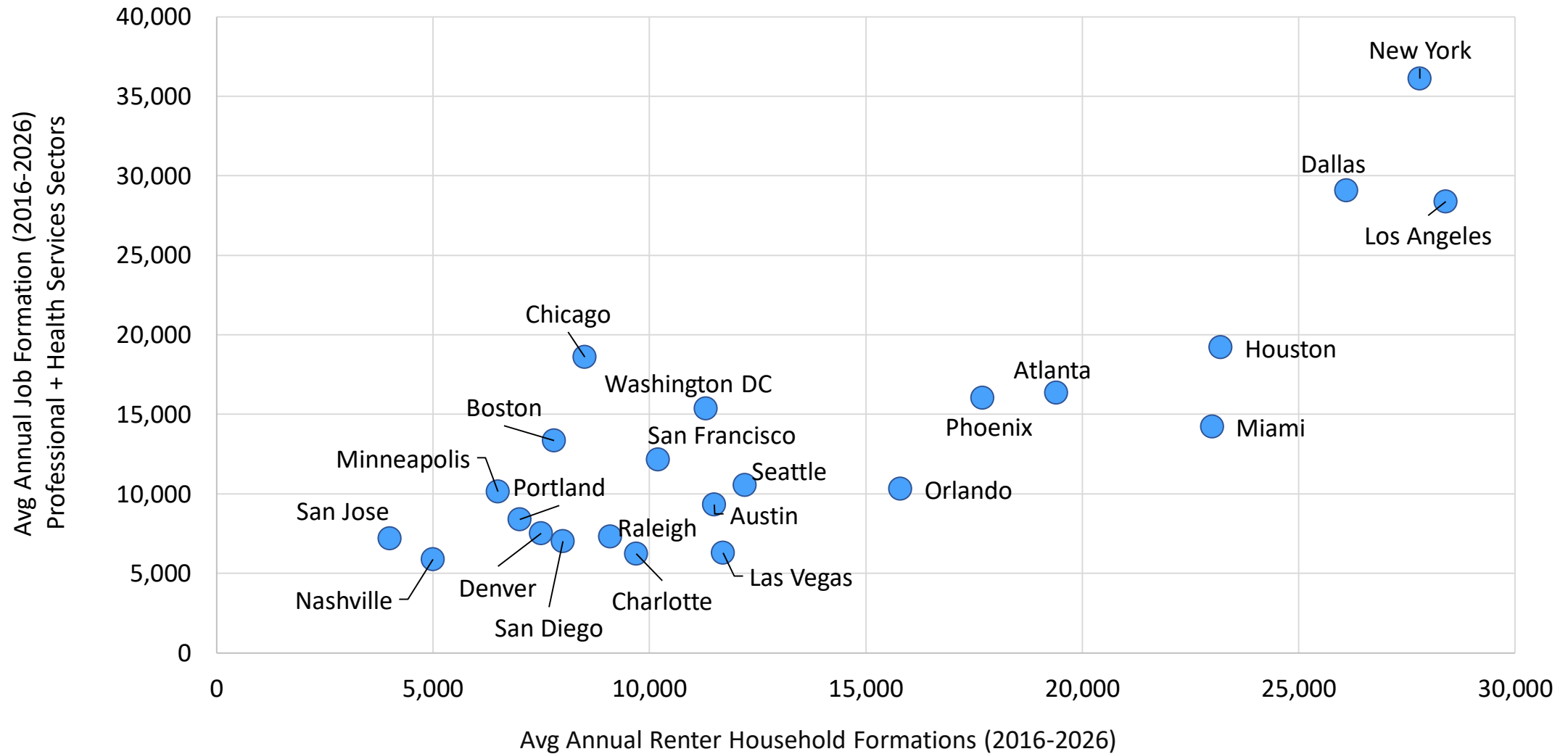
Expect a Bumpy 18-24 months



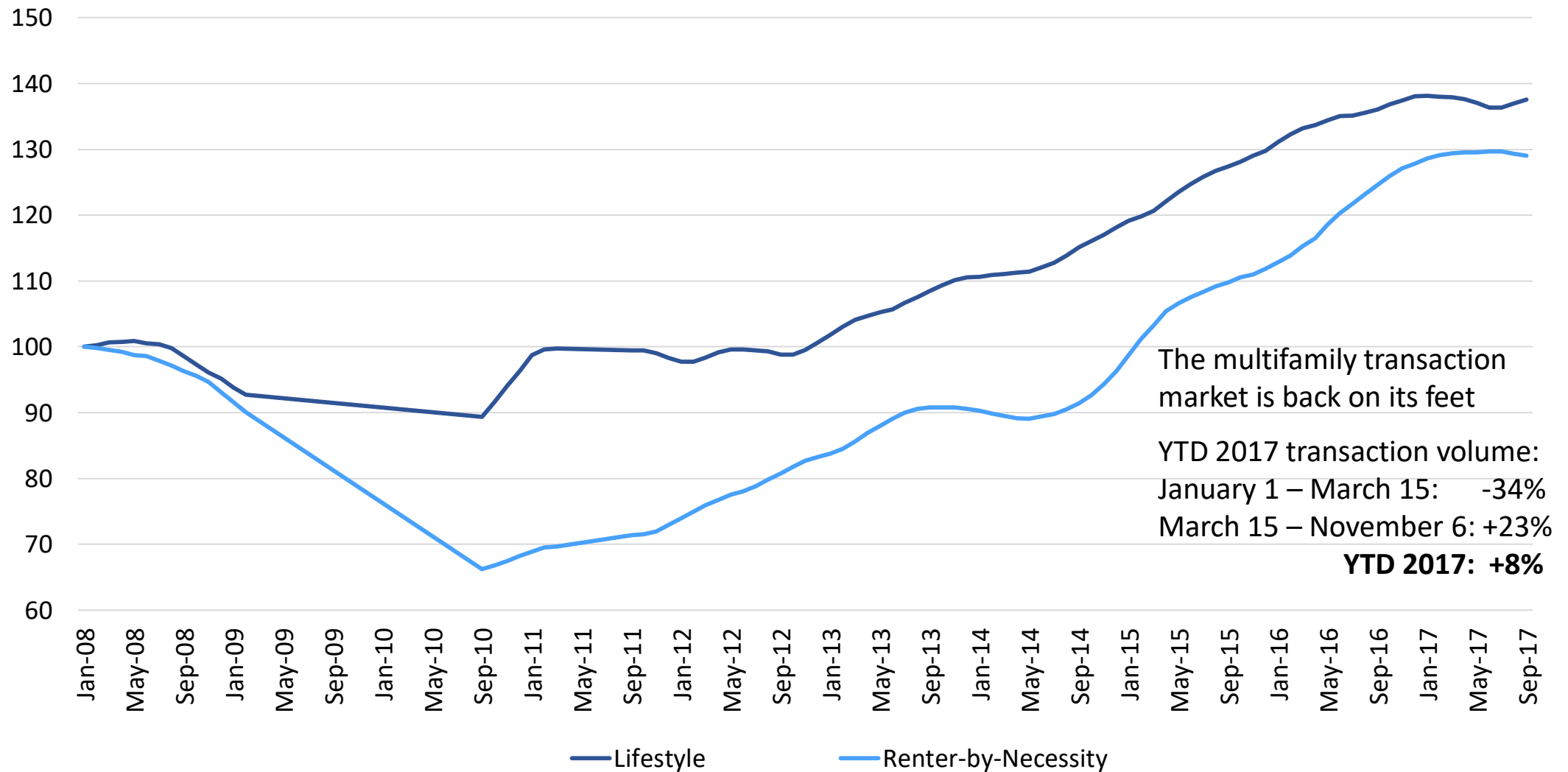
Employment Growth is Expected to Slow Over the Next Two Years



Room for New Supply: Long-Term Job Formation vs Renter Households



U.S. Multifamily Sales Price Per Unit Index 2008-2017

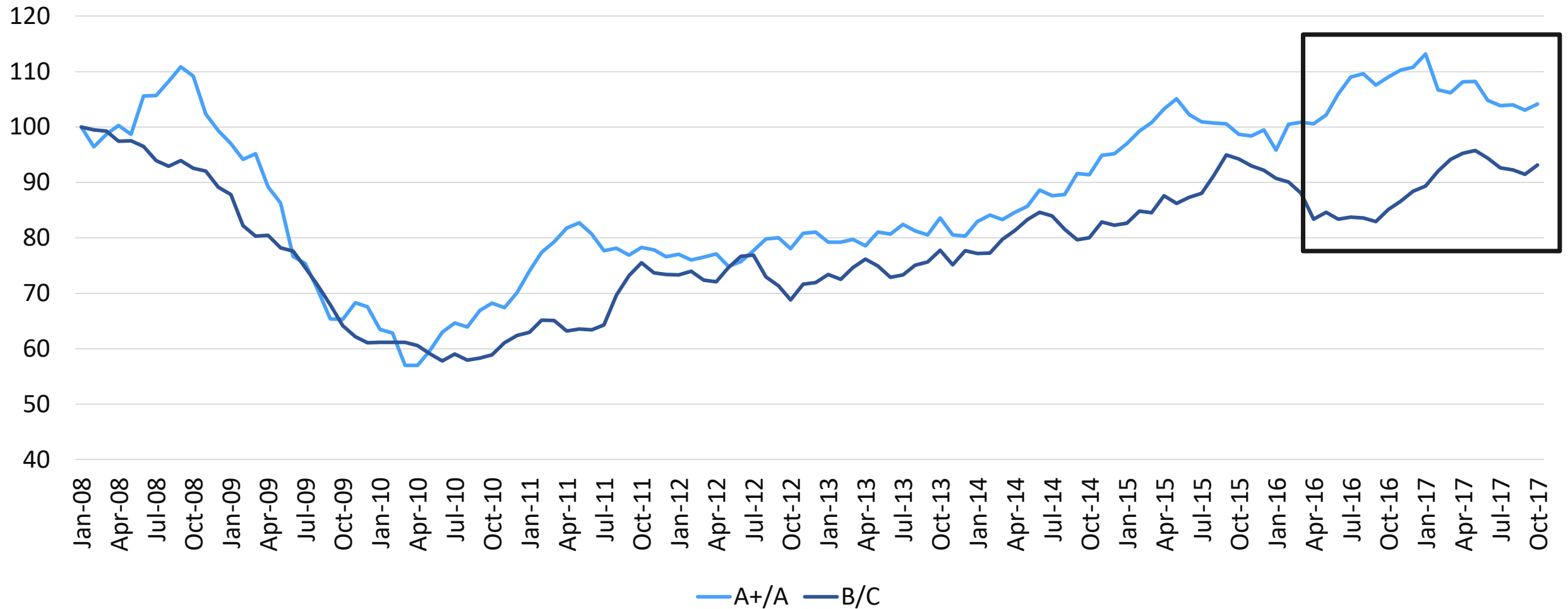


Sales price per unit-index 2008 = 100

Source: Yardi®Matrix

Office Price Per Sq. Ft.

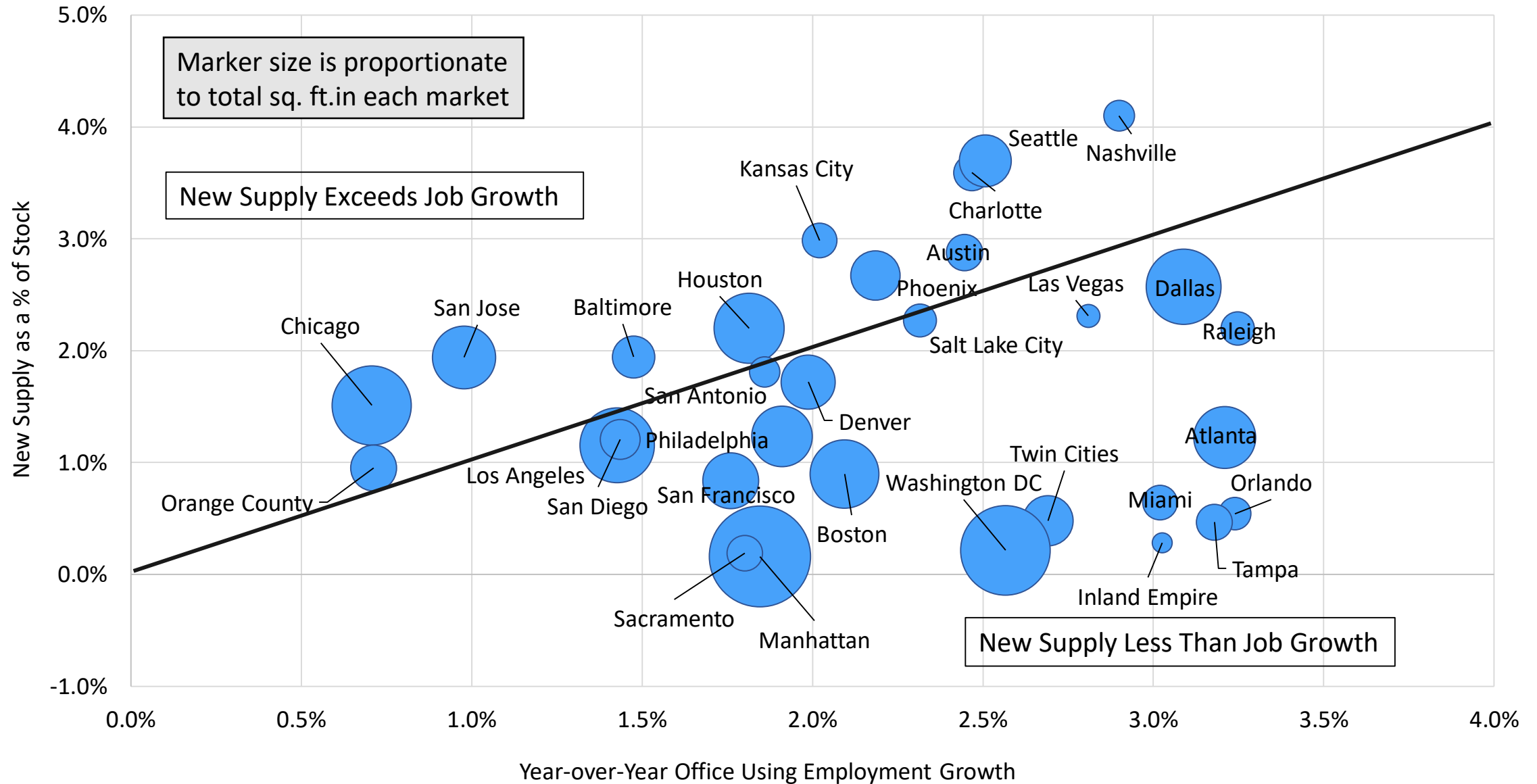
All Asset Classes are Beginning to Flatten



Sales price per unit-index 2008 = 100

Source: Yardi®Matrix

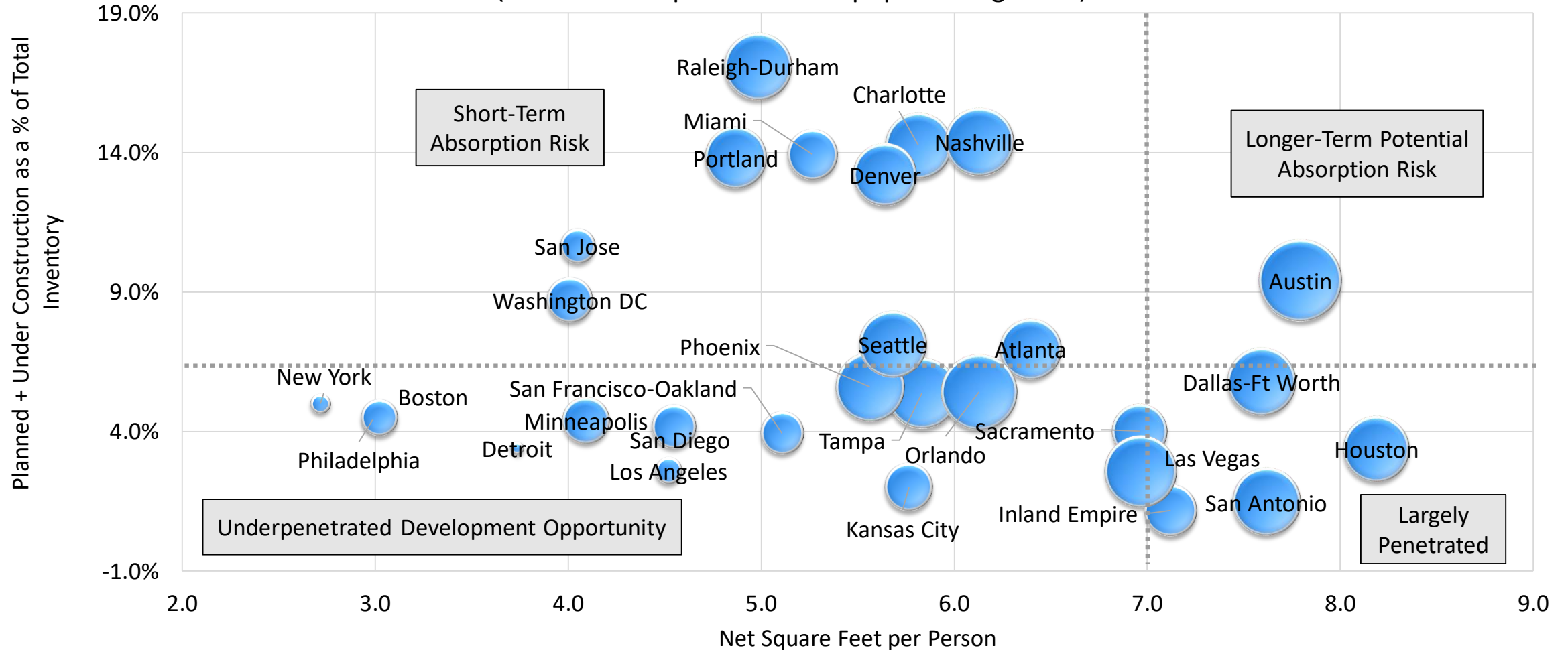
Office-Using Employment Growth Outpacing Supply



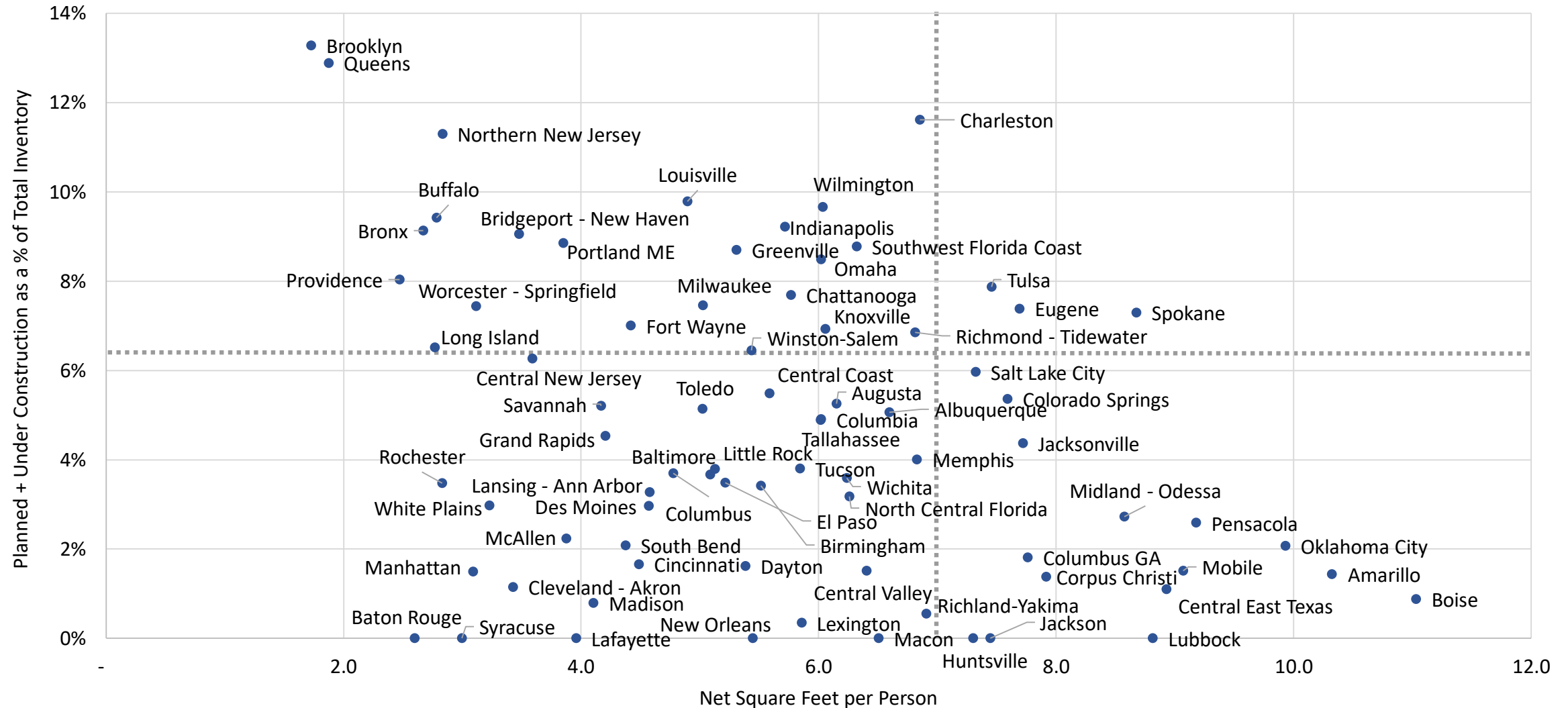
Source: Yardi®Matrix; Bureau of Labor Statistics (BLS)

Self Storage Major Metros: Development Pipeline and Inventory per Person

(bubble size represents 2016 population growth)



Self Storage Other Markets: Development Pipeline and Inventory per Person

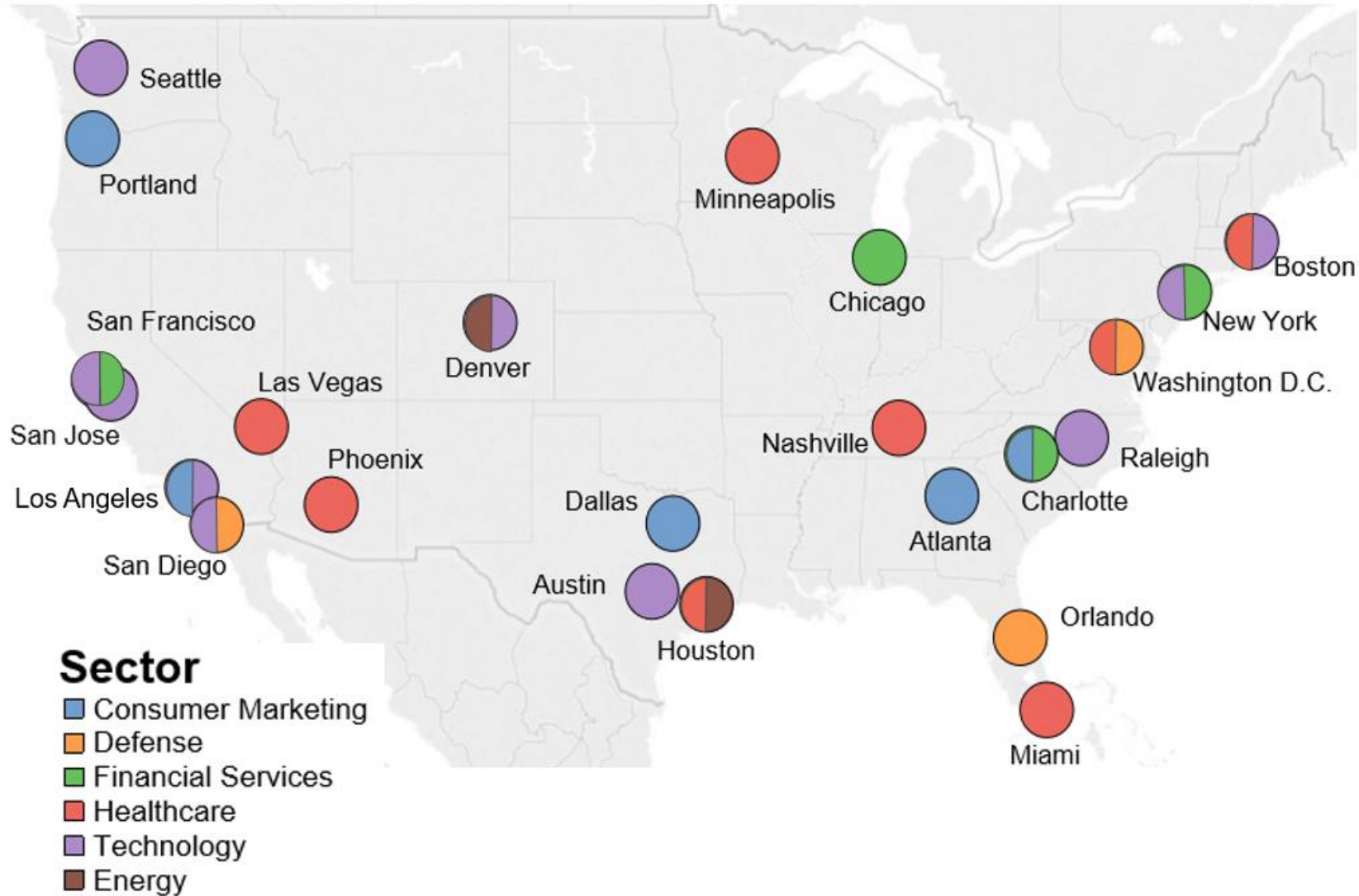


So What? Real Estate Fundamentals

- The next 18-24 months will be a “slow-grind” while this new supply gets absorbed
 - Class A urban most impacted
 - Class B will also be impacted, to a lesser degree
 - International gateway cities most impacted, inland lower-cost cities less so
- Asset value appreciation will be very closely linked to cash flow generation
- Move to suburban “urbanized” nodes already underway
- Operational efficiency should be the main near-term objective in all its forms
 - Marketing Spend, Maintenance Expense, Turn Costs, Energy, Retention, Pricing Efficiency

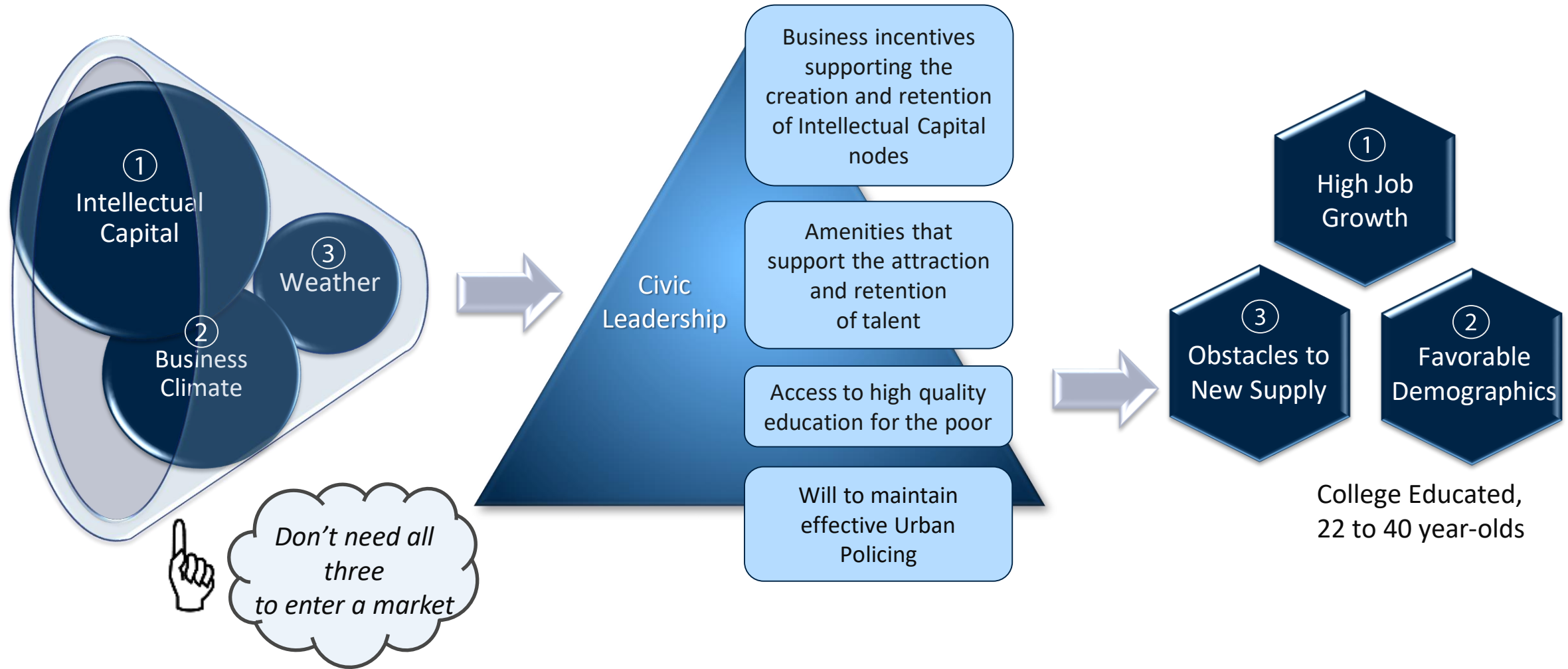
Technology, Demographics, Migration and Immigration

Our “Curated” Markets

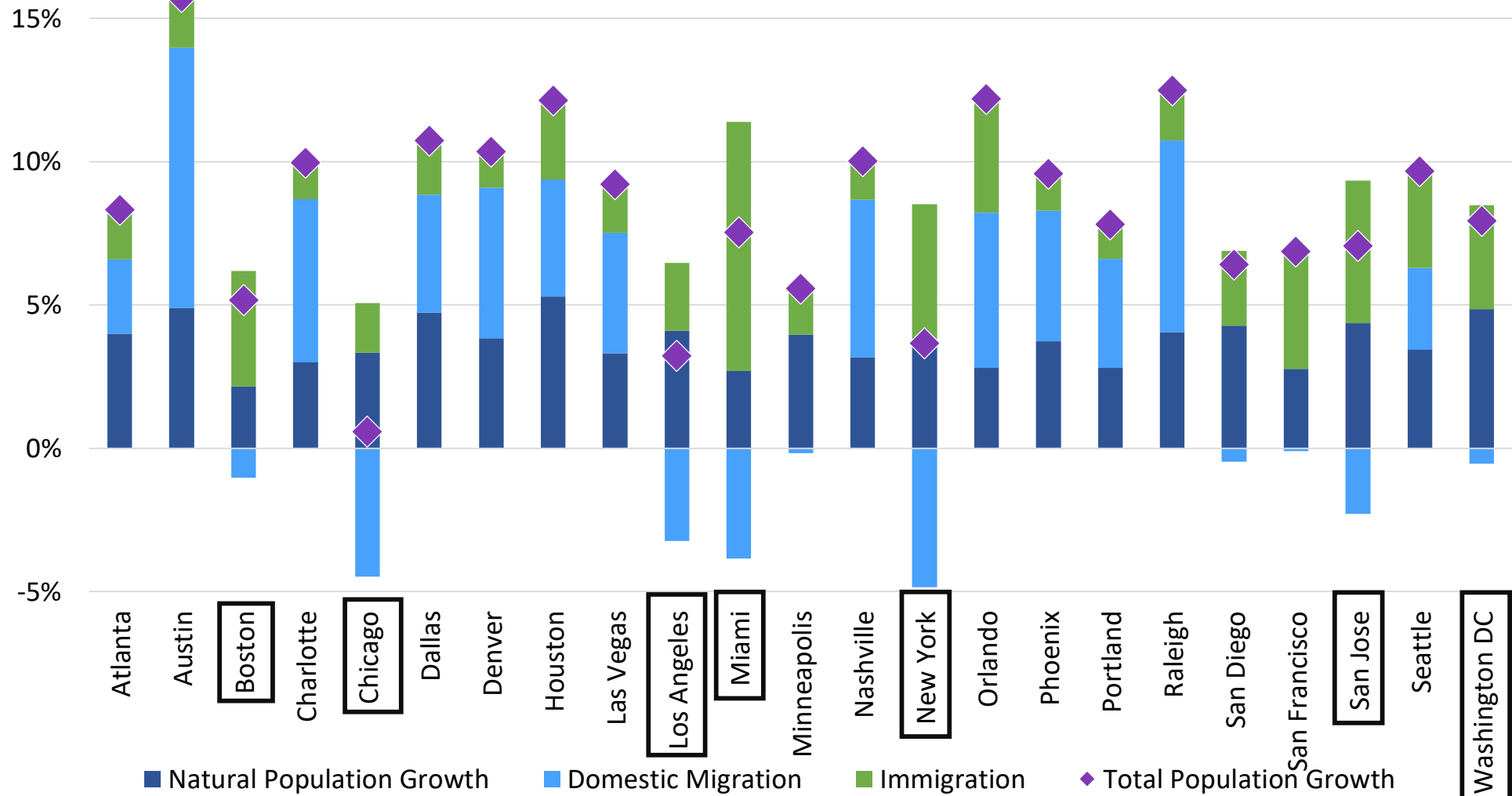


- Based on population growth
- Driven heavily by growing tech, financial services, health care, universities, consumer marketing – Intellectual Capital
- Mostly in “Smile” States, with exception of a few Midwestern Markets

The Investment Decision-Making Process



Immigration Drives International Gateway City Growth



*2011-2016

Source: U.S. Census Bureau (BOC); Moody's Analytics

Gateway Cities Exposed

International cities' net migration deficit is only made up by immigration.

Within that, certain industries and cities are impacted by specific programs:

H1-B /EB-5

- San Francisco
- Boston
- New York
- Washington, D.C.

Industries Affected

Tech, Finance
Tech, Healthcare
Finance, Tech
Healthcare, Defense

Certain cities, while not international gateways, are exposed to a lesser degree:

H1-B /EB-5

- Seattle

Industries Affected

Tech

Restrictive Borders

- Miami
- Orlando
- Los Angeles

Hospitality
Hospitality, Construction
Construction

Revamped Immigration System

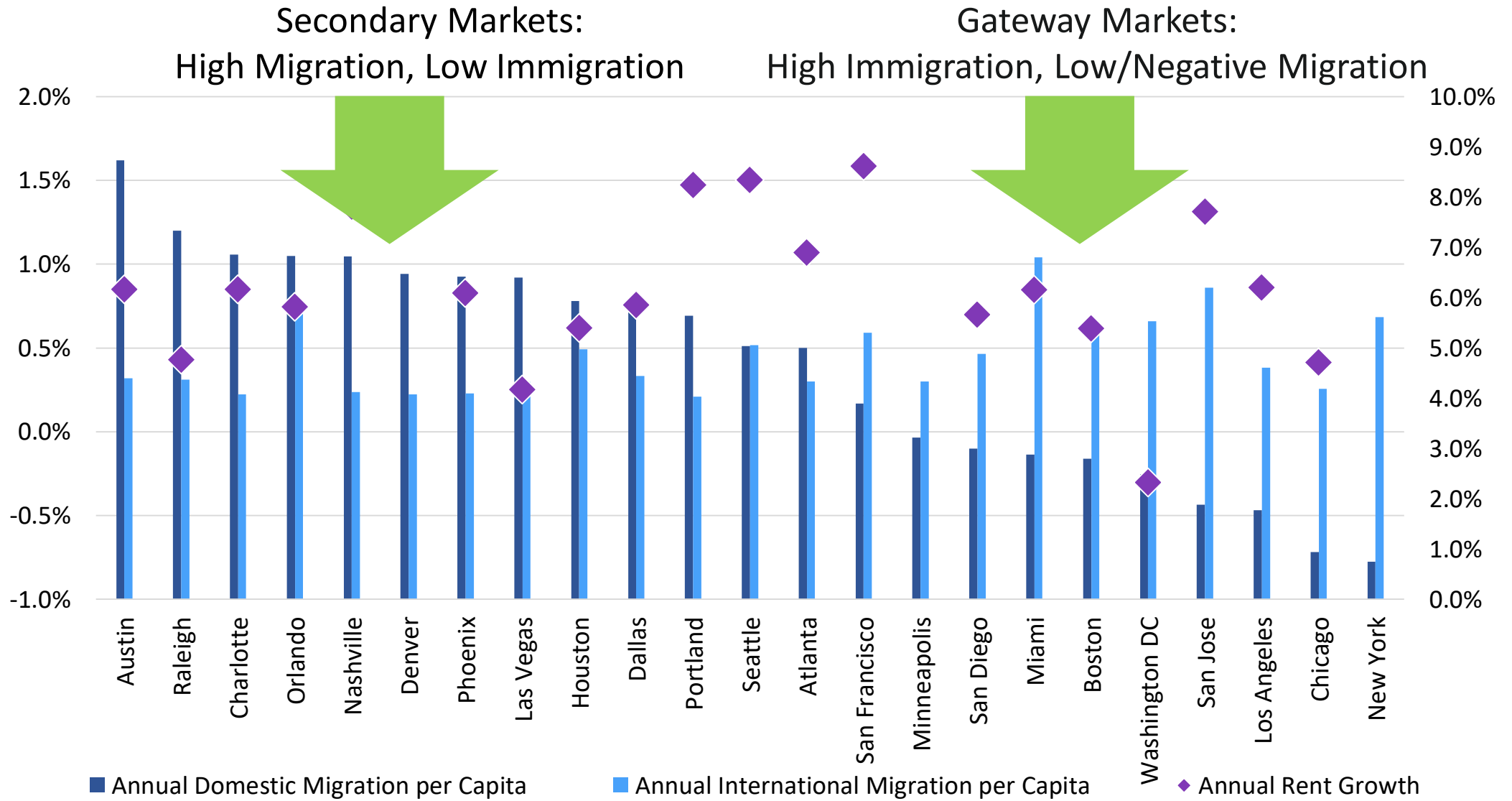
Merit Based Immigration Similar to Canada:

- Foreign nationals may apply for green cards on the basis of educational, intellectual, and personal skills
- Limits “chain migration” of residents bringing family members to U.S.
- Would benefit intellectual capital based markets, and limit unskilled immigration



Actually proposed by Trump Administration
(But with a 50% reduction in immigration per year)

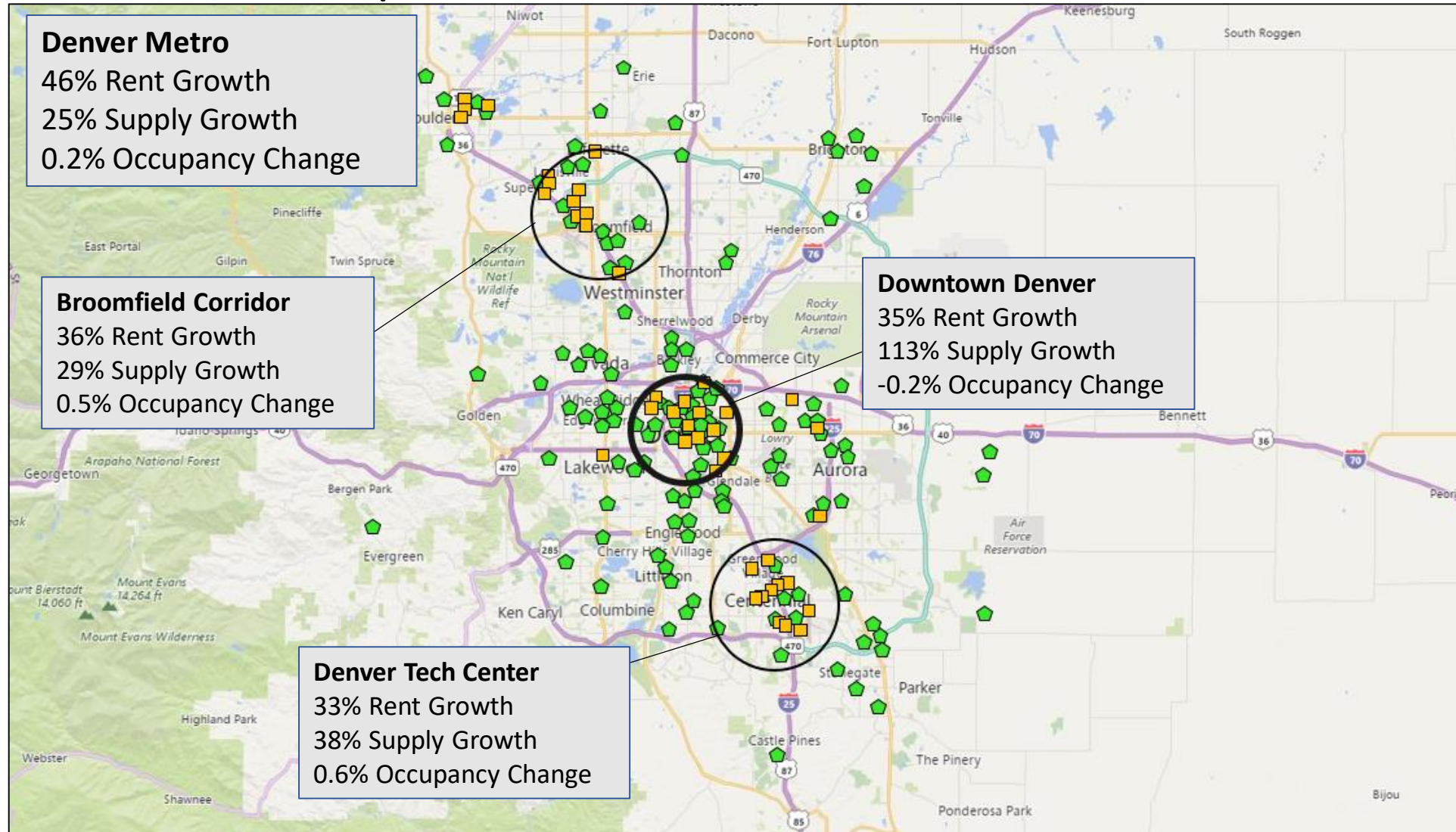
Immigrant vs Domestic Migrant Patterns



*2012-2016 Migration Data

Source: U.S. Census Bureau (BOC); Moody's Analytics; Yardi® Matrix

Intellectual Capital Nodes – Denver



■ Office Development

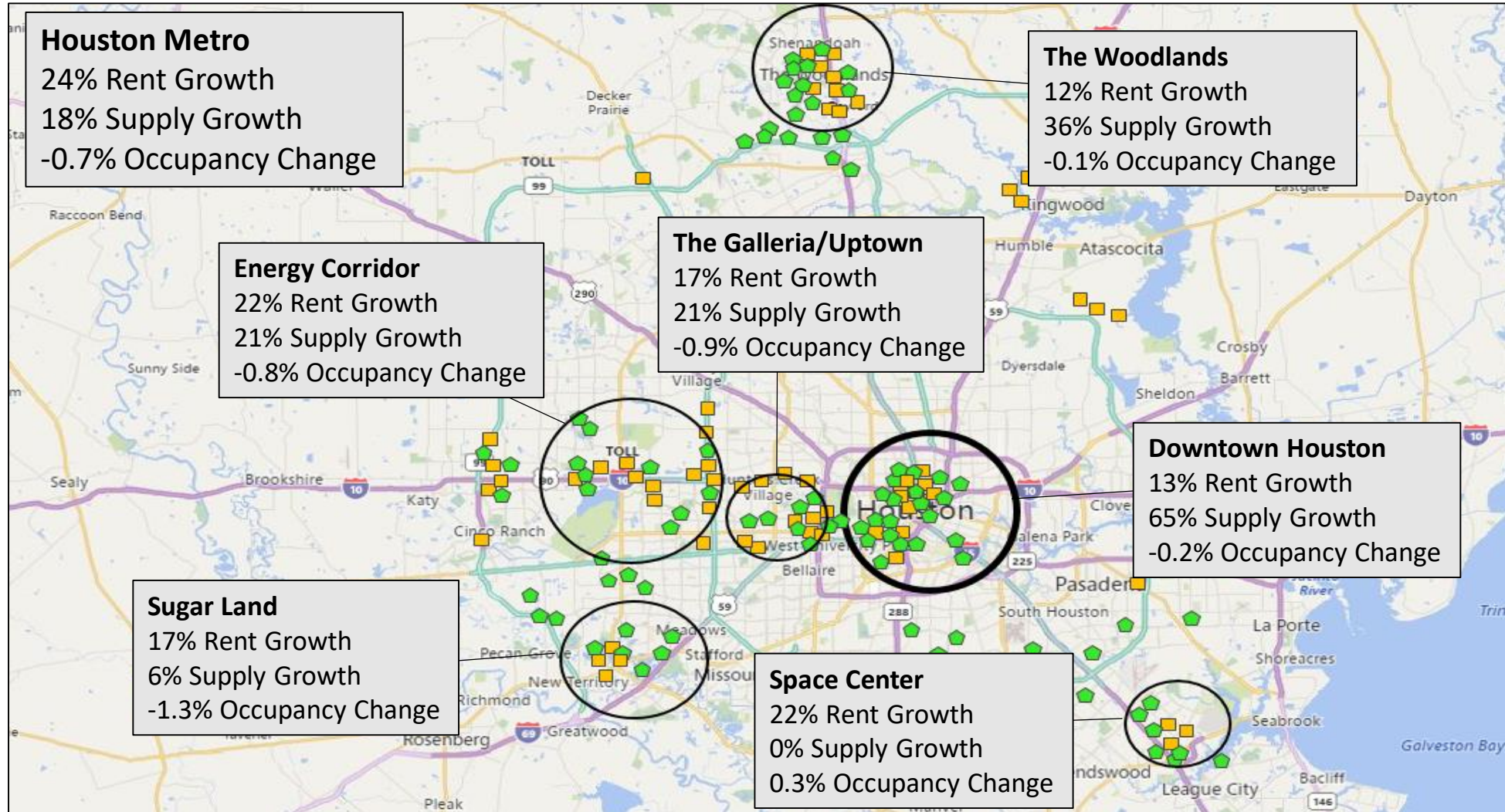
◆ Multifamily Development

* Multifamily rent and supply growth based on Sept 2012 through Sept 2017

* Change in multifamily occupancy based on Aug 2016 through Aug 2017

Source: Yardi® Matrix

Intellectual Capital Nodes – Houston



■ Office Development

◆ Multifamily Development

* Multifamily rent and supply growth based on Sept 2012 through Sept 2017

* Change in multifamily occupancy based on Aug 2016 through Aug 2017

Source: Yardi® Matrix

Technology's Impact on the Future of Real Estate

- Position where wealth is created and where the value of “place” will increase
- With a focus on live/work/play then “fulfill”/store

Technologies

*Energy

- Batteries
- Solar

*Electric & Autonomous Vehicles

- Lithium-Ion Batteries
- LIDAR Sensors

IoT/Sensors

- Smart home
 - Amazon Echo
 - Nest Thermostat

Artificial Intelligence/Robotics

- Drones
- Virtual Realty

“Taken-for-Granted” Tablestakes

Connectivity

- 1G Connectivity, 40x High Speed
- Mobility
- Security

Collaboration

- Mobile apps
- Connectivity and free-up trapped resources

*Focus today on these two

Technology Disruption Model

Technology



Technology Convergence



Business Model Innovation



Technological Disruption

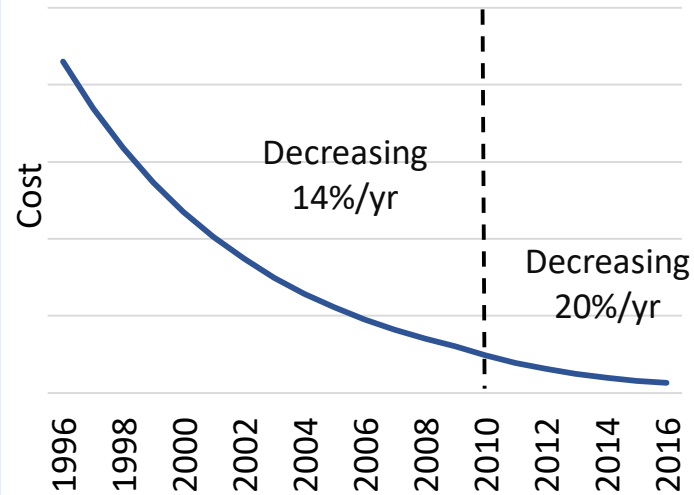
- **Lithium Ion Battery** is a new technology, but it won't lead to disruption on its own
- Converge with other technologies + business model innovation for disruption

- New functionalities possible when several technologies converge
- **Lithium Ion Battery** + Data Storage + Computing + Digital Imaging + Network Capacity = **Smartphone**

- Smartphone + Cloud convergence enabled **Uber** (business model innovation)
- Loan financing or cost sharing will drive down current cost of usage

- Several technologies + business model innovation converge to enable certain functionality at a certain cost
- Cost reduction will lead to disruption, adapted as an S-Curve

Lithium-Ion Cost Curve



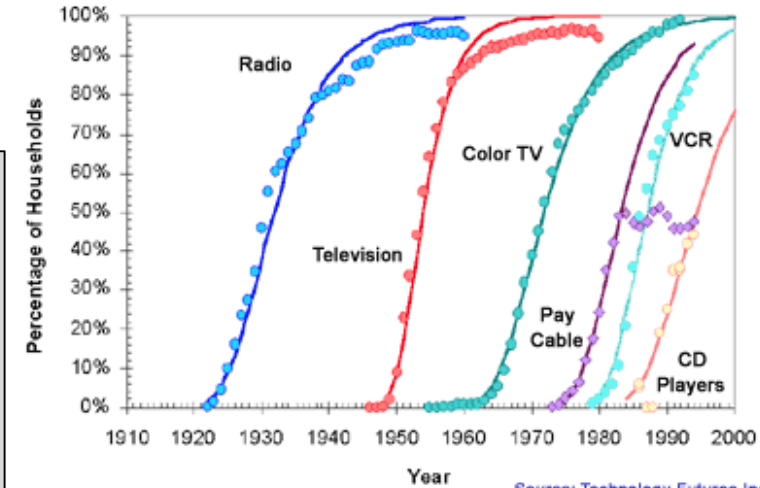
Example:

Lithium Ion Battery (**Technology**)

Touchscreen + Computing + Digital Imaging + Lithium Ion Battery = Smart Phone (**Convergence**)

Smart Phone + Cloud = Uber (**Business Model Innovation**)

Uber is a disruption of the taxi business!



Horse → Car
 Telephone → Cellphone
 Taxi → **Uber**

Energy Disruption Model

Battery Cost

- Investment in vehicle and grid markets driving down cost of batteries
- Energy storage can lead to disconnection from the grid, avoidance of peak load pricing **(SOLAR)**
- Declining battery costs result in lower-cost electric cars, and vice versa
- Electric vehicles are 10x cheaper to charge/fuel than vehicles with internal combustion engines
- Li-ion battery cost dropping rapidly, 16-20% per year
 - Result of major industries heavily investing, more research and development, more scale

Solar Panels Cost

- Solar PV cells cost ~ \$0.35/per watt, and continues to drop
- Solar accounts for 39% of new electricity generation last year, more than any other source
- Grid parity – when solar is as cheap or cheaper than what we pay the utility
- Currently lowest cost for stand alone generation, but next will be new central generation, then individual business generation, then consumer generation
- Eventually, the cost of solar on your rooftop will cost less than transmission, thanks to **STORAGE**

Financing

- Solar-plus-battery systems are long-term assets
 - Upfront capital cost
 - Likely to be financed at some interest rate
 - Paid off in monthly installments
- Landlord can finance cap ex as part of building revenues



Rapid adoption

Electricity Cost to End Users

	<u>Generation</u>		<u>Transmission</u>		<u>Total</u>
Central Plant (Arizona)	\$0.20/kWh	+	\$0.09/kWh	=	\$0.29/kWh
Solar + Storage at Home (By 2020)	\$0.04/kWh	+	\$0.03/kWh	=	\$0.07/kWh
Tucson Electric Power	\$0.03/kWh	+	\$0.015/kWh	=	\$0.045/kWh ★
Australia	\$0.07/kWh	+	\$0.12/kWh	=	\$0.19/kWh

“Post 2020, there may never be another peaker built in the U.S.” – NextEra Energy CEO Jim Robo

Solar + Storage: Grid-Scale and Consumer Scale

Grid System



- 396 stacks of Tesla batteries installed in Southern California Edison's Mira Loma substation, with 20 MW of energy storage capacity
- System sucks up electricity from the grid during the day and feeds it back into the system at night
- Can power roughly 15,000 homes over 4 hours
- Estimated cost of roughly \$29 million and took just under 3 months to complete
- PG&E's Colusa Generating Station, a 660 MW natural-gas fired power plant, cost roughly \$450 million and took 2 years to complete!

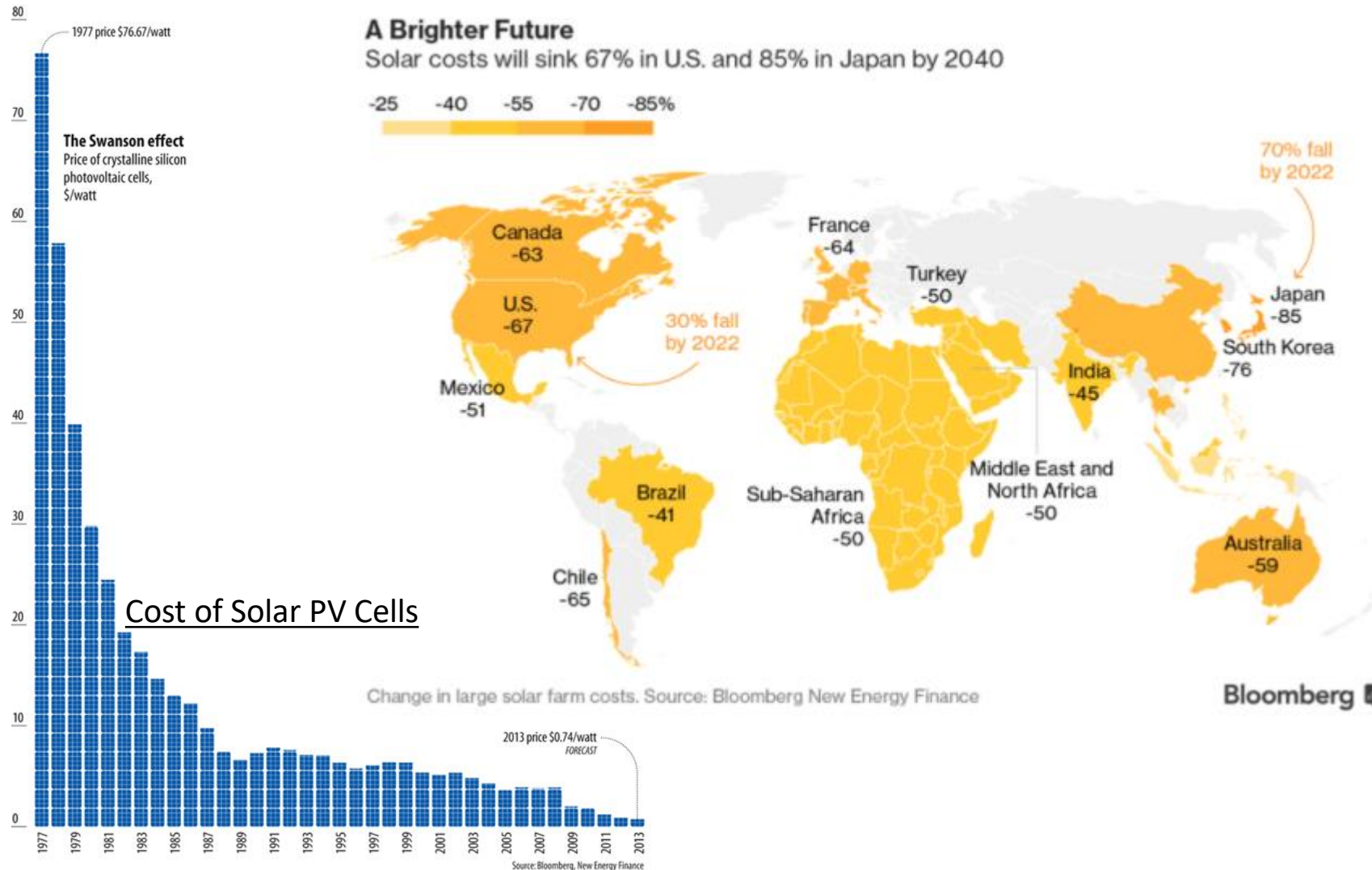
Home System



- Home battery (Lithium-Ion)
- Integrates with Tesla Solar
 - Stores surplus energy from solar panels for use at night and during utility outages
 - Uninterrupted service day and night
- Battery can draw electricity from the utility grid when rates are low and store it for later use
- Completely automated and requires no maintenance

Source: nytimes.com; Tony Seba, Clean Disruption of Energy and Transportation; energy.ca.gov; tesla.com; businessinsider.com

Solar Energy is Becoming More Affordable



Prices could go up, though...

- Chinese control 2/3 of the market
- U.S. companies want to impose tariffs on foreign solar cells and modules
- Solar cells currently cost about \$0.35-\$0.40/watt
- Tariff of \$0.25/watt for solar cells
- Tariffs of \$0.32/watt with floor price of \$0.74/watt for solar modules
- ITC will vote late October, and Trump administration will decide mid January
- Could result in solar electricity rising 30% if accepted!

Solar Will Be Adopted When It's Economical

Disintermediation Starts at Highest Cost

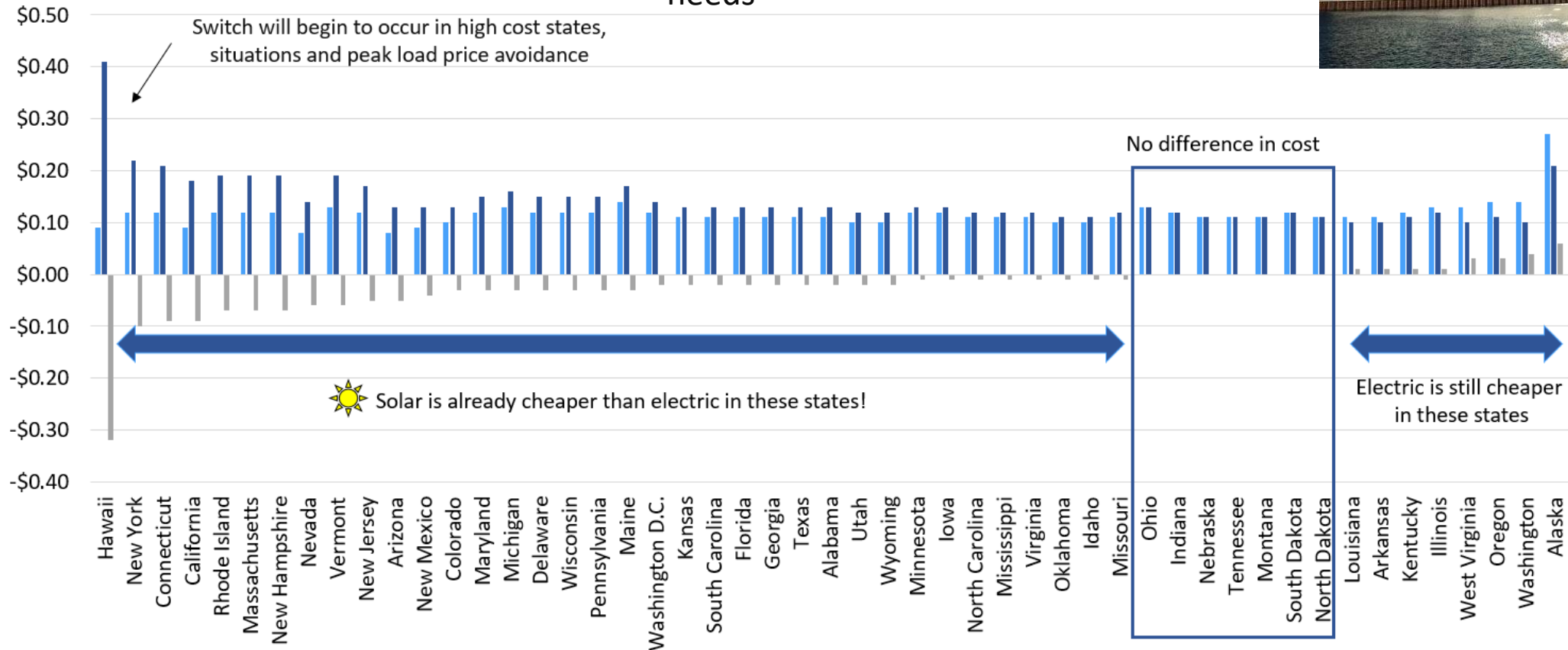
- Islands
- Peak Load Pricing
- NYC StuyTown announces Rooftop Solar

Copenhagen International School in Denmark

- Building is completely covered by solar tiles
- Provides 300 MWh of electricity per year, accounting for 50% of the school's energy needs



Photo: EPFL



Further Innovation: Tesla Solar Roof

- No longer need solar panels attached to roof
- Now your actual roof can turn sunlight into electricity with glass solar tiles developed by Tesla
- Integrates with Tesla Powerwall home battery
 - Provides backup power during utility outages and natural disasters
 - Energy collected during the day is stored and made available any time

Switch will first come in business, later among consumers

Available Now



Available Now



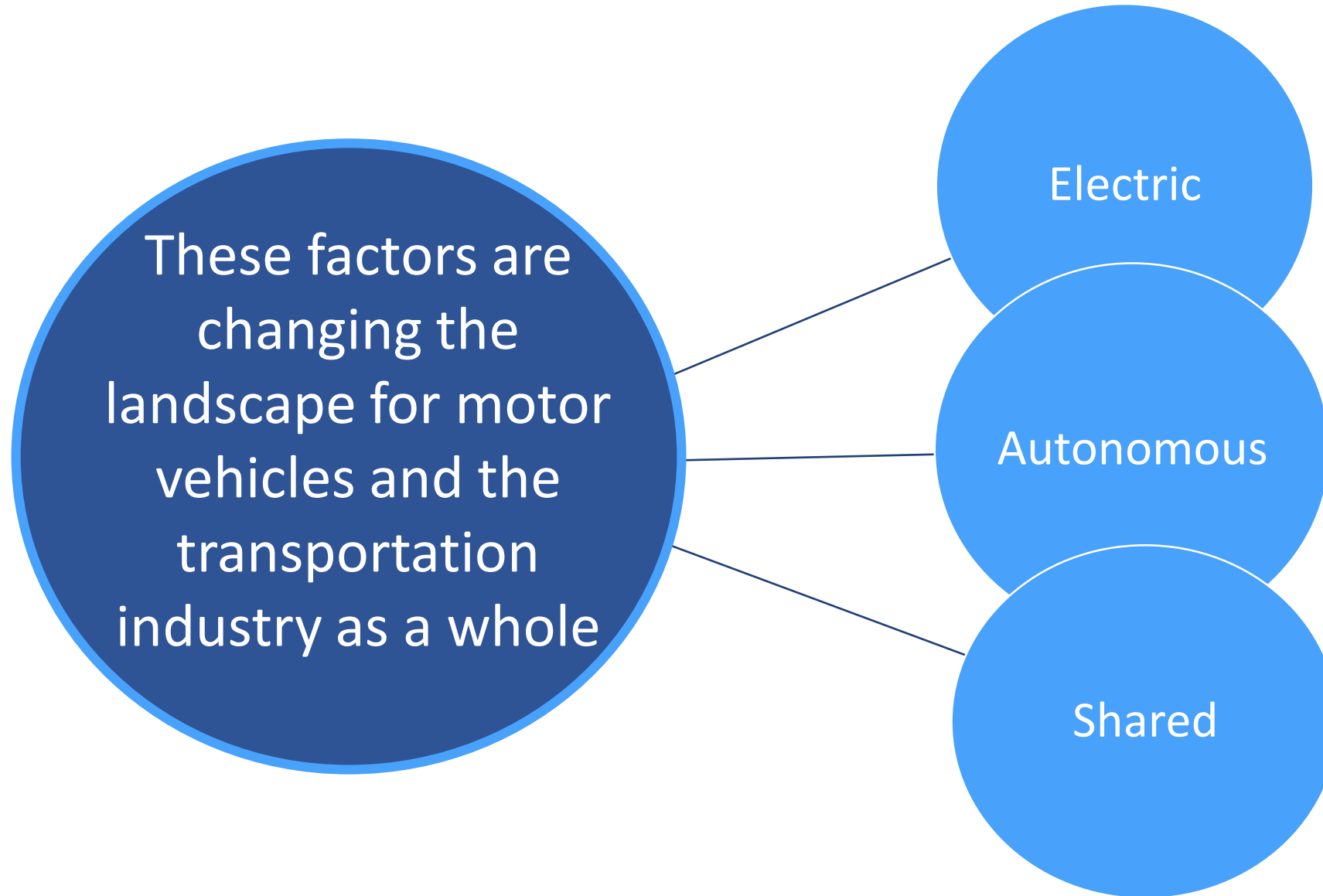
Coming in 2018



Coming in 2018



The Consumer Transportation Industry is Changing

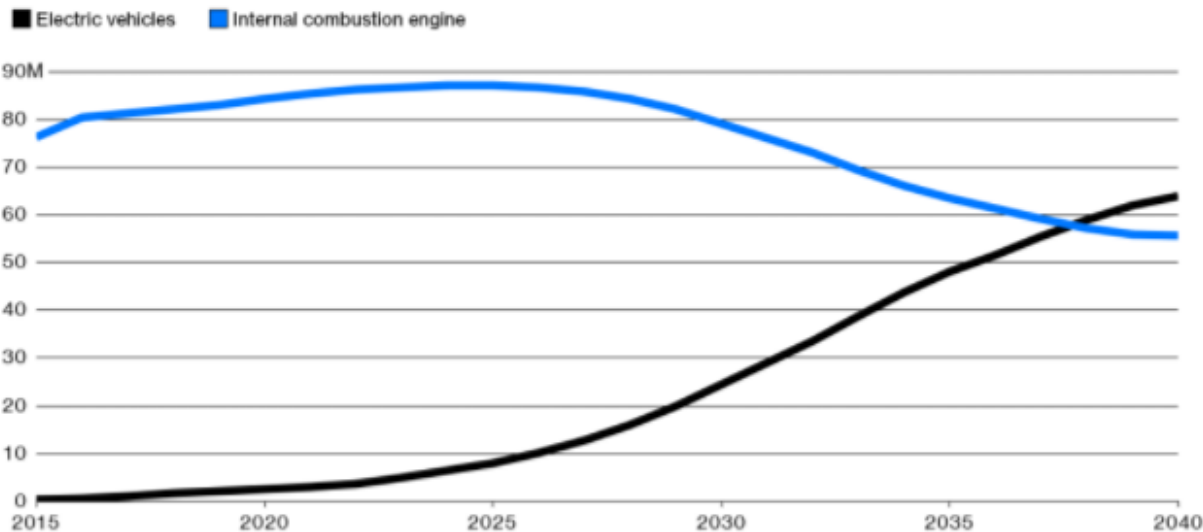


Electric Vehicles Will be the Standard in Coming Years

- Regulators seeking to reduce automotive CO2 emissions – cost for gasoline cars will increase
- Meanwhile, cost of building cars and Li-ion batteries are falling, making electric vehicles more affordable
- It makes economic sense:
 - 18 moving parts (EV) **vs.** 2,000 (gasoline)
 - 90-95% efficient (EV) **vs.** 17-21% efficient (gasoline)
 - EV is cheaper to fuel, cheaper to maintain, and lasts longer...

Overtaking Lane

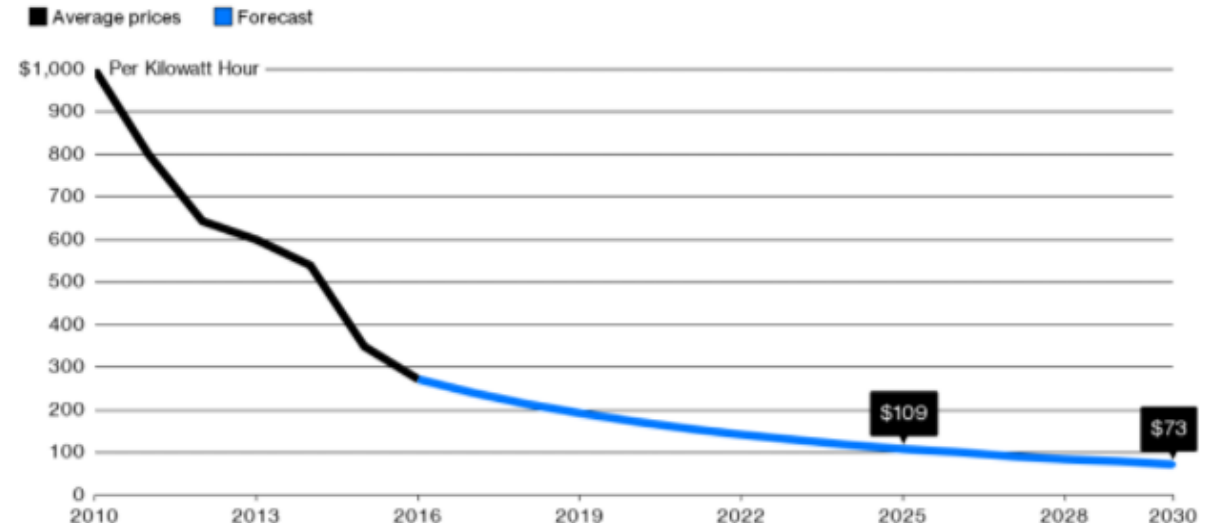
Electric vehicle sales will surpass internal combustion engine sales by 2038



Source: Bloomberg New Energy Finance

More Bang for Your Buck

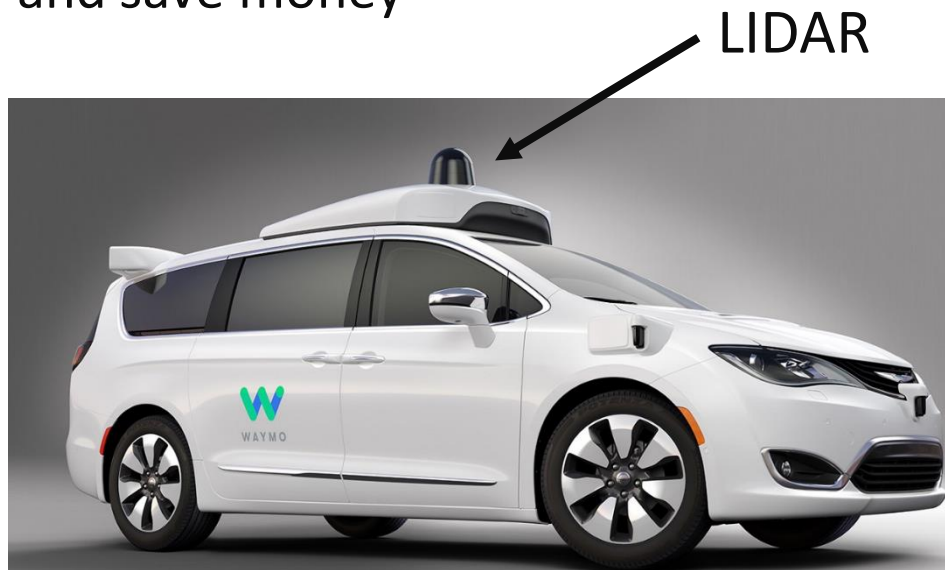
Greater efficiency means a \$1,000 battery in 2010 will cost \$73 in 2030



Source: Bloomberg New Energy Finance

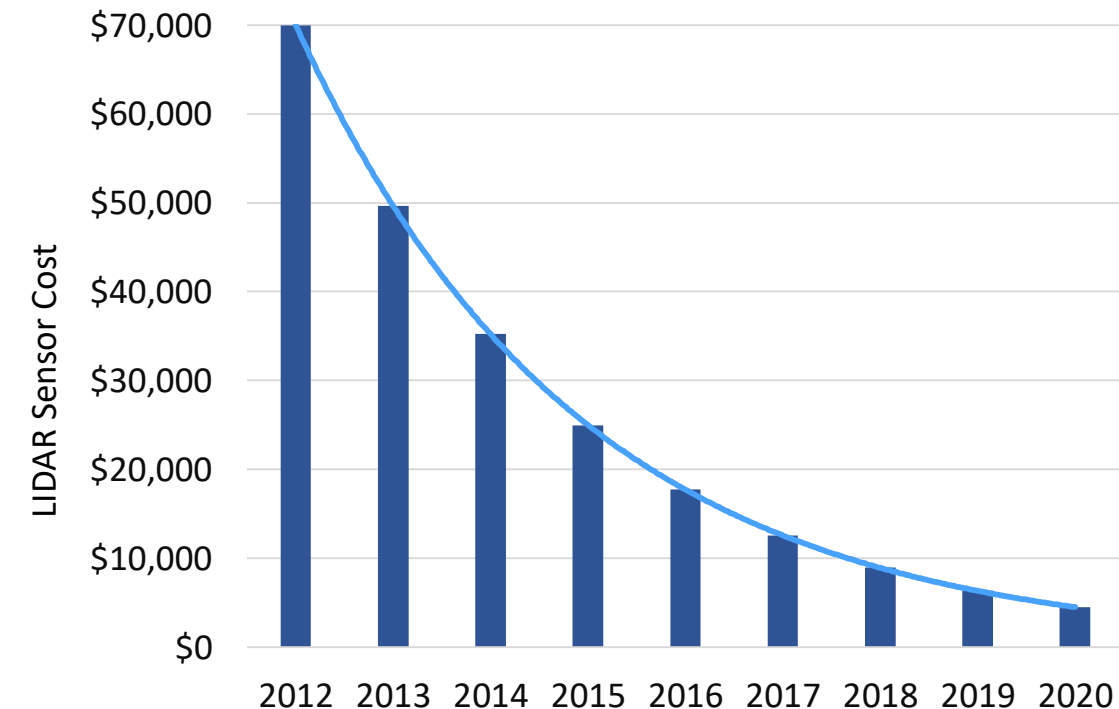
Autonomous Vehicles

- Google's self-driving car project, now 'Waymo', has 3 million miles self-driven
- Nissan, BMW, and Mercedes have pledged to have autonomous vehicles ready by 2020
- Tony Seba: autonomous vehicles will save lives, save time, save space, save energy, and save money



LIDAR (laser + radar)

- Allows car to “see” in 360 degrees
- Most expensive component of autonomous vehicles, but the cost is rapidly decreasing



The Growth of Ridesharing Services

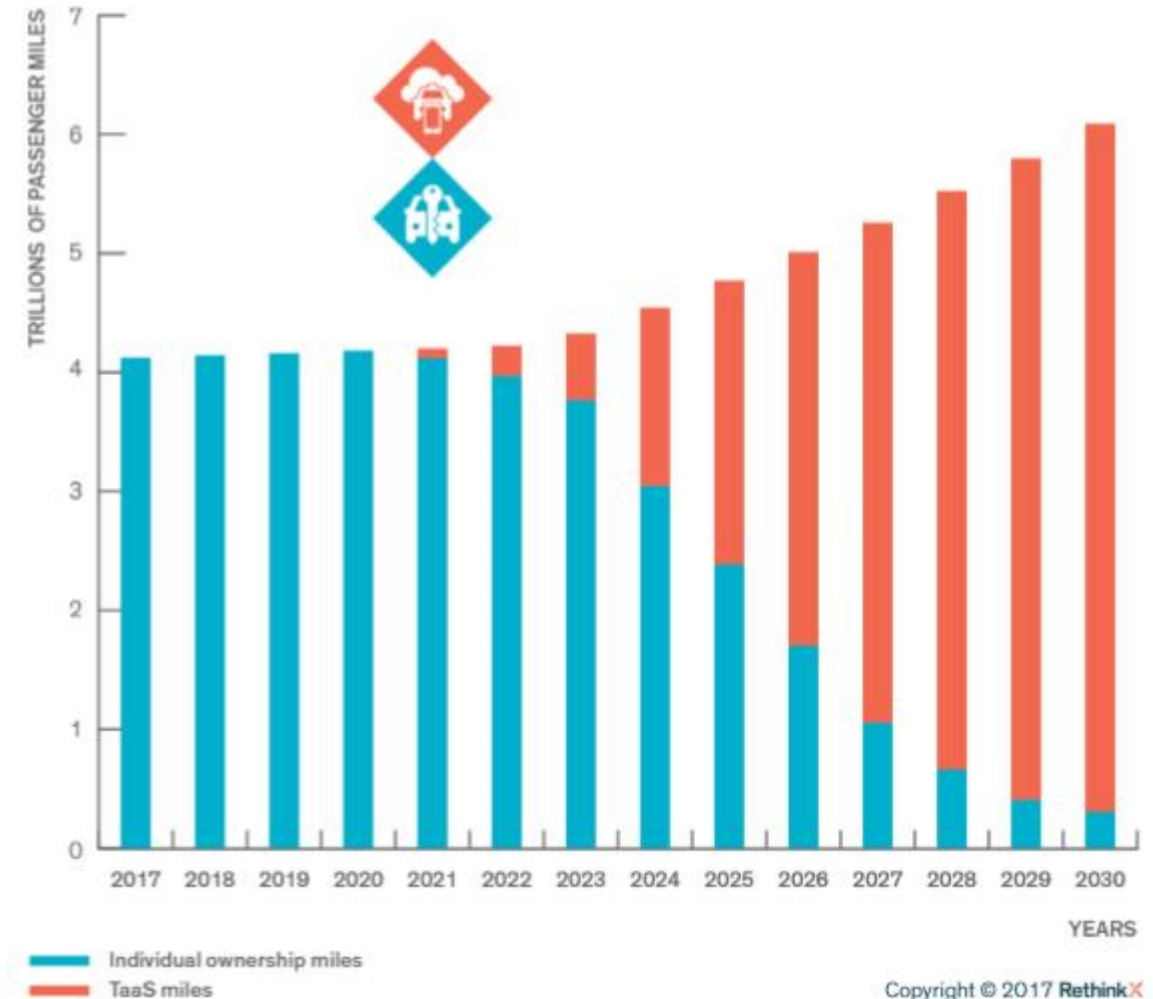
UBER

- Started in 2010
- Completed 5 billion trips (May 2017)
- 6 continents, 76 countries, 450+ cities (May 2017)



- Started 2012
- Provides over one million rides per day (July 2017)
- 360 communities (July 2017)
- Drivers have earned \$250 million in tips (June 2017)


» Speed of TaaS adoption



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Adoption in Commercial Transportation

- Long haul trucking
- Short haul trucking
- Delivery
- Services
 - Garbage
 - Snow Removal
 - Buses



These changes will be adopted by commercial transportation much quicker than consumer transportation because it makes economic sense!

So What? Demographics and Technology

- New technologies will be more widespread within the next 10 years
- May not affect you in the next two years, but certainly will over the typical ten year investment period
- Start the process for thinking how these technological disruptors will impact live/work/play environments
 - **You may be forced to take a more active role in the energy utility business**
 - **You may have more land than you think!**
 - **Efficiency is the play for the next 2 years, disruption in the next 10**

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