

Income and racial disparities in financial returns from solar PV deployment

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Residential adoption of rooftop solar a key contributor to MA climate goals

- Solar power will account for roughly 34% of electricity generation in MA by 2050
- Ideally solar panels should be installed rooftops, structures and degraded lands
- Less than 5% of MA households have solar panels



Photo: www.thisoldhouse.com

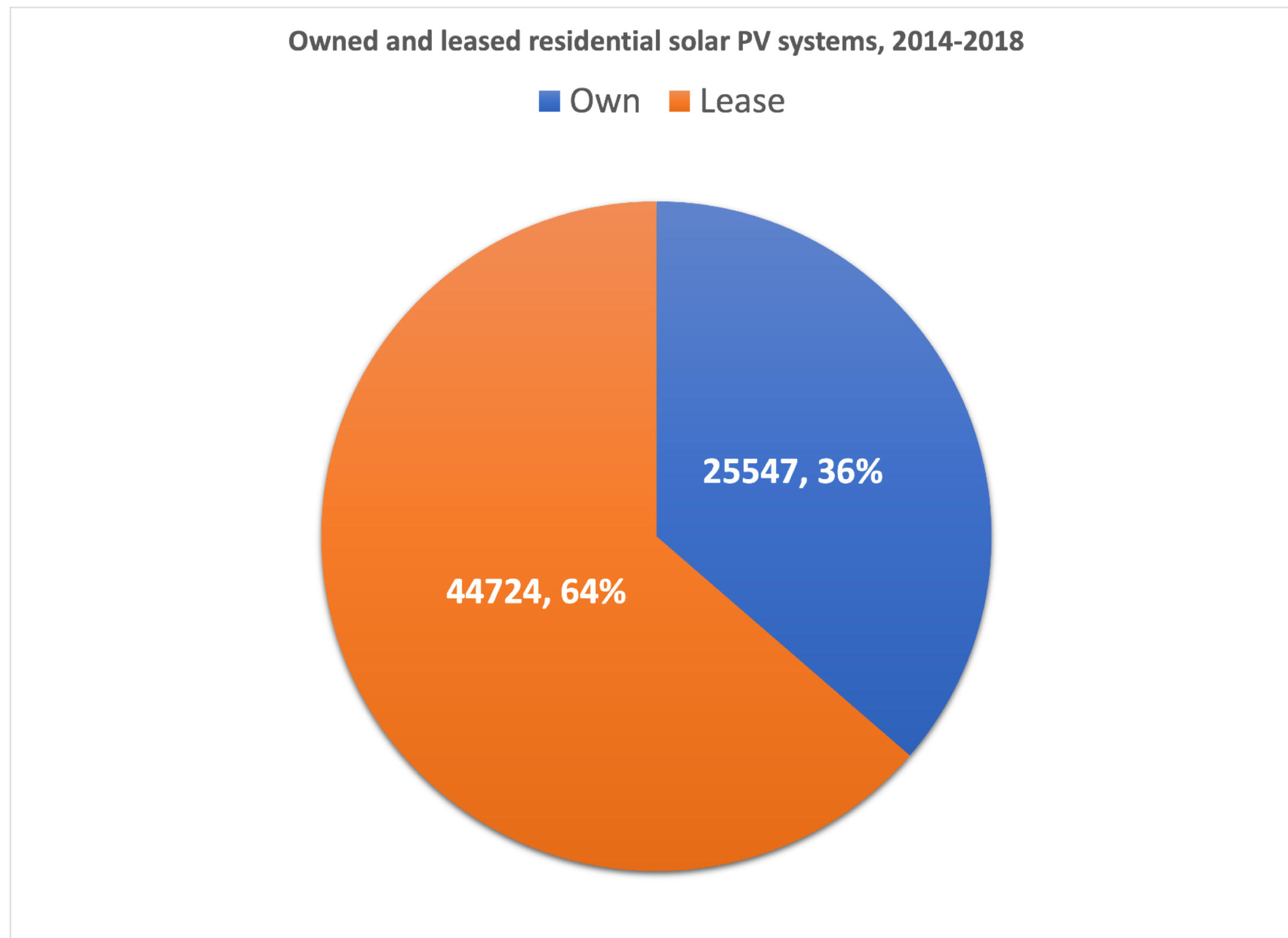
DATA

- All residential solar PV systems installed in MA between 2014-2018 (~70,000)
 - Address location
 - System size, cost, incentives
 - Leased or owned
- Demographic information on 4,950 census block groups in MA
- Financial model to calculate NPV of financial returns from solar PV

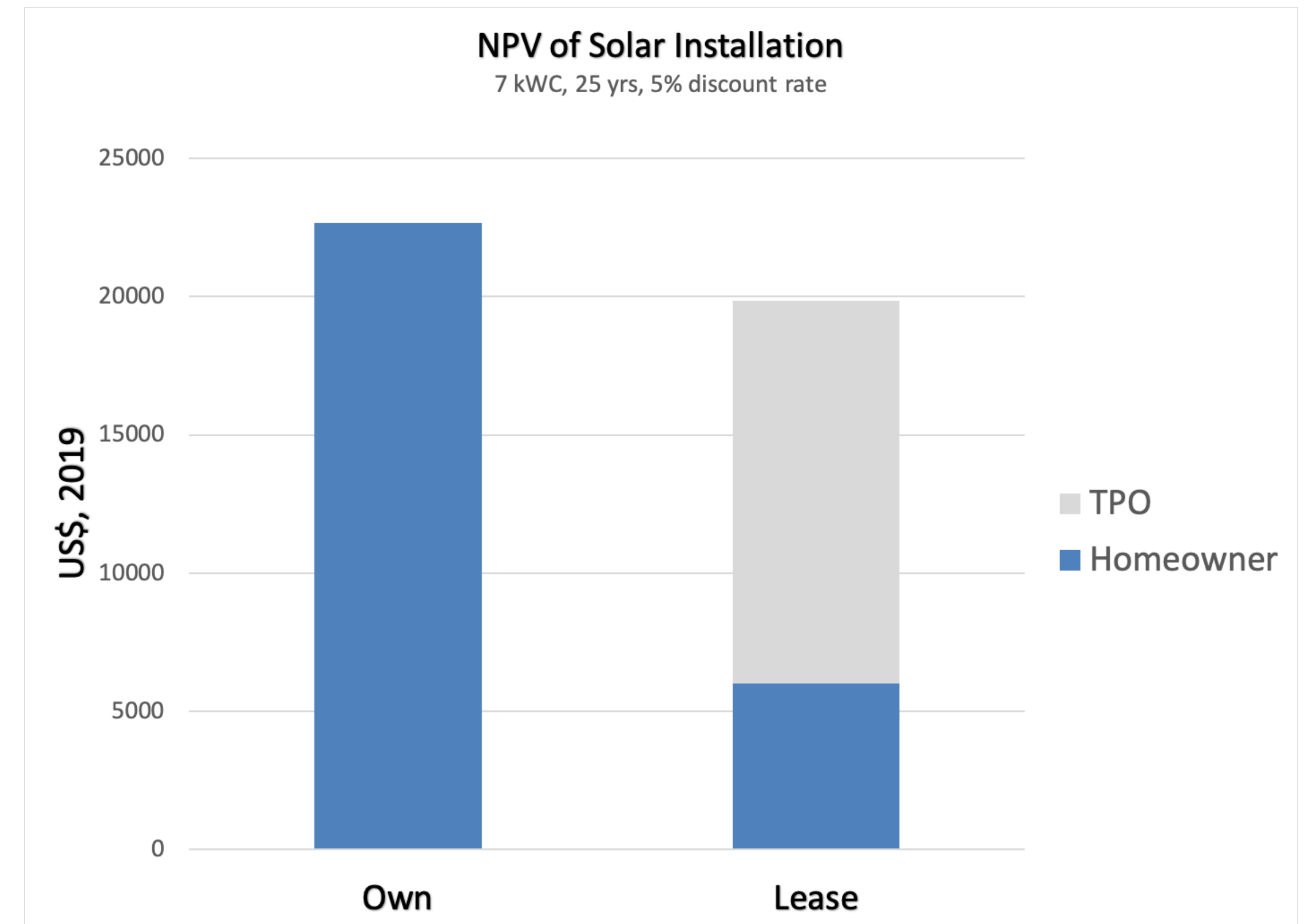
METHODOLOGY OVERVIEW

- Use financial model to calculate the Net Present Value (per kW_C) of financial returns from a solar PV system depending on:
 - Year of installation (incentives, cost of installation)
 - Leased or owned
- Assign financial return to each of ~70,000 residential solar PV systems
- Map each solar PV installation to census block group (CBG) to obtain total financial returns in a CBG
- Statistical analysis at CBG level

1. Ownership versus Leasing

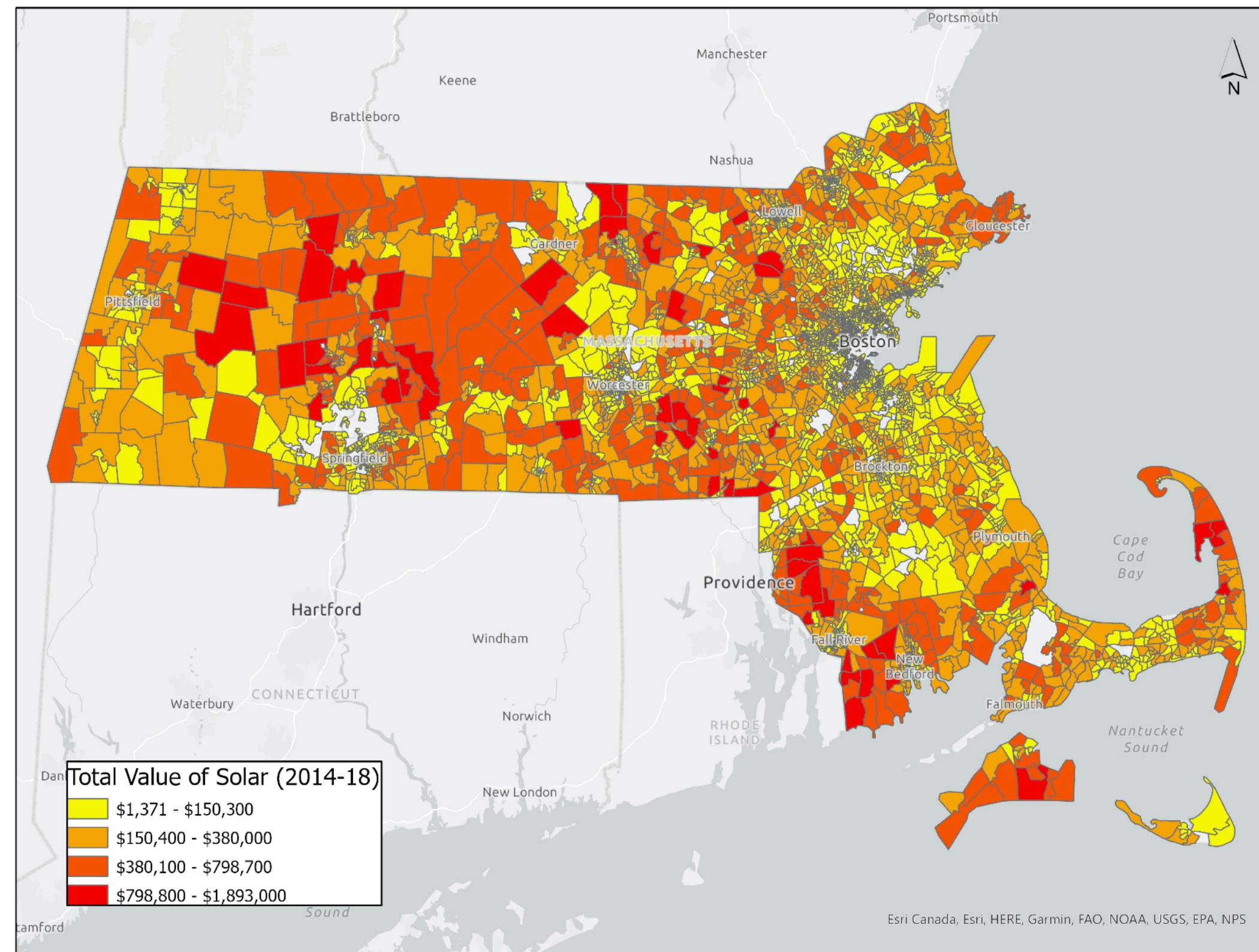


Majority of solar adopters are leasing.



Ownership yields 3X of financial return compared to leasing.

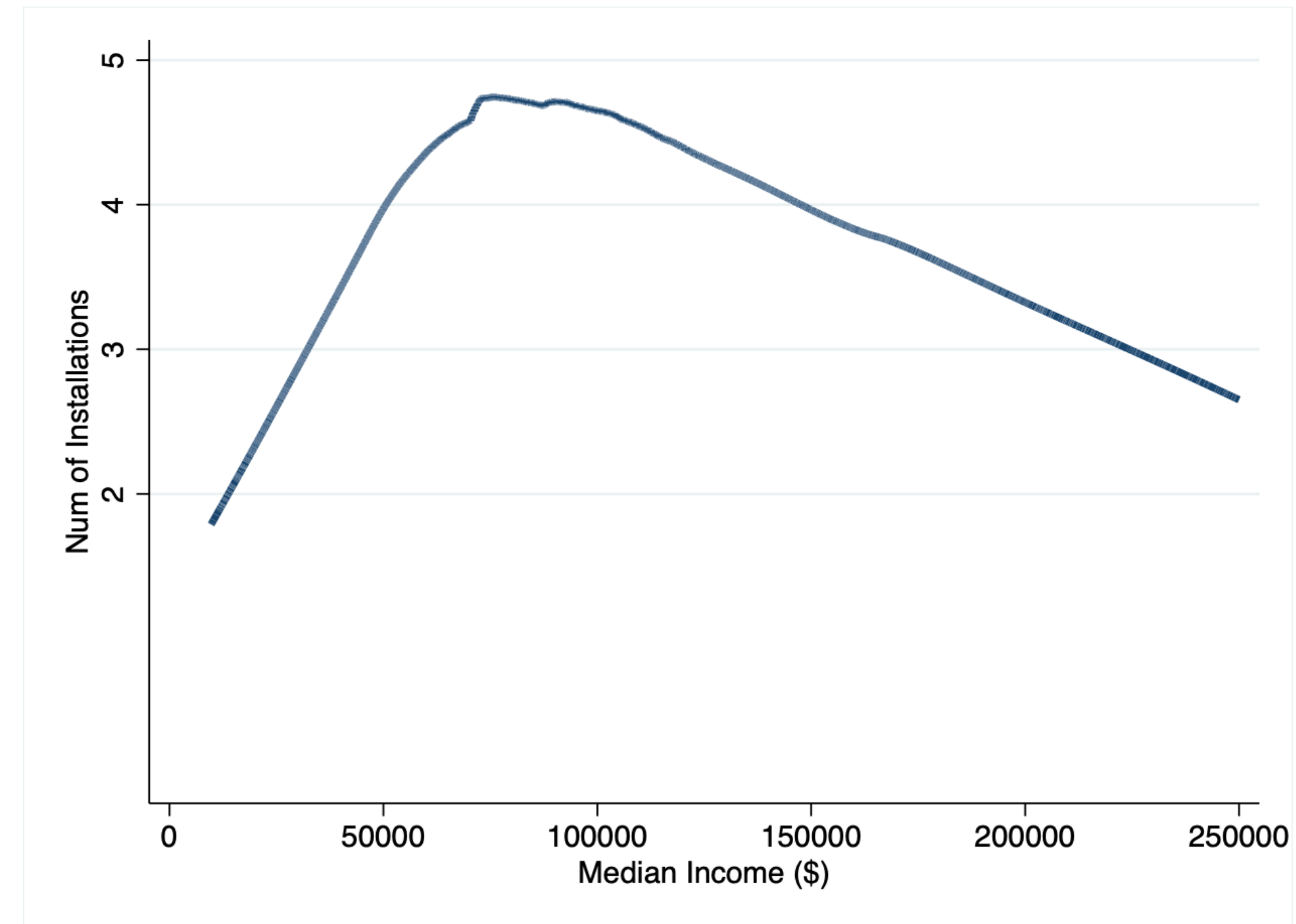
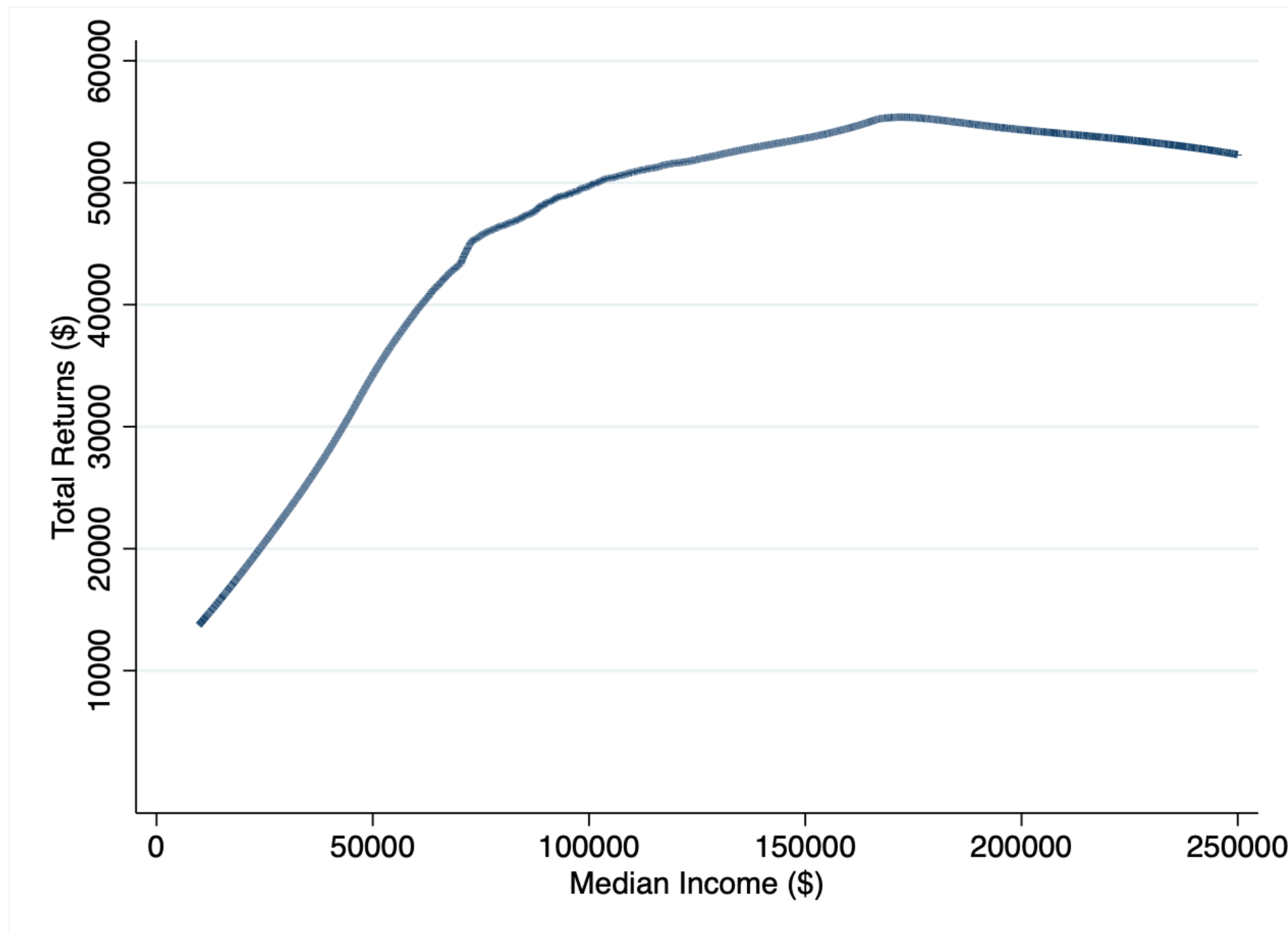
2. Financial returns vary across the state



Financial returns by census block group

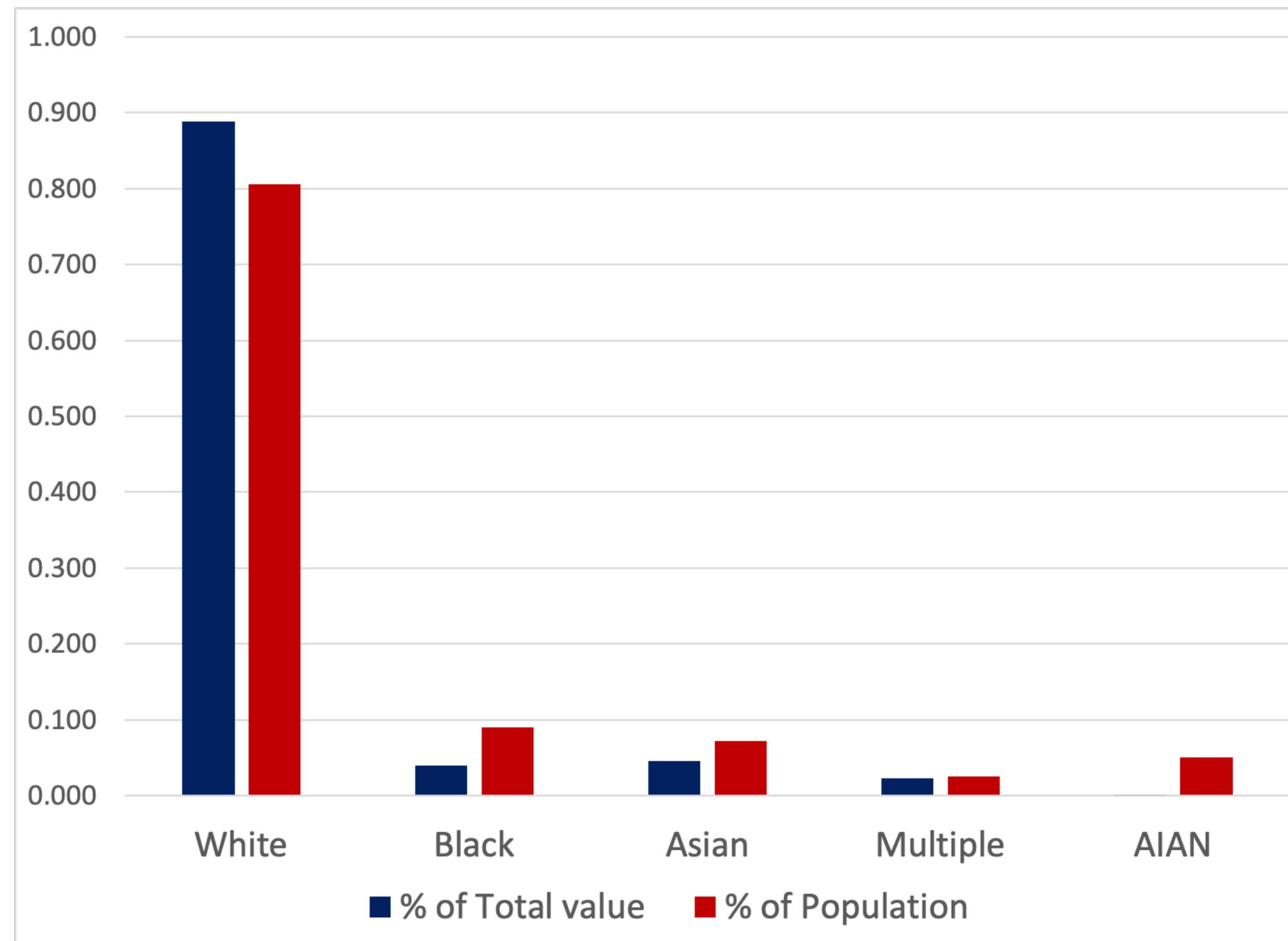
Year	Category	Num. Installs	Num. MW	Mean Return	Min Return	Max Return
2018	Total	10,852	84.32	\$50,760	\$1,687	\$645,520
2017	Total	11,722	83.37	\$50,760	\$1,237	\$609,871
2016	Total	23,859	174.62	\$56,119	\$567	\$595,151
2015	Total	18,436	129.38	\$41,623	\$1,080	\$662,908
2014	Total	5,402	34.52	\$18,512	\$1,176	\$293,366

3. Financial returns are greater in higher income CBGs



- ➔ High income block groups obtain \$6,157 greater financial returns compared to low income block groups
- ➔ Figures above show that this increase is driven by greater number of owned systems among the highest income groups

4. Financial returns are lower for non-white communities



- ➔ A one percent increase in black share of the population associated with a decrease of \$16,000 in financial returns in a census block group.
- ➔ Figure above shows a disproportionate share of financial returns compared to population share.

Future Research Directions

- Better understanding of mechanisms behind low uptake of solar power in low income and minority communities
 - Renter status, unsuitable roof are factors, but there could be other barriers
 - Low- and moderate-income households are less likely to adopt solar than high-income households, even when the low-income households have better rooftop energy production potential (O'Shaughnessy et al., 2020; Reames, 2020)
 - Black and Hispanic majority census tracts have lower solar adoption rates compared to no majority and White majority tracts, even when homeownership and income are controlled for (Sunter and Kammen, 2019)
 - Familiarity with/ trust in technology, low employment in renewable energy sector among certain groups can be barriers
 - Research examining attitudes toward risk and delayed financial returns
 - Community and stakeholder input is crucial

Thank you!
Questions and comments welcome.

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