
Mortgage Rates, Household Balance Sheets, and the Real Economy

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Motivation

- Long-standing debate on real effects of monetary policy
 - ❑ Extraordinary recent actions to keep rates low
- Residential mortgage market believed to play an important role in the transmission of monetary policy
 - ❑ Homes and mortgage debt as key household asset and liability
- Empirical evidence on the impact of lower mortgage rates on households/broader economy fairly limited
 - ❑ Data limitations
 - ❑ Identification challenges

This Paper

- Provide novel evidence on the impact of lower rates on households and broader economy during the crisis
 - ❑ Micro: Household balance sheet and (inferred) consumption
 - Credit card debt, auto financing
 - ❑ Regional: Broader economy
 - House prices, durable consumption, employment
- Speak to policies on mortgage market rules/regulations
 - ❑ Significant debate regarding the relative magnitudes
 - Does debt deleveraging limit consumption response?
(Agarwal et al. 2012, Mian and Sufi 2013)
 - ❑ Mortgage modification programs, programs facilitating refinancing
 - Remove institutional frictions in implementation of policies [HAMP/HARP] since all eligible households receive rate reduction

Empirical Challenges

- Hard to empirically assess impact of lower interest rates
 - ❑ Rates endogenous with either borrower characteristics and/or macroeconomic environment
- Our approach
 - ❑ At micro level: Exploit variation in ARM contract types across borrowers to generate variation in rates faced by similar households
 - ❑ Similar identification as in Tracy and Wright (2012) and Fuster and Willen (2013) in their studies of impact of rates on default
 - ❑ At regional level: Exploit variation in distribution of contract types (ARM share) across similar regions
 - ❑ Propensity score approach to make comparisons across regions (also IV approach for robustness)

Outline

- Data
- Micro Evidence
 - Heterogeneity
- Regional Analysis
- Conclusions

Micro Data

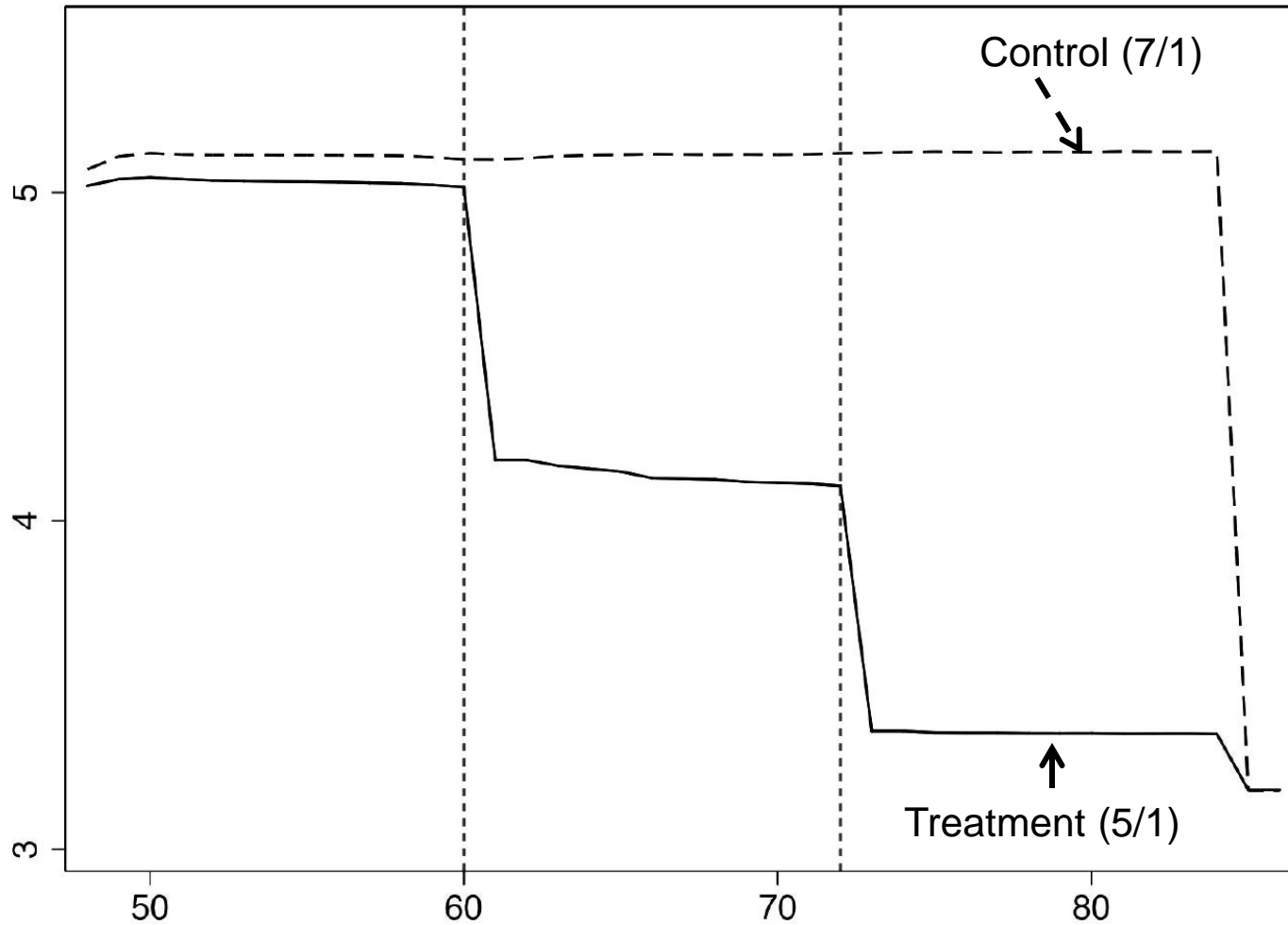
- Proprietary data from a secondary market participant
 - Detailed monthly loan-level panel data
 - Mortgage performance data
 - ↕
 - Loan balances, current interest rate, mortgage type, payments, delinquency status, location (zip code), etc.
 - Consumer credit records
 - Credit card balances, auto loans, student loans, credit inquiries, payment status, current credit score (FICO), etc.
 - Records matched using borrower SSN
- Dataset representative of most U.S. mortgage borrowers
 - More than 350,000 agency borrowers

Micro Evidence

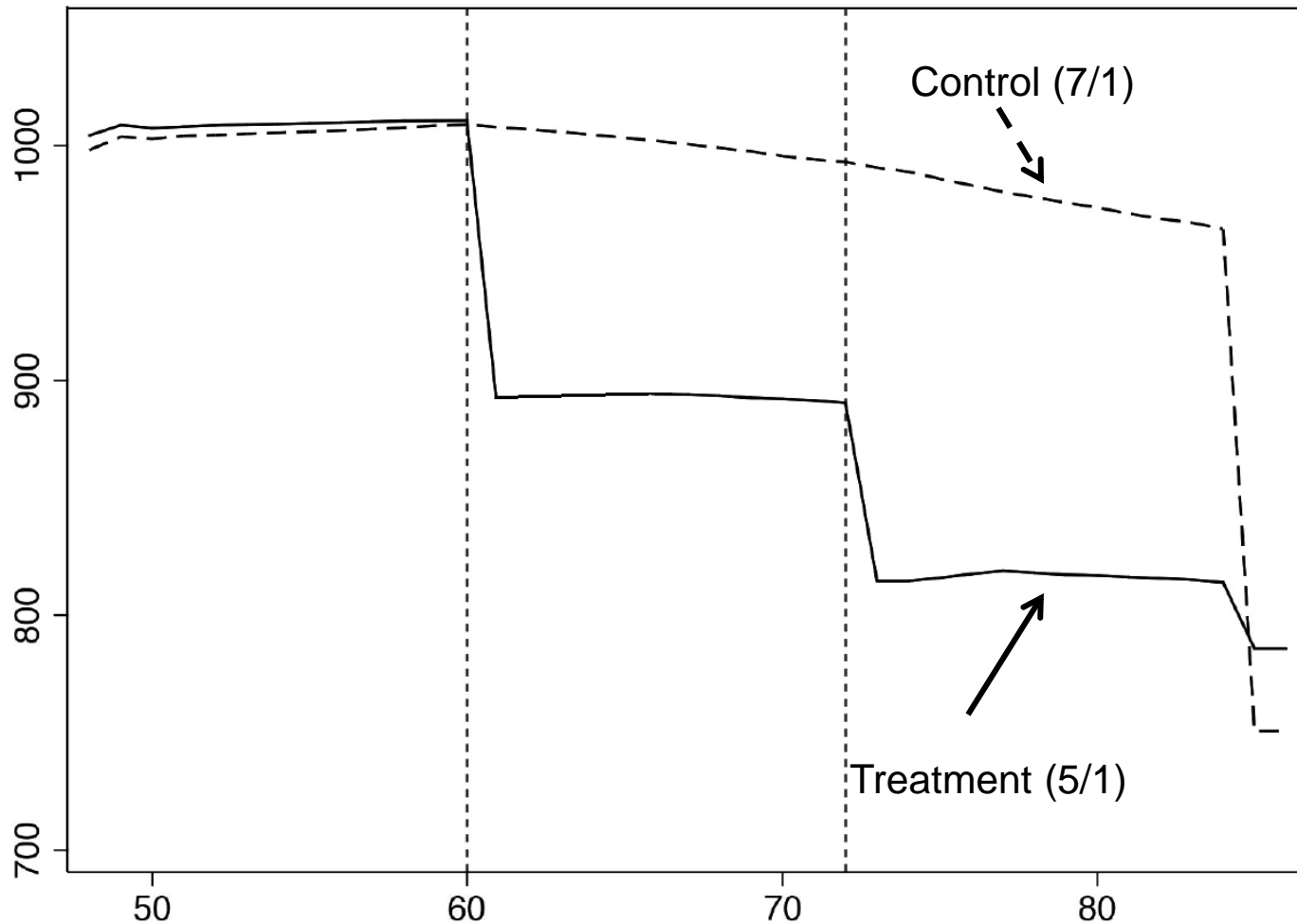
Micro Evidence (Summary)

- Both Papers (Di Maggio et al. 2014 and Keys et al. 2014):
 - Find similar results on key outcome variables
 - Sizeable increase in car spending following rate reduction
 - Larger response among less wealthy (e.g., high CLTV)
 - Consistent with standard models of MPC
 - Significant portion of the stimulus used to repay debt
 - Jointly shows external validity of the estimates
 - Similar relative effects in agency and non-agency data
 - Similar relative effects across various treatment strength
 - Similar results in diff-in-diff setting exploiting variation *between* ARM contract types as well as in the setting exploiting the timing of reset *within* the same contract type

Rate Resets and Interest Rates

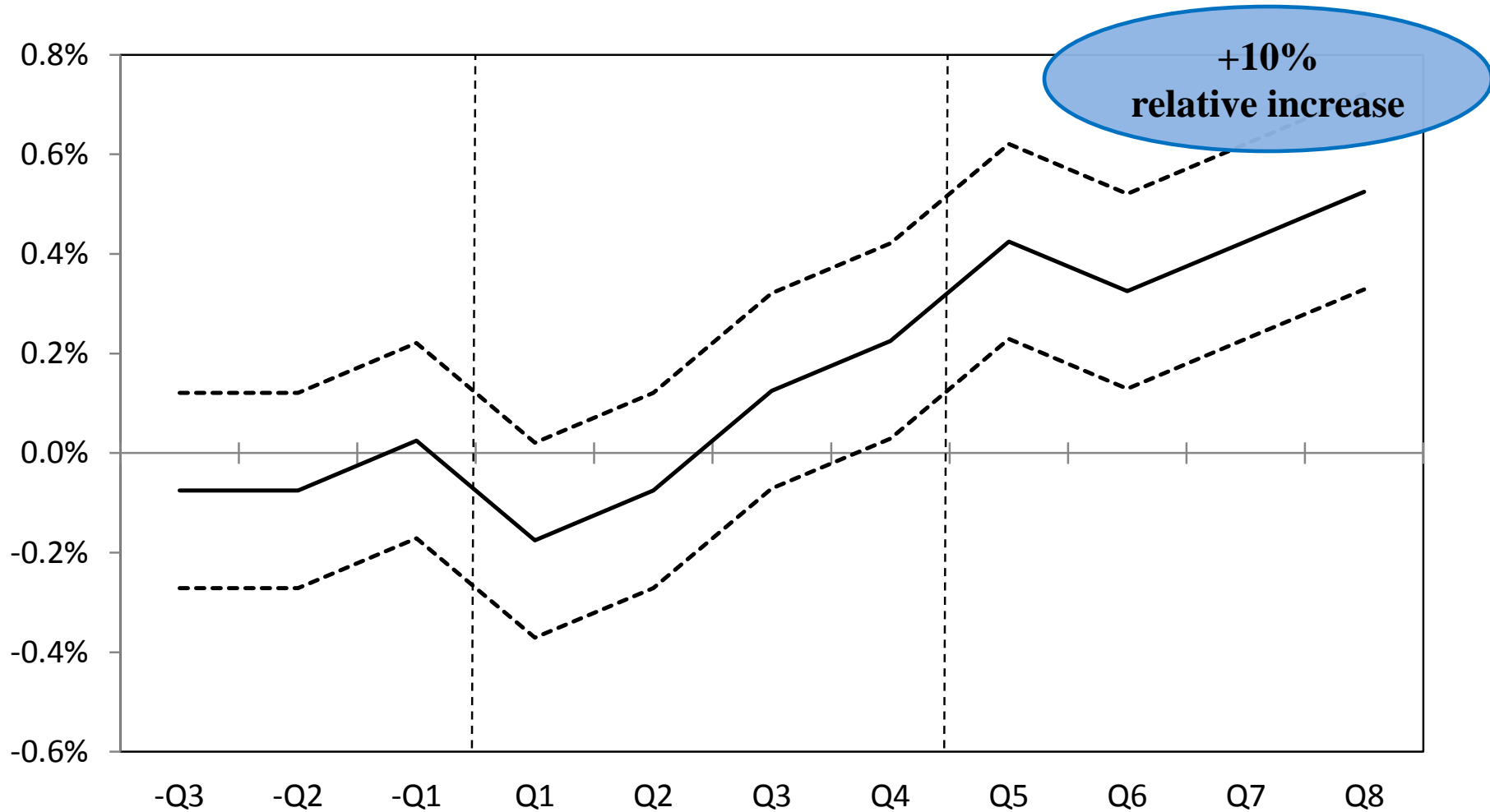


Rate Resets and Mortgage Payments

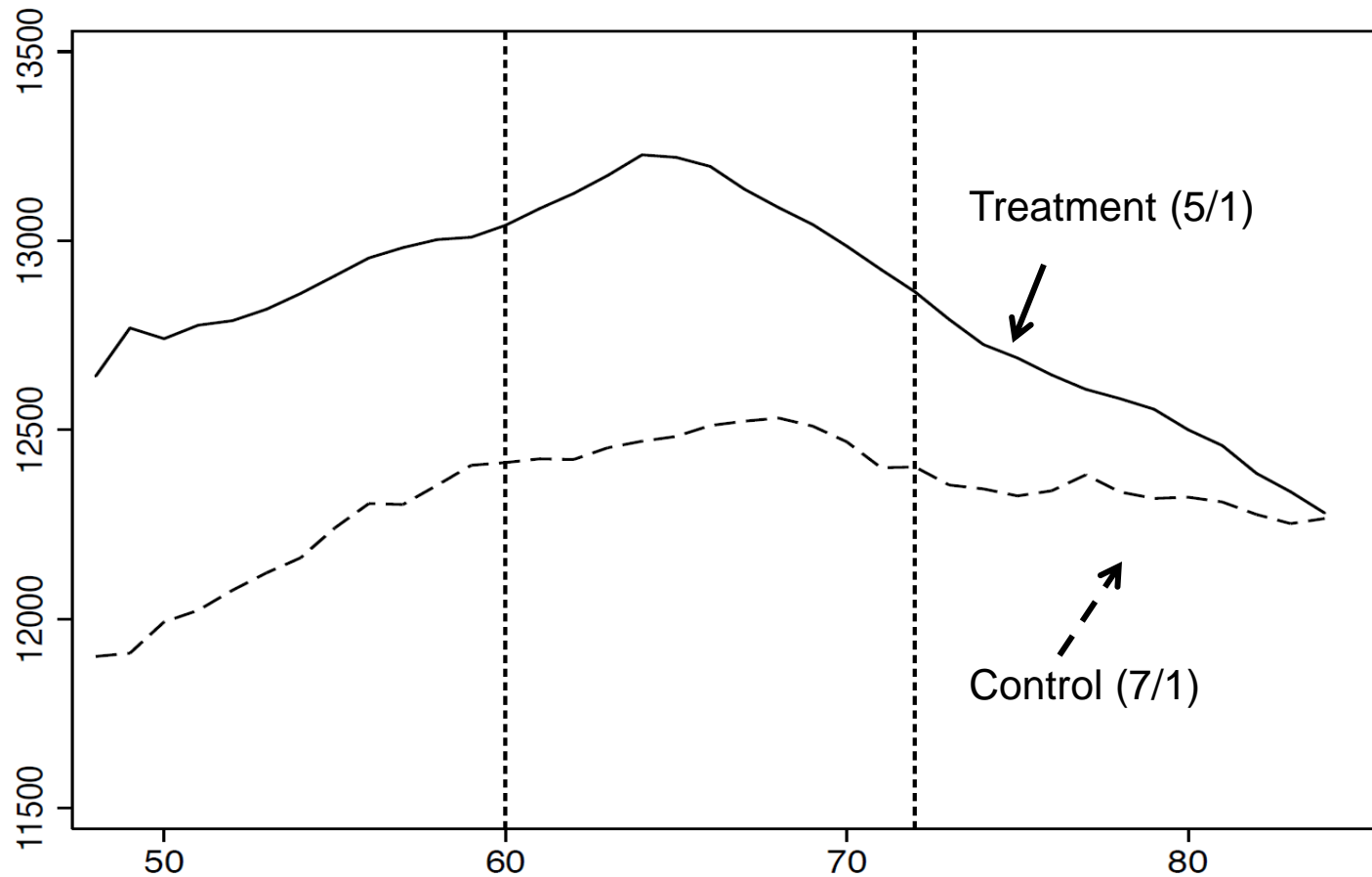


Mortgage Payments are reduced by \$1,500 (on average) in the first year, and by \$3,434 over two years

Impact on Change in Probability of Auto Financing



Impact on Revolving Debt Balance



19% of extra liquidity from lower mortgage payments allocated to revolving (credit card) debt repayment over two years

Cross-Sectional Heterogeneity

Debt Deleveraging: Liquidity Constrained

	Top Quartile Credit Utilization	Bottom Quartile Credit Score
Change in Revolving Debt	-\$1284.9 (321.4)	-\$1206.4 (280.7)
As % of Mortgage Payment Reduction	70.6%	65.1%

- Very significant debt repayment (deleveraging) in the bottom quarter of liquidity-constrained borrowers
 - ❑ Key target of many interventions
 - ❑ MPC often viewed as high in this group
 - But **upper bound MPC of 0.35 – 0.31**
 - ❑ Not surprising that marginal dollar allocated to high cost credit card debt (average credit card interest rate +14%)

Credit Utilization and CLTV (One Year Out)

Auto Financing and Durable Consumption

	Current Payment	Auto Balance	Probability of New Auto Financing
Treatment	-113.84 (23.27)	-15.06 (66.47)	0.002 (0.003)
Treatment x (Utilization>M)	-13.43 (7.39)	-151.30 (50.65)	-0.004 (0.002)
Treatment x (CLTV>M)	-19.189 (8.58)	258.77 (87.98)	0.009 (0.003)
Number of loans	348,259	348,259	348,259
Adjusted R-squared	0.233	0.044	0.042

- Durable spending sees heterogeneous response
 - ❑ High utilization group sees much less increase in auto balance / new cars (especially at 1 year horizon)
 - ❑ High CLTV group sees significant increase in balance / new cars

Heterogeneity across Wealth/Liquidity Constraints

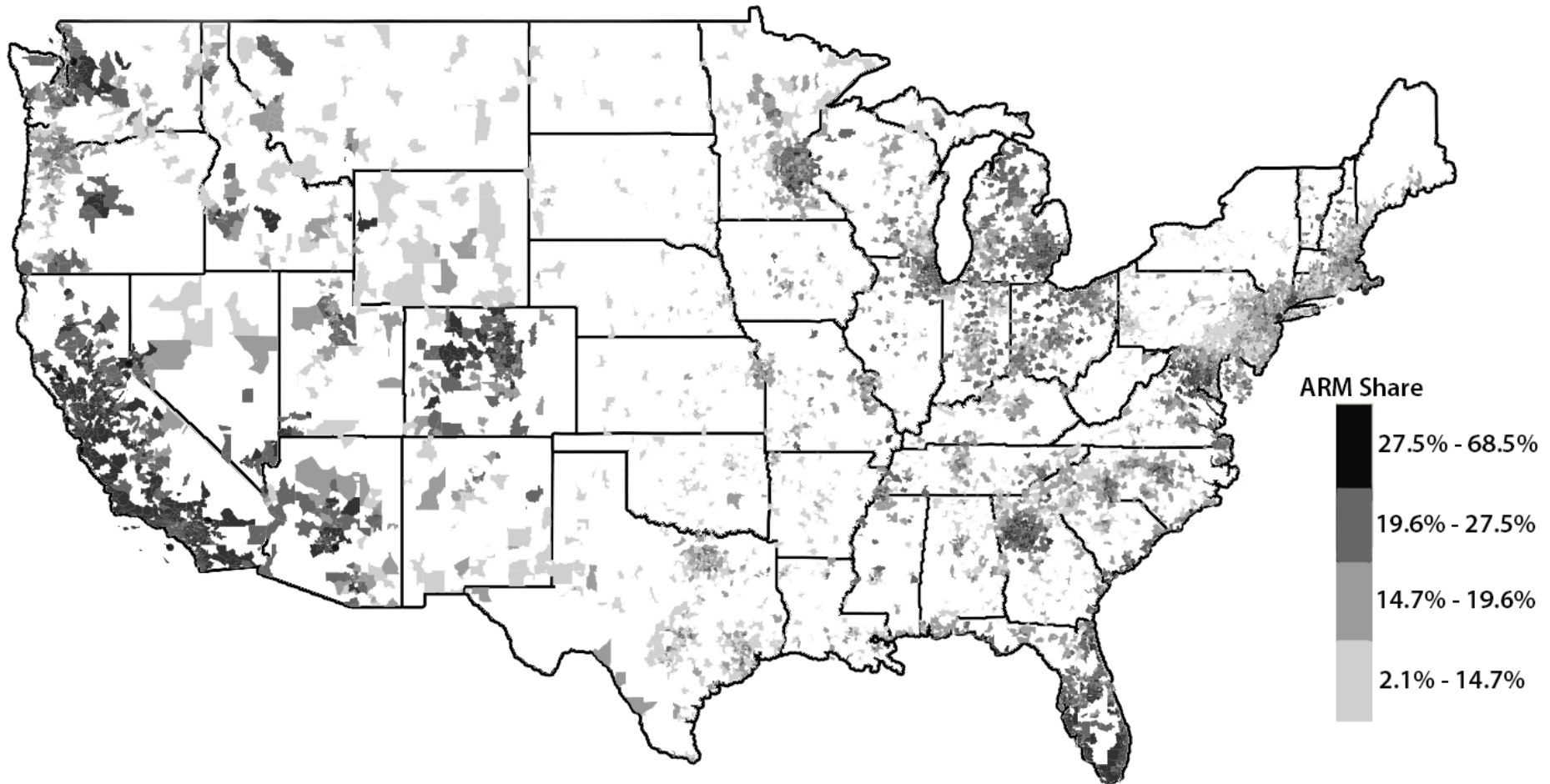
- Wealth constrained show:
 - Bigger improvement in mortgage delinquency
 - Significantly larger increase in new auto debt financing
- Liquidity constrained (with costly debt burden) show:
 - Larger reduction in credit card debt
 - Much less increase in new auto debt financing
- New evidence of complex interaction across measures of wealth and liquidity constraints
 - Traditional response: Lower-wealth households are more responsive to income shock, but less so if they have a large credit card debt burden

Regional Analysis

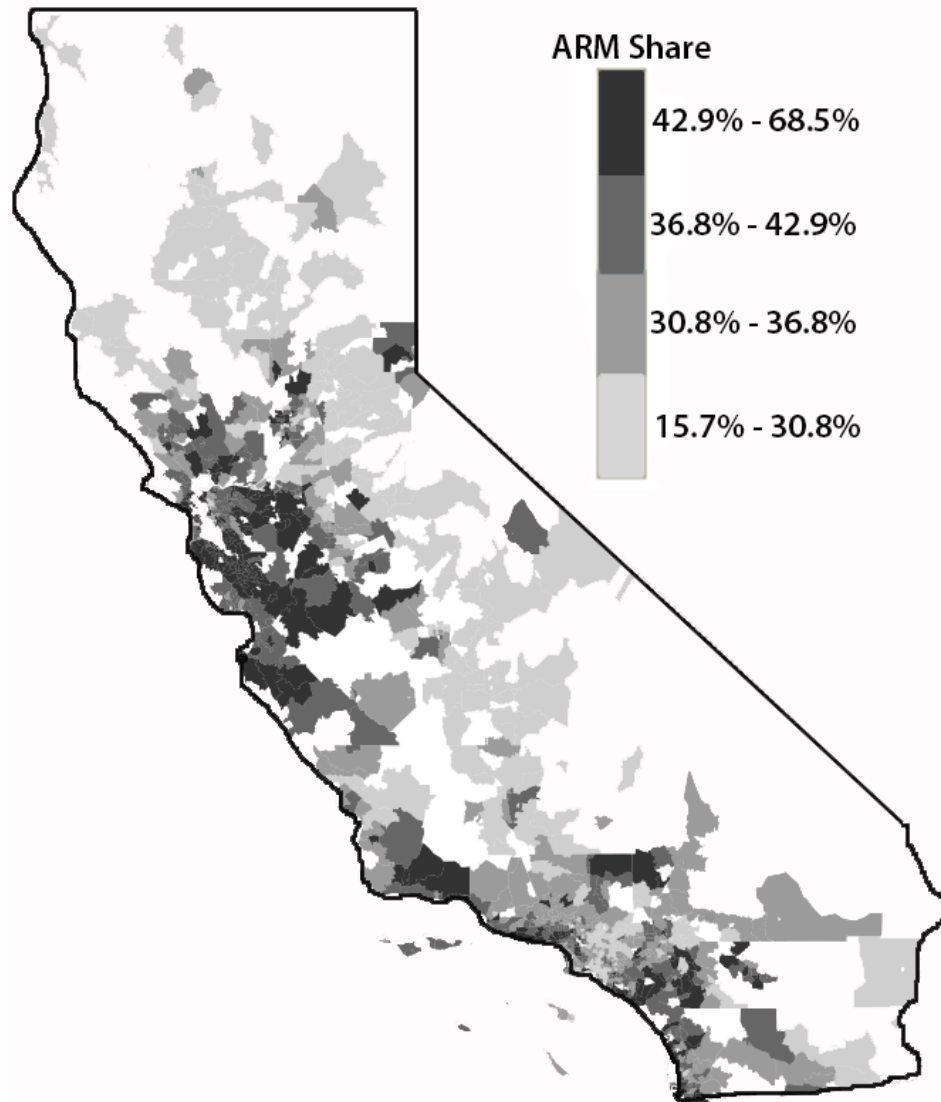
Empirical Strategy

- Exploit regional variation in share of ARMs
 - ❑ Regions with more ARMs more “exposed” to lower rates
 - ❑ Similar to Mian and Sufi (2011) and Agarwal et al. (2012) in the context of “Cash-for-clunkers” and HAMP programs
- Ex-ante measure of exposure to interest rate declines
 - ❑ Zip code ARM share as of Q2 2007 predicts treatment intensity
- Construct sample of similar zip codes
 - ❑ Matched on observables (FICO, LTV, interest rate, etc.)
 - ❑ Similar results in IV framework (using all zips w/state FEs)
- Investigate impact on economic outcomes
 - ❑ Difference-in-differences methodology
 - ❑ Outcomes: mortgage defaults, house prices, durable consumption (autos), and employment

Geographic Distribution of ZIP Codes



Geographic Distribution of ZIP Codes

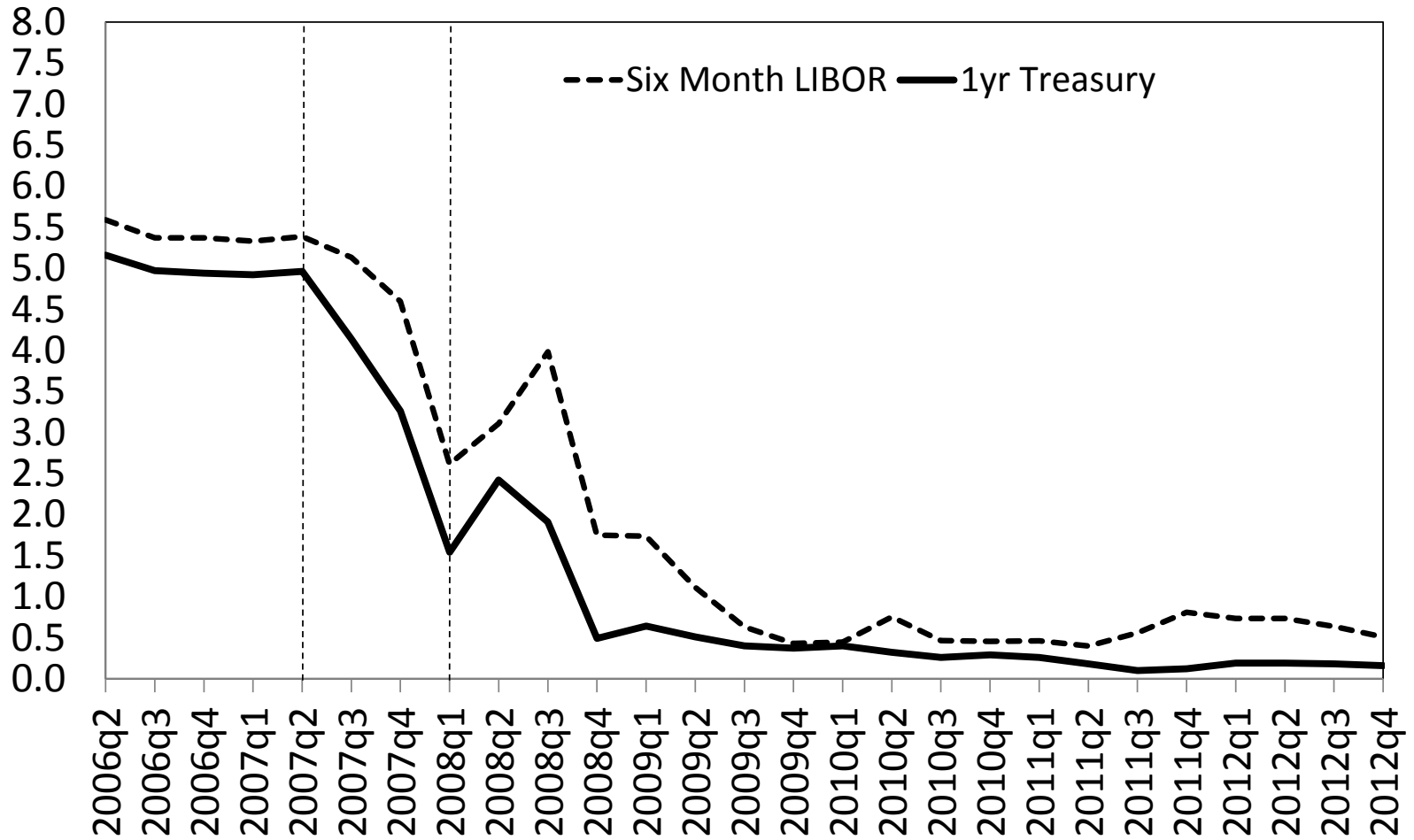


Summary Statistics

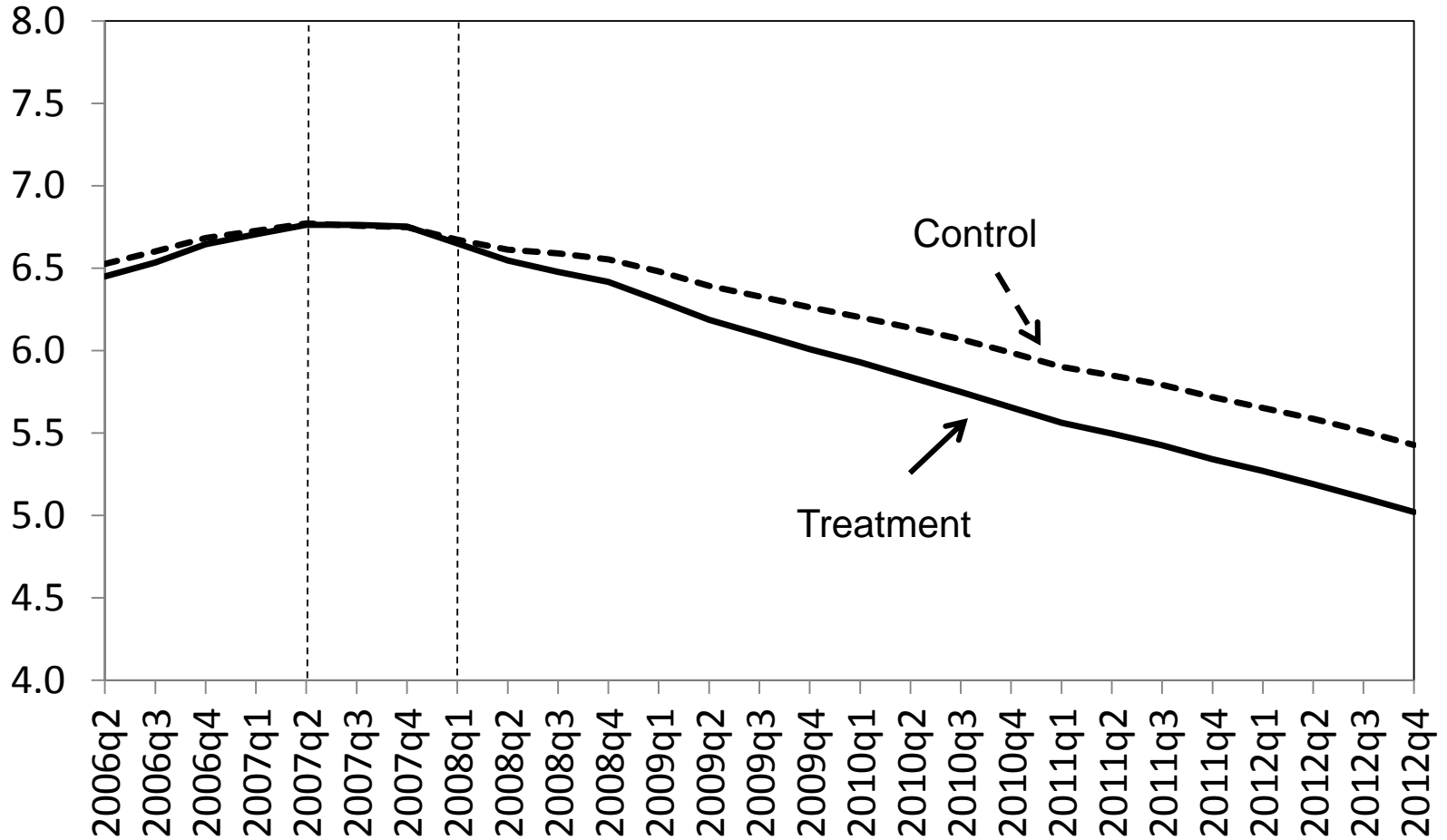
	High Exposure Zip Codes		Low Exposure Zip Codes	
	Mean	(S.D.)	Mean	(S.D.)
FICO	714.8	(23.2)	716.0	(18.9)
LTV	64.5	(7.29)	68.1	(7.00)
Interest Rate	6.64	(0.57)	6.68	(0.48)
Mortgage Delinquency Rate	2.81	(3.09)	2.23	(1.83)
Unemployment Rate	6.04	(1.55)	5.91	(1.47)
Median Income	58.42	(14.13)	52.77	(14.38)
Percentage with College Degree	31.4	(10.1)	29.5	(9.42)
Percentage Married with Children	21.9	(5.13)	21.6	(5.13)
Consumer Credit Score	3.37	(0.41)	3.35	(0.35)
ARM Share	35.2	(7.62)	17.3	(4.51)

Range in zip code ARM share: 5.8% to 63%

Time Series of Interest Rate Indices



Mortgage Rate: High & Low Exposure ZIP Codes



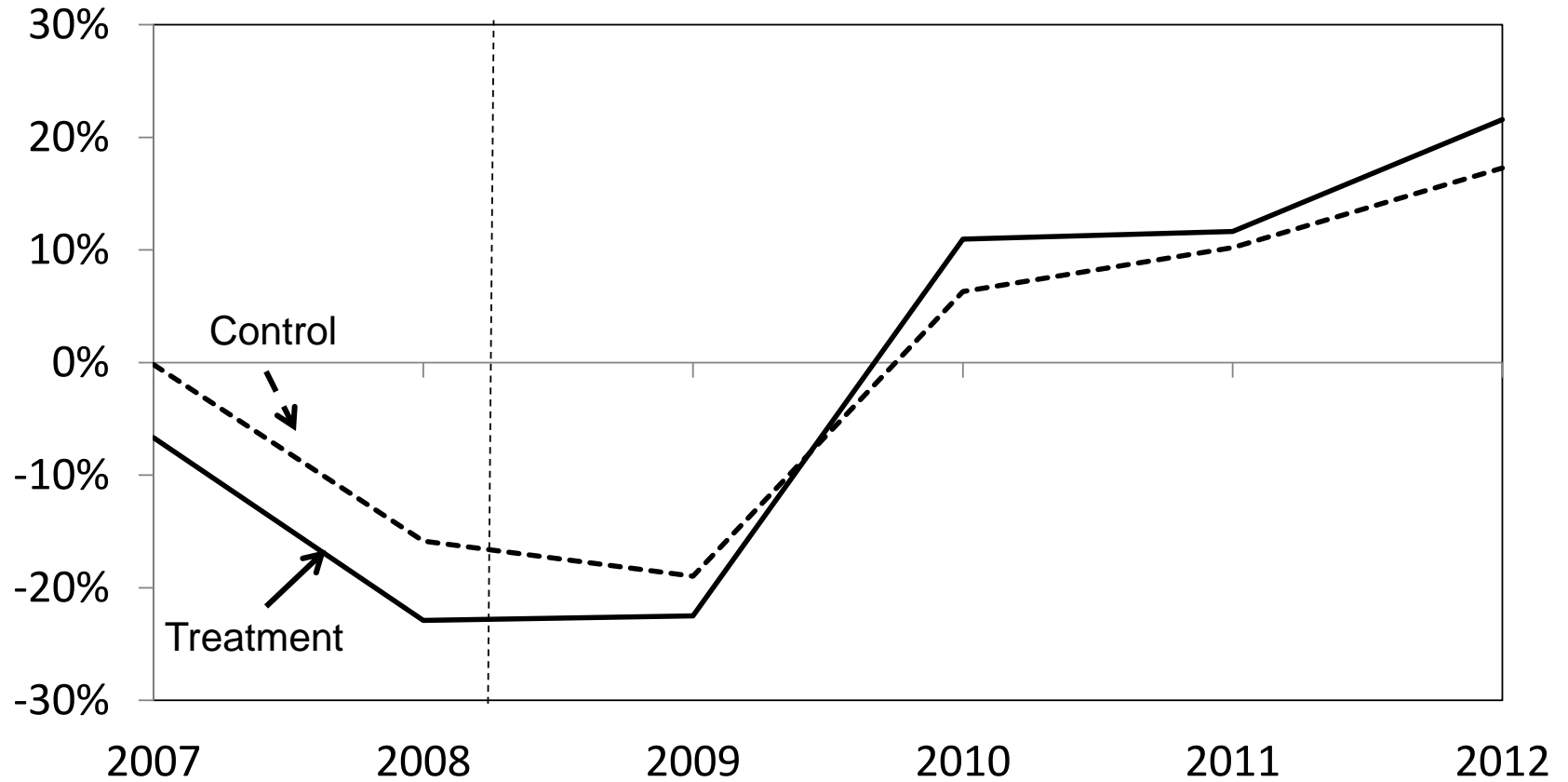
- Interpreting size of first stage:
 - 100% ARM share would lead to a decrease of 175 bp in mortgage rate

ZIP ARM Share & Change in Interest Rate

	(1)	(2)	(3)
ARM Share	-0.0198 (0.0005)	-0.0176 (0.0006)	-0.0174 (0.0008)
Zip Code Controls	No	Yes	Yes
State FE	No	No	Yes
Number of Zip Codes	1000	902	902
R-Squared	0.568	0.759	0.800

- Interpreting size of first stage:
 - 100% ARM share would lead to a decrease of 175 bp in the zip code mean mortgage rate

Auto Growth: High & Low Exposure ZIP Codes



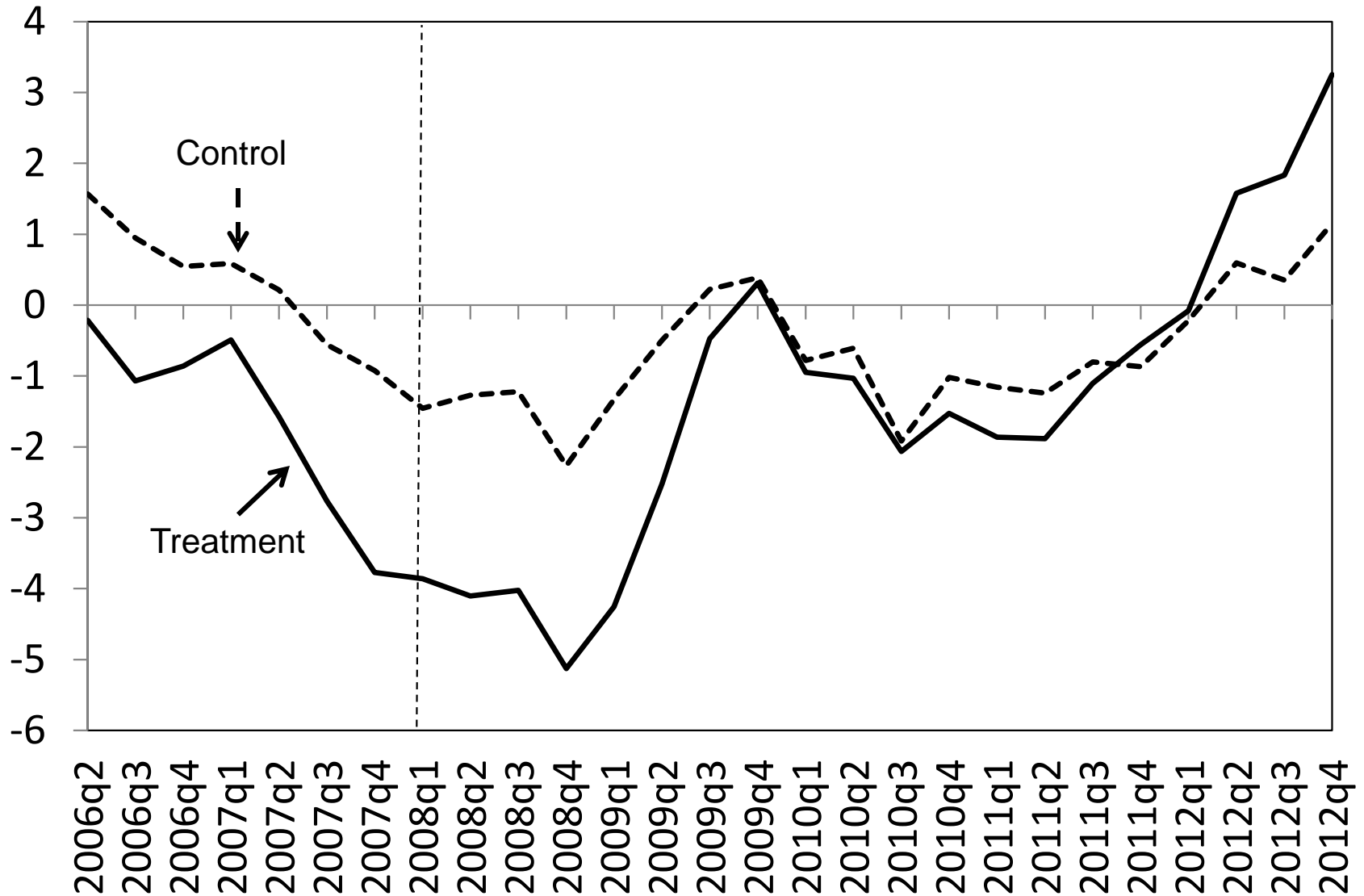
ZIP ARM Share & Change in Auto Growth

	(1)	(2)	(3)
ARM Share	0.085 (0.008)	0.088 (0.013)	0.037 (0.018)
Zip Code Controls	No	Yes	Yes
State FE	No	No	Yes
Number of Zip Codes	1000	902	902
R-Squared	0.089	0.154	0.282

County Level Evidence (DiMaggio et al.)

- Use county-level data on auto sales and within-county changes in ARM share to show relationship between exposure to monetary policy and auto consumption
 - Include county fixed effects, time-varying county-level controls, state-specific time trends
- Find that a 10 percentage point decline in mortgage payments is associated with a 10% increase in car sales
- Differences in identifying variation, in specification (levels vs. changes, but robust results across both papers for car sales at zip and county levels based on relative intensity of exposure to declining interest rates

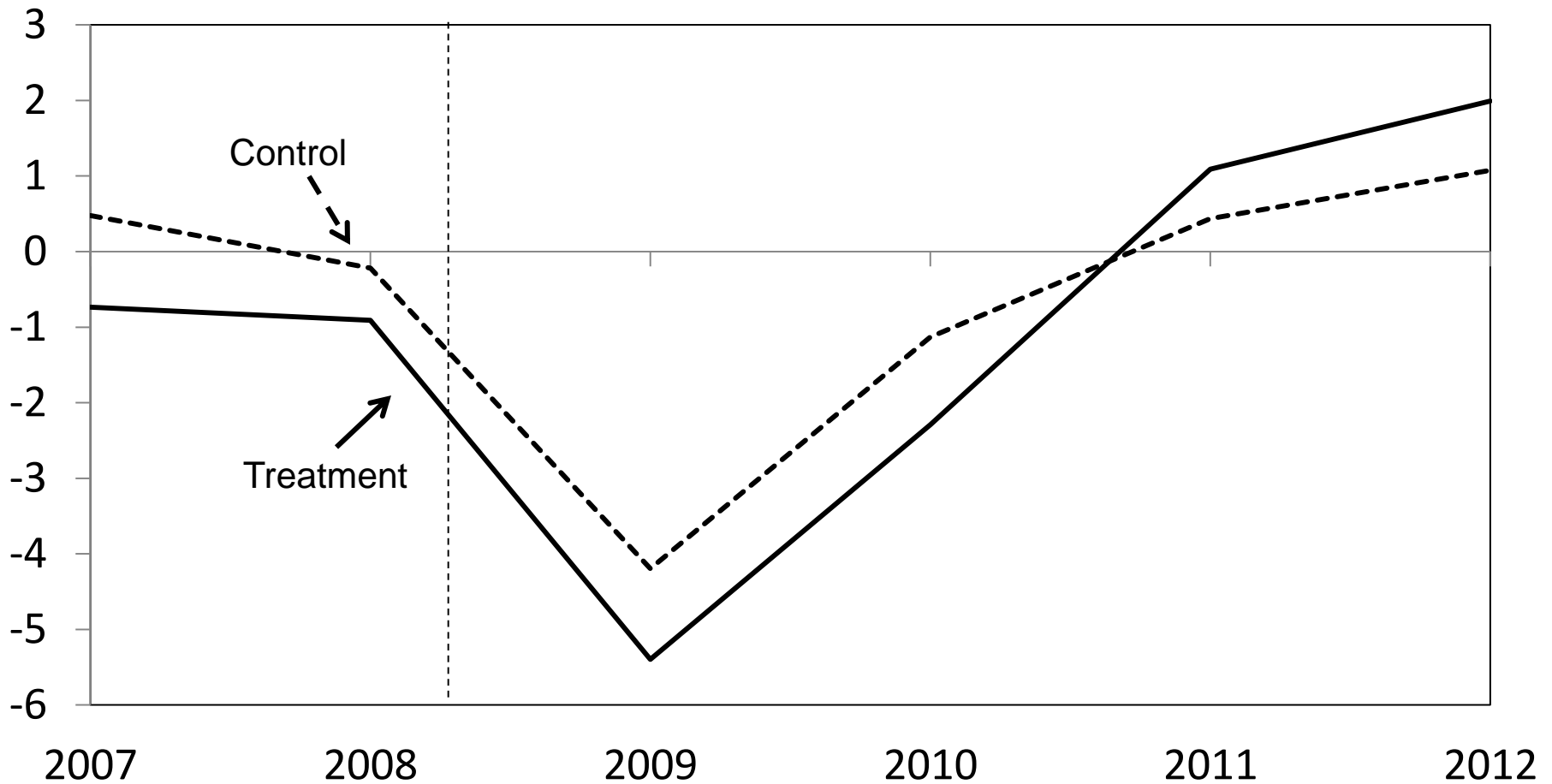
HP Growth: High & Low Exposure ZIP Codes



ZIP ARM Share & Change in HP Growth

	(1)	(2)	(3)
ARM Share	0.0319 (0.0053)	0.0251 (0.0068)	0.0258 (0.0058)
Zip Code Controls	No	Yes	Yes
State FE	No	No	Yes
Number of Zip Codes	1000	902	902
R-Squared	0.035	0.313	0.497

Employment Growth: High & Low Exposure ZIP Codes



- All of the employment response comes from non-tradable sector e.g. restaurants and grocery stores

ZIP ARM Share & Change in Employment Growth

	All Industries	All Industries	All Industries	Restaurant and Groceries	Tradable Sector
	(1)	(2)	(3)	(4)	(5)
ARM Share	-0.0557 (0.0131)	-0.0873 (0.0166)	-0.00559 (0.0219)	0.00643 (0.0425)	0.0693 (0.304)
ARM Share × (09-12)	0.0902 (0.0185)	0.0891 (0.0186)	0.0891 (0.0183)	0.0711 (0.0351)	-0.0018 (0.253)
Zip Code Controls	No	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	Yes
Number of Zip Codes	1000	902	902	829	878
R-Squared	0.0999	0.123	0.173	0.0648	0.0555

ZIP Code ARM Share & Change in Mortgage Rate (IV 1st Stage)

	(1)	(2)	(3)
ARM Share	-0.0209 (0.0002)	-0.0201 (0.0002)	-0.0198 (0.0003)
Zip Code Controls	No	Yes	Yes
State FE	No	No	Yes
Number of Zip Codes	8084	7488	7488
R-Squared	0.571	0.711	0.728

- Interpreting size of first stage:
 - 100% ARM share would lead to a decrease of 200 bp in the zip code mean mortgage rate

Change in Delinquency, House Price & Auto Sales Growth on ZIP Code Change in Mortgage Rate (IV 2nd Stage)

	Mortgage Delinquency Growth		House Price Growth		Auto Sales Growth	
	(1)	(3)	(4)	(6)	(7)	(9)
Mortgage Rate Change	28.93	18.08	-0.39	-0.79	-2.70	-1.26
	(0.82)	(1.31)	(0.07)	(0.10)	(0.15)	(0.27)
Zip Code Controls	No	Yes	No	Yes	No	Yes
State FE	No	Yes	No	Yes	No	Yes
Number of Zip Codes	8082	7487	8000	7487	8084	7488
Adjusted R-squared	0.091	0.341	0.05	0.429	0.020	0.185

Discussion (DiMaggio et al and Keys et al)

- Low interest rate policies have had meaningful impact on household spending and broader economy
 - ❑ Supports view that shocks to household balance sheets important factor affecting employment
 - ❑ Will we see reversal when stimulus withdrawn?
- Partial estimates suggest that 20% relative reduction in average mortgage rates in a region results in:
 - ❑ +3.5% increase in the annual house price growth rate
 - ❑ +5% increase in the annual auto purchase growth rate
 - ❑ +3% increase in the non-tradable employment growth rate
- Caveats: Cannot quantify overall impact (GE effects)
 - ❑ Generic limitation of diff-in-diffs regional analyses

Conclusions

- Household debt deleveraging can significantly limit the ability to simulate household consumption
 - ❑ Significant part of stimulus due to lower rates transferred to the banking sector
 - ❑ Target policies to alleviate high cost of credit card debt?
- ARM contracts facilitate quick transmission of low interest rate policy
 - ❑ Avoid institutional frictions impacting HARP and HAMP
 - ❑ Circumvent inability to refinance
 - ❑ E.g. due to negative equity, borrower inertia etc.