Online Appendices for Cash for Corollas: When Stimulus Reduces Spending

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A Data Appendix - For Online Publication

The Texas Department of Motor Vehicles (DMV) provided us with confidential access to all Texas vehicle registrations for the years spanning our study. From these records, we attribute individual vehicles to households as follows. First, we used ESRI's ArcMAP software to geocode the population of entered registration addresses to the North American Address Locator database. Of importance, this process additionally returns the standardized postal address for each specific matched location, thereby correcting for database entry errors. For these standardized addresses, we drop records at any address to which more than 700 unique vehicles (VIN17) were registered within a single calendar year, as these are almost exclusively commercial or institutional registrants. For similar reasons, we drop records for which the last name consists of some variation of a commercial, industrial, or other non-household registrant (e.g. corporation, association, dealer, school, etc.). We drop another roughly one percent of DMV records for the following reasons: (1) we could not match the record to a standardized postal address; (2) the record is missing a sale date; or (3) the record is missing a last name in both last name fields. Finally, we drop records for non-consumer vehicle identification numbers that are not included in EPA fuel economy data (e.g. tractor trailers).

We attribute a pair of vehicles to the same household if either of the following sets of conditions are met: (1) the pair of vehicles is sequentially and jointly registered at multiple locations (i.e. a household moves to a new address); or (2) the pair of vehicles is registered at the same address to the same "fuzzy" last name.[1] After determining pairs of vehicles belonging to the same household, we chain these connections to allocate the population of vehicles to households for each date included in our data.

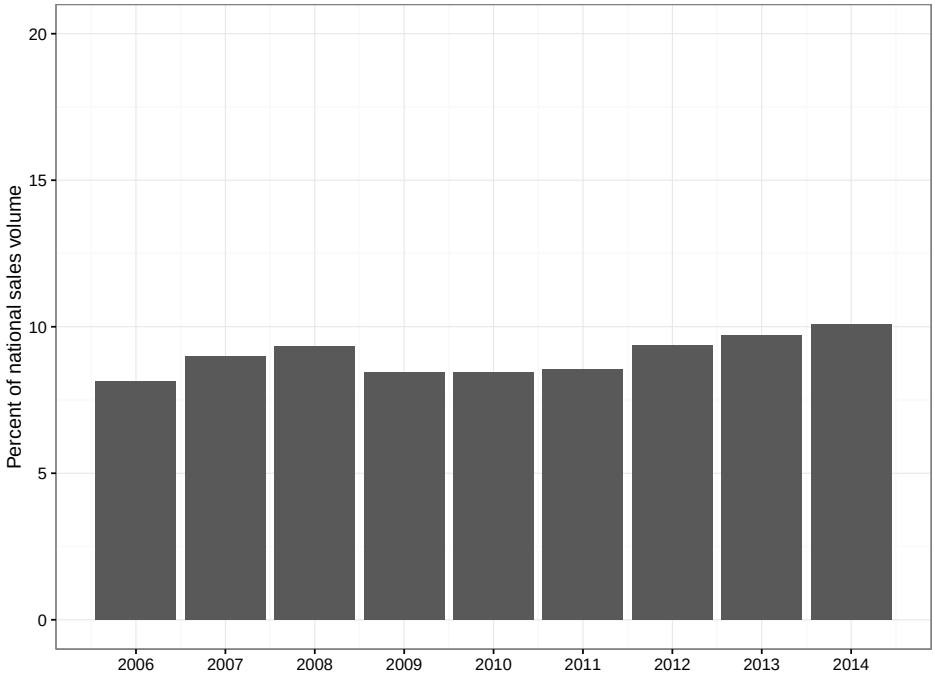
Because DMV registrations are better suited for tracking vehicle purchases than exits from a household's fleet, we make two additional adjustments to households' duration of vehicle ownership. We remove a vehicle from a household's fleet if the latest observed registration (in Texas) has lapsed by six months. And, because car dealerships often do not appear in the same DMV registration database as households, we backdate a vehicle's end date for a household if: (1) the vehicle is later sold by a used car dealership, and (2) the former registered household purchased a new vehicle within six months preceding this sale date. This treats the former registrant's new vehicle purchase transaction date as a trade-in date for the used vehicle.

[1] We use a dynamic Levenshtein distance metric to match last names. First, we trim each of the two last name fields to fifteen letters. Then, we match them pairwise using a Levenshtein critical value of 0.34. The most common entry errors for names in the database are omitted letters (an L-distance of one) and transposed letters (an L-distance of two). For a six letter last name, an L-distance of two requires a critical value of 0.34 to correct. A nine letter last name is allowed three transformations under this critical value.

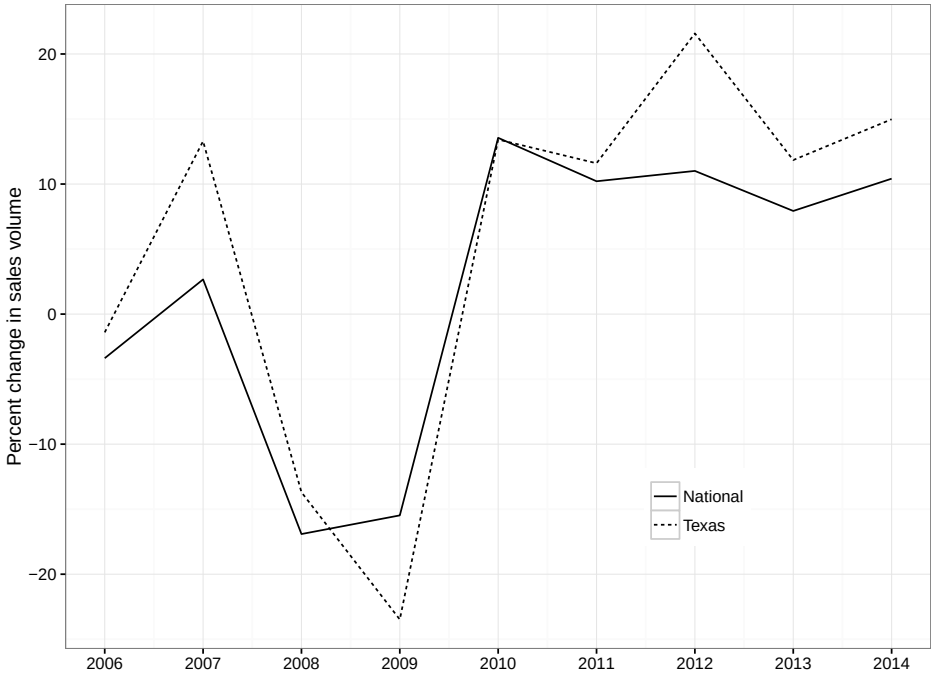
B Figures and Tables for Online Publication

Figure B.1: Representativeness of Texas new vehicle sales

(a) Texas proportion of national new vehicle sales volume

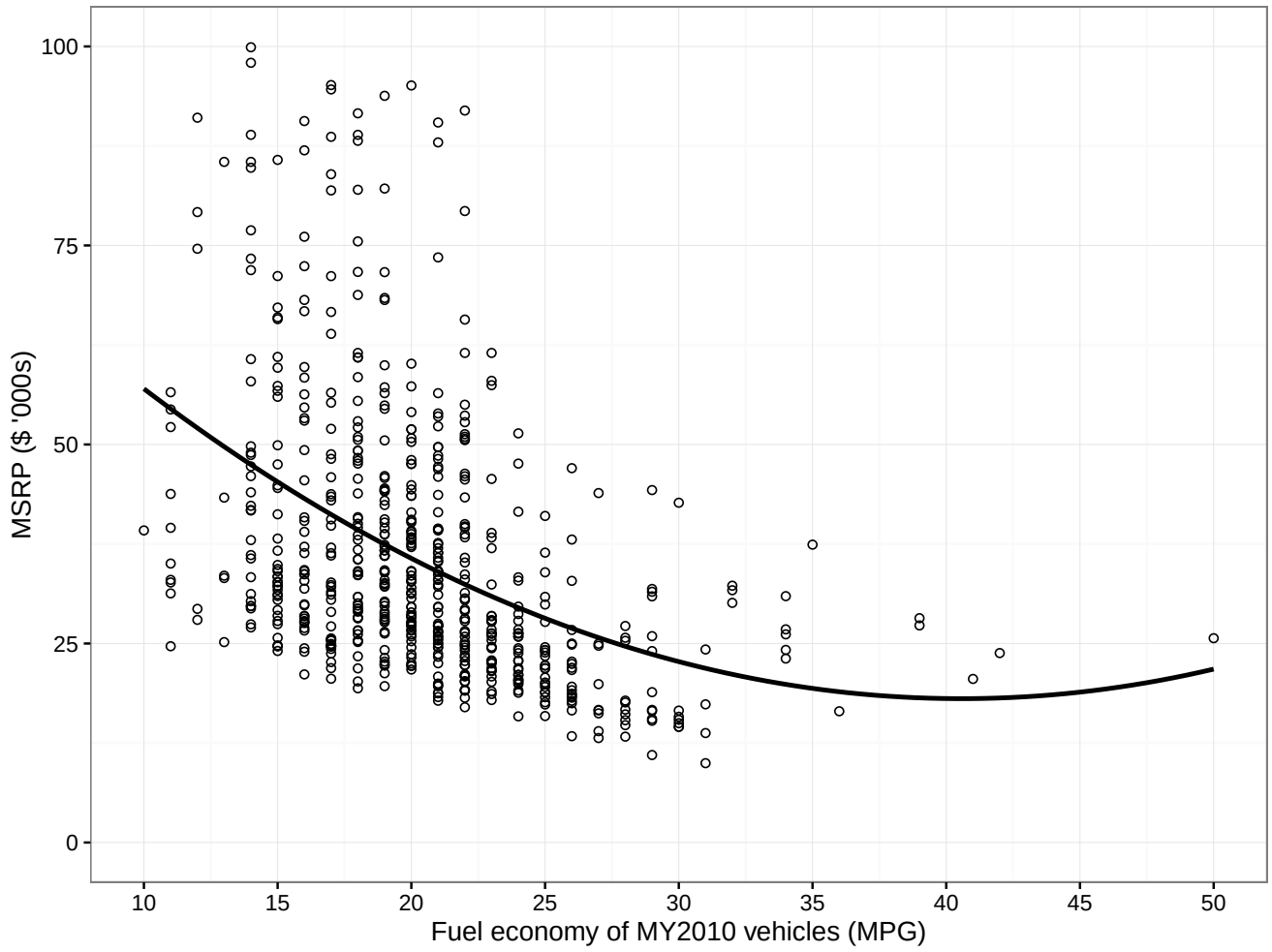


(b) Annual change in new vehicle sales volume



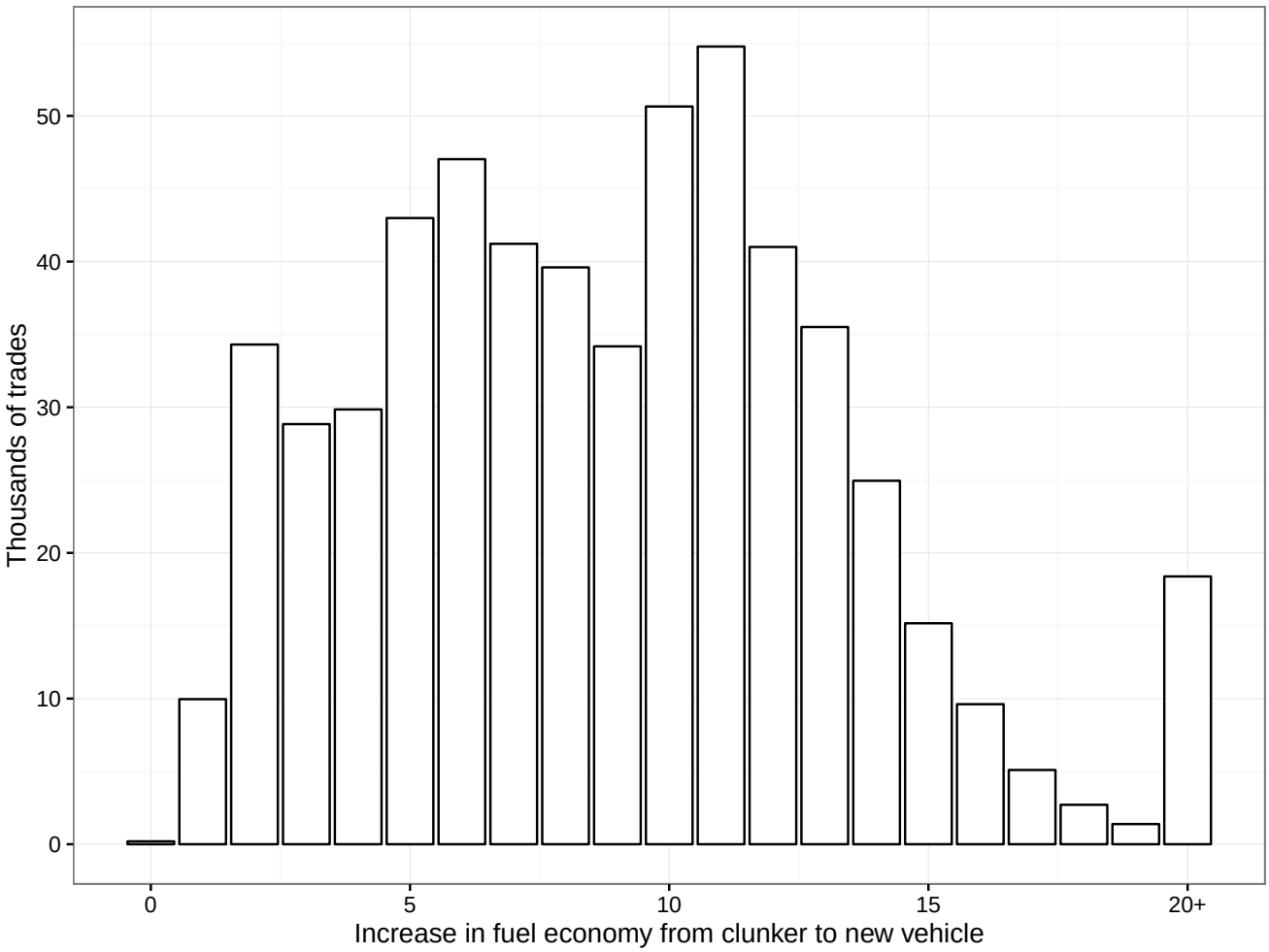
Data source: National Automobile Dealers Association.

Figure B.2: Relationship between fuel economy and sale price



Note: includes all MY2010 vehicles with a sub-$100,000 MSRP. Data source: DataOne Software.

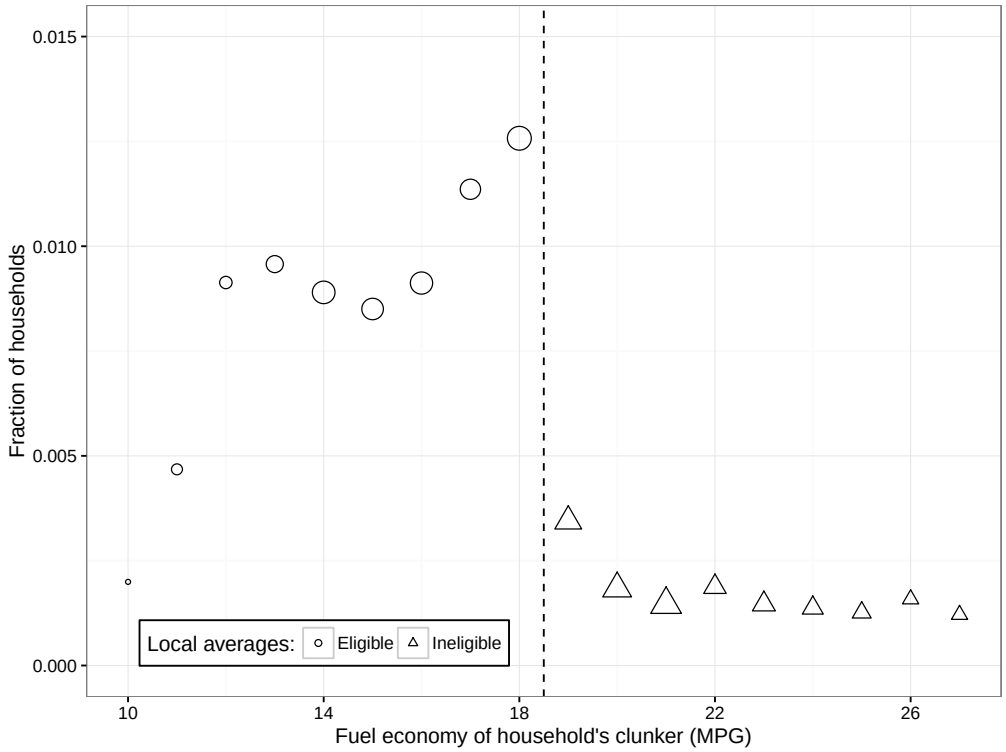
Figure B.3: Distribution of improvements in fuel economy for actual CARS trades



Note: includes all passenger cars and trucks traded in nationally under CARS program.
Data source: National Highway Traffic Safety Administration.

Figure B.4: First-stage subsidy and reduced-form spending unconditional on purchasing vehicle

(a) Cash for Clunkers subsidy rate for all Texas households



(b) New vehicle spending per Texas household (July 2009 - April 2010)

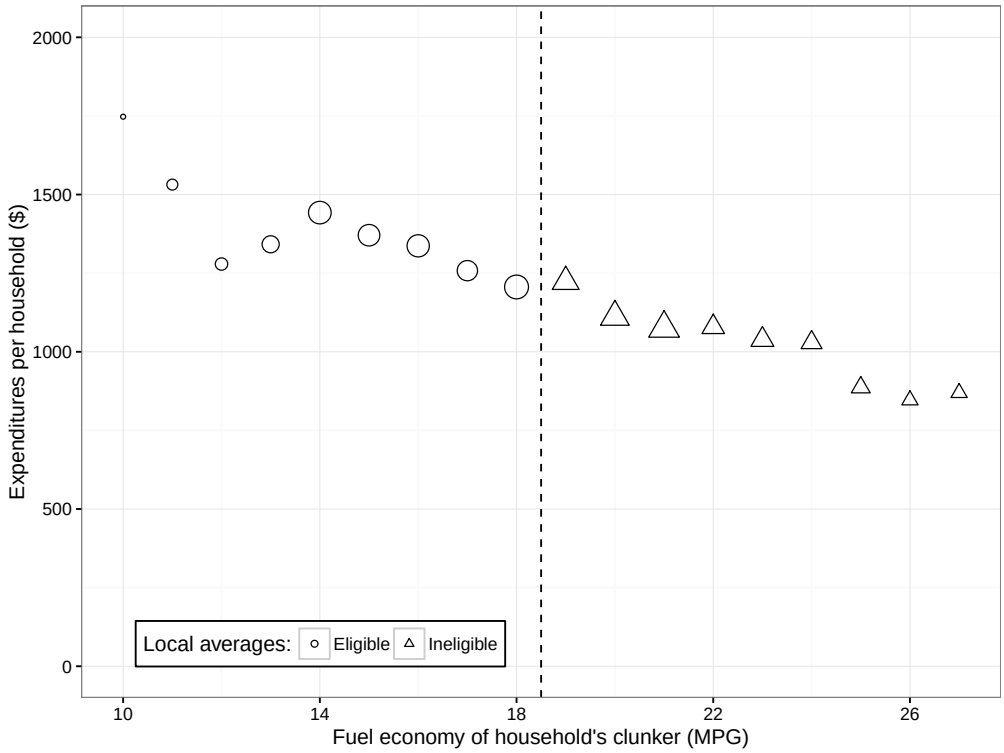
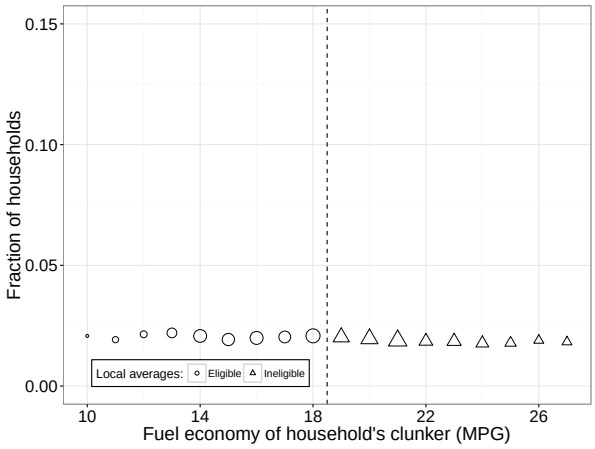
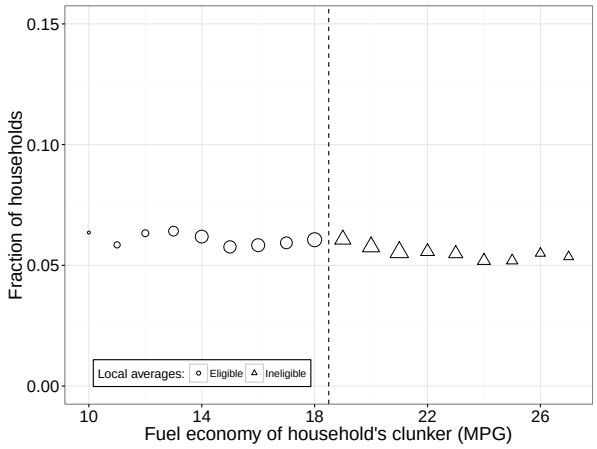


Figure B.5: Cumulative fraction of households purchasing any **used** vehicle by time period

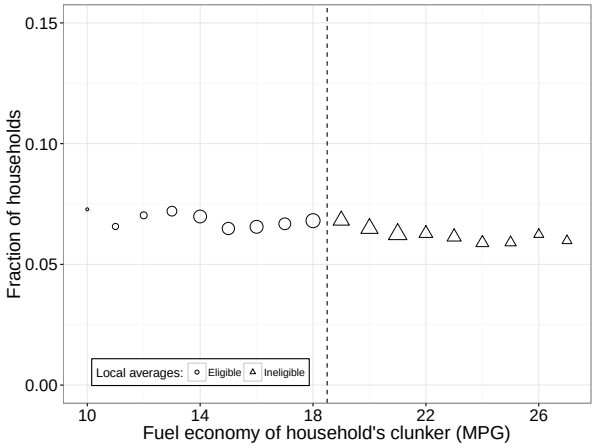
(a) July 2009 - August 2009 (Cash for Clunkers)



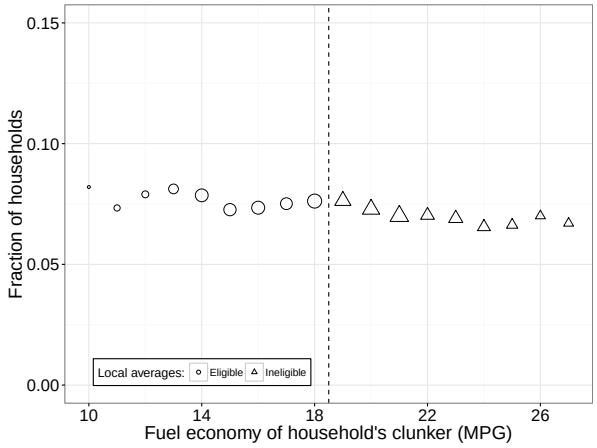
(b) July 2009 - January 2010 (7 months)



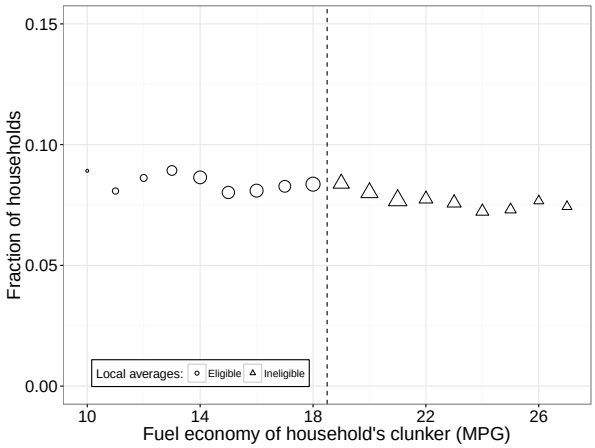
(c) July 2009 - February 2010 (8 months)



(d) July 2009 - March 2010 (9 months)



(e) July 2009 - April 2010 (10 months)



(f) July 2009 - May 2010 (11 months)

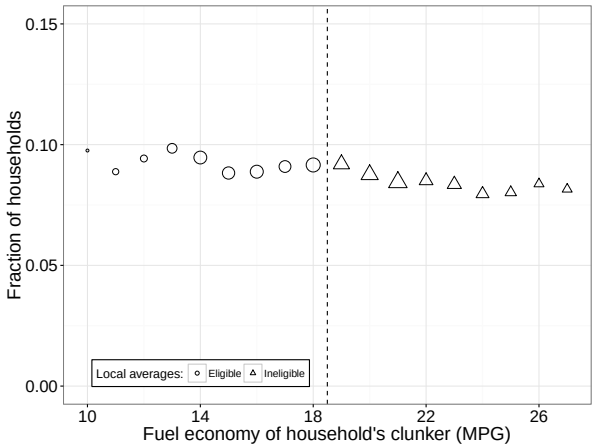


Table B.1: Estimated discontinuities for Texas households unconditional on purchasing vehicle

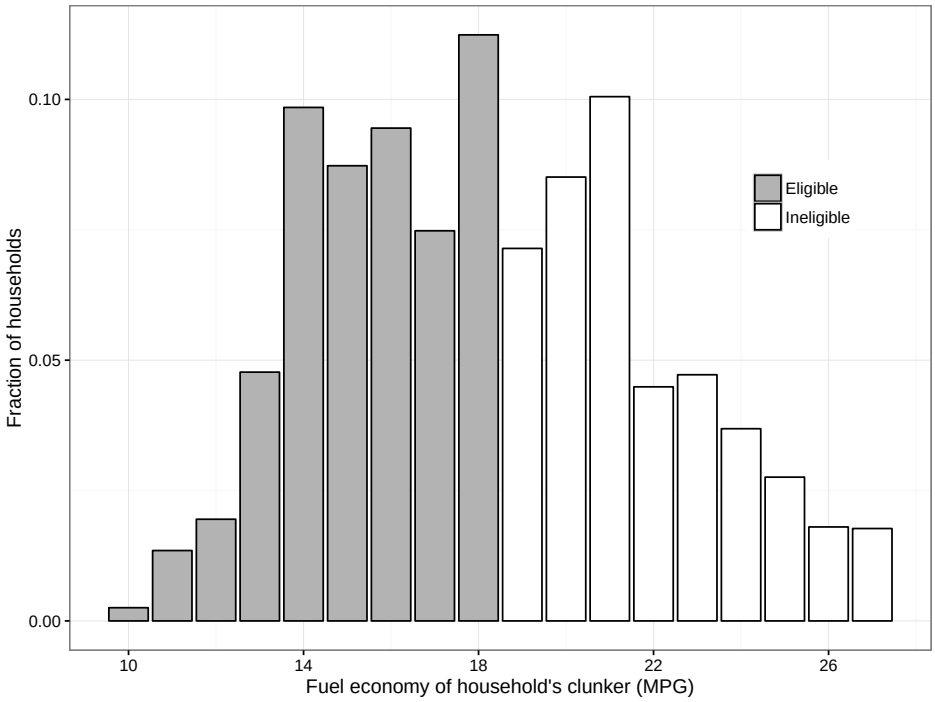
	Estimated discontinuity					
	(1)	(2)	(3)	(4)	(5)	(6)
Subsidized (percent)	0.0100***	0.0091***	0.0101***	0.0099***	0.0089***	0.0093***
[First-stage]	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0003)	(0.0003)
Spending (dollars)	−91***	−129***	−39***	−74***	−100***	−47**
[Reduced-form]	(19)	(22)	(13)	(15)	(20)	(20)
Spending (dollars)	−9,106***	−14,091***	−3,914***	−7,453***	−11,211***	−5,092**
[2SLS]	(1,907)	(2,478)	(1,325)	(1,547)	(2,330)	(2,180)
Bandwidth	5 MPG	4 MPG	4 MPG	3 MPG	2 MPG	2 MPG
Polynomial	Quadratic	Quadratic	Linear	Linear	Linear	Linear
Controls	No	No	No	No	No	Yes
Observations	4,525,057	3,717,845	3,717,845	2,985,445	1,897,837	1,897,837

*p<0.1; **p<0.05; ***p<0.01 Each coefficient in rows 1-2 represents a separate regression of the dependent variable (in rows) on an indicator for CARS eligibility. Each coefficient in row 3 represents a separate two-stage least squares regression of the dependent variable (spending) on an indicator for CARS subsidy, instrumented for by CARS eligibility. Columns vary the bandwidth and included control terms. Standard errors are reported in parentheses.

C Figures and Tables for Online Publication

Figure C.1: Fuel economy of clunkers in Texas fleet

(a) As of June 2009



(b) As of June 2008

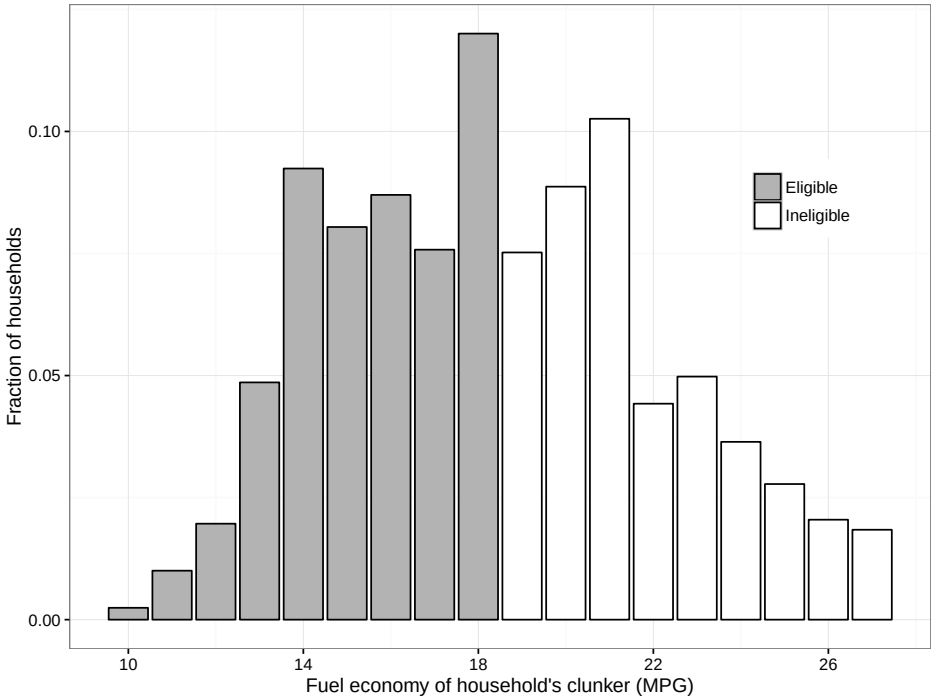
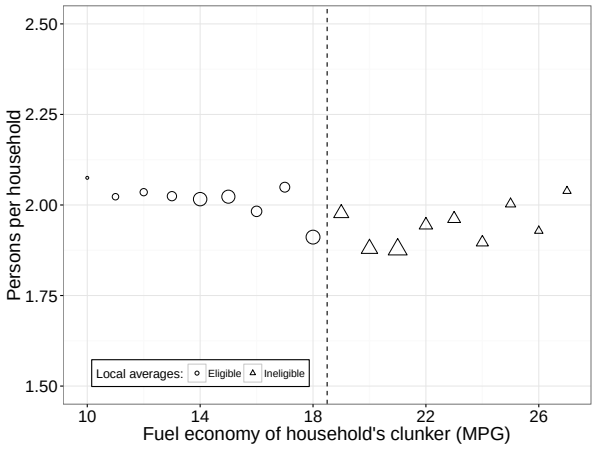
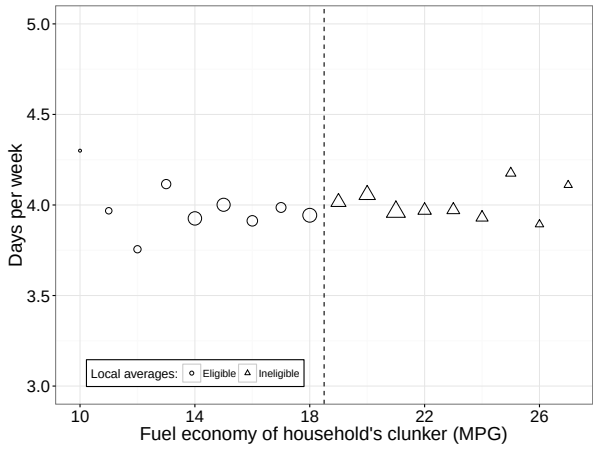


Figure C.2: Identification checks: National Household Travel Survey (spring 2009)

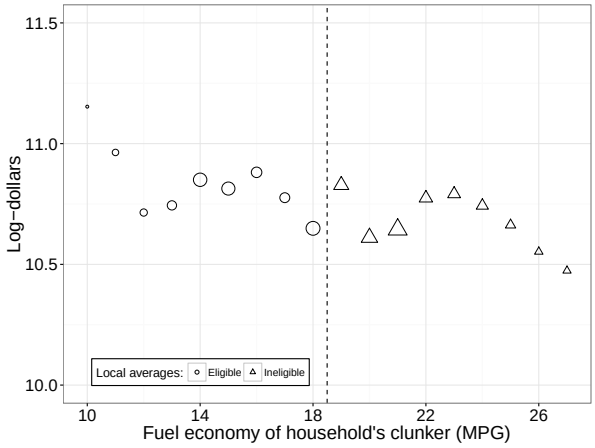
(a) Number of adults in home



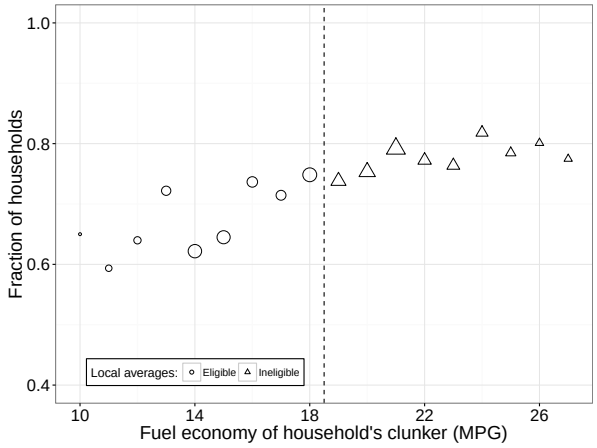
(b) Weekly travel days



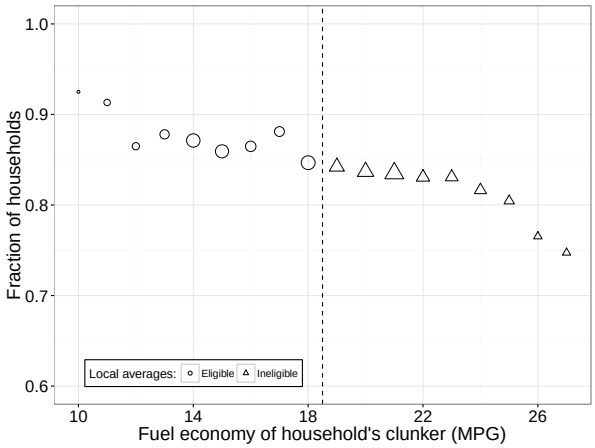
(c) Log of annual household income



(d) Live in urban area (%)



(e) Live in single family home (%)



(f) White (%)

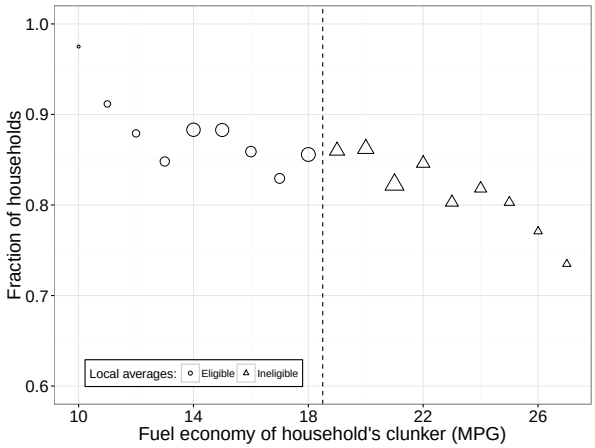
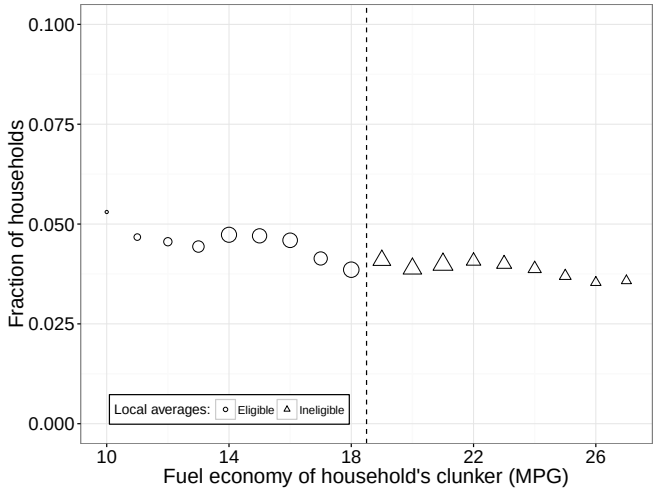
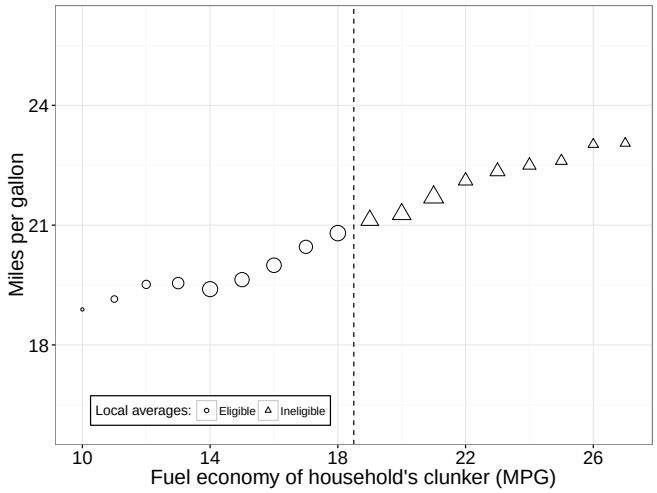


Figure C.3: Identification checks: Characteristics of buyers prior to CfC (July 2008-April 2009)

(a) Purchased any new vehicle



(b) Fuel economy of purchases



(c) Price of purchases

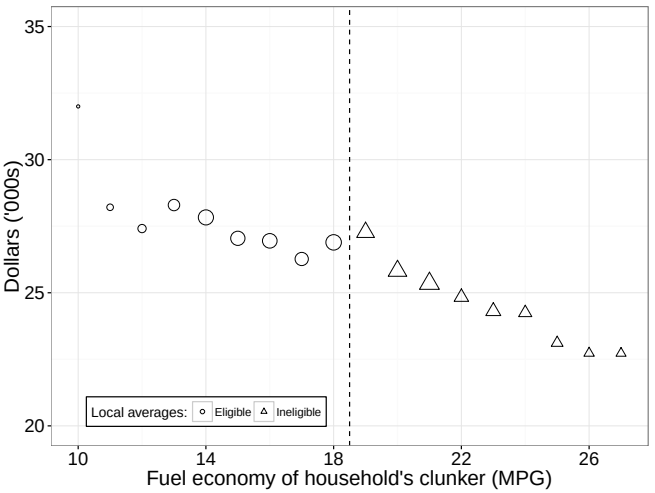
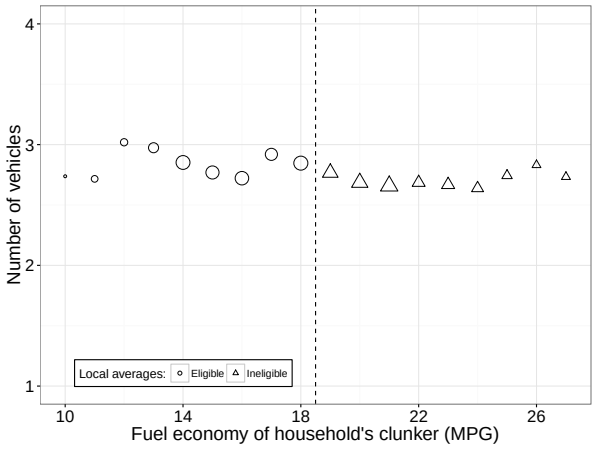
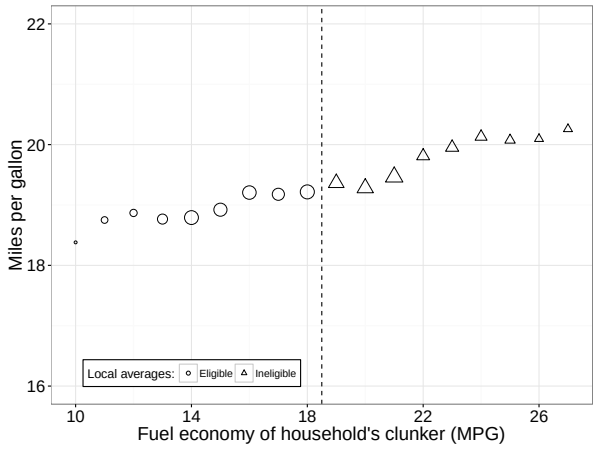


Figure C.4: Identification checks: Characteristics of buyers during July 2009 - April 2010

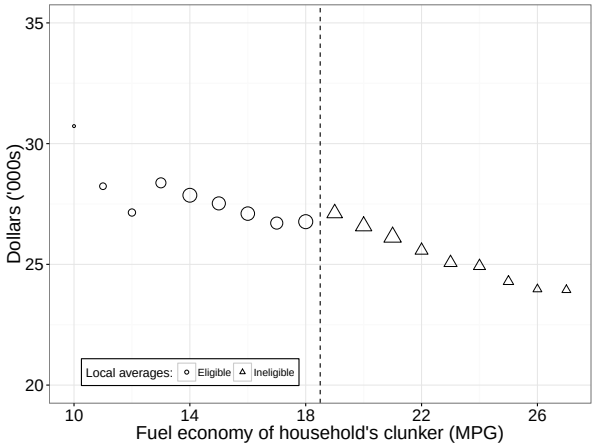
(a) Number of vehicles owned (June 2009)



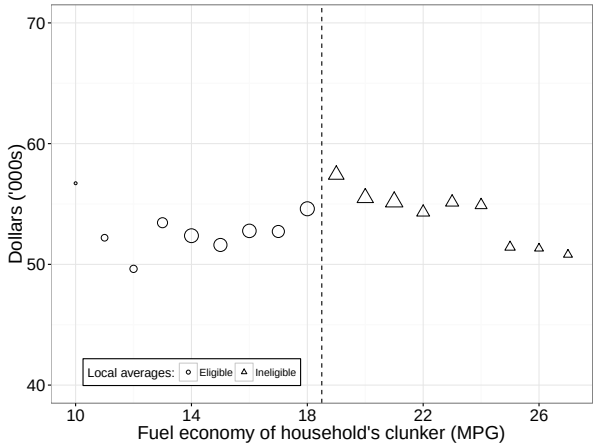
(b) Non-clunker fleet fuel economy (June 2009)



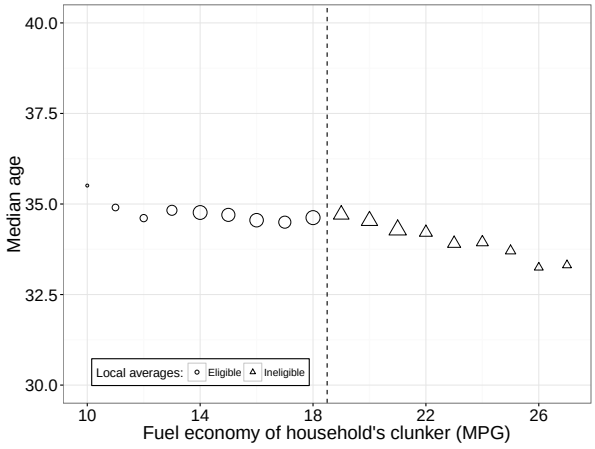
(c) Non-clunker fleet MSRP (June 2009)



(d) Census Tract median income



(e) Census Tract median age



(f) Census Tract white (%)

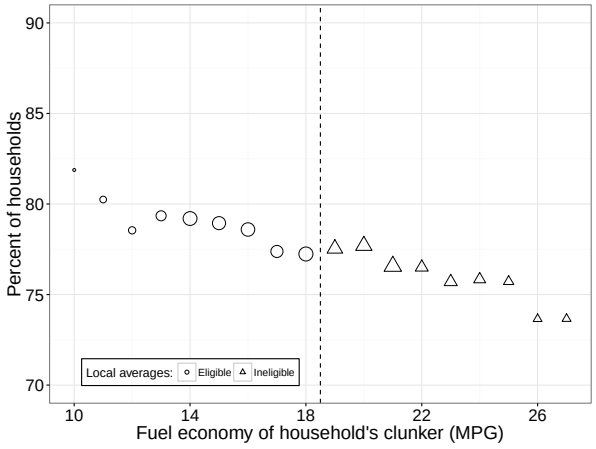
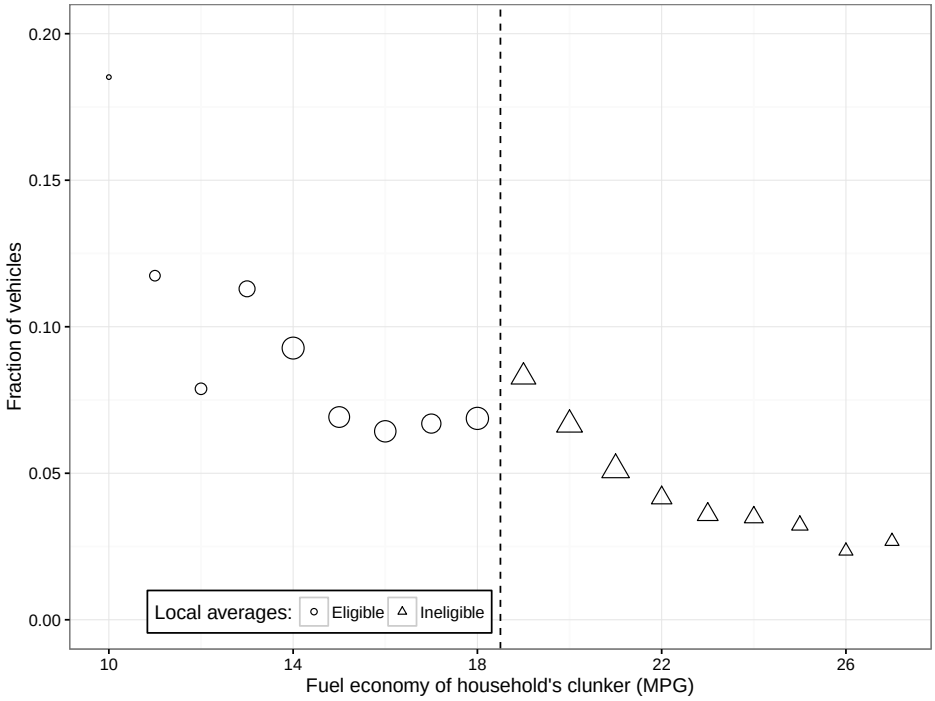
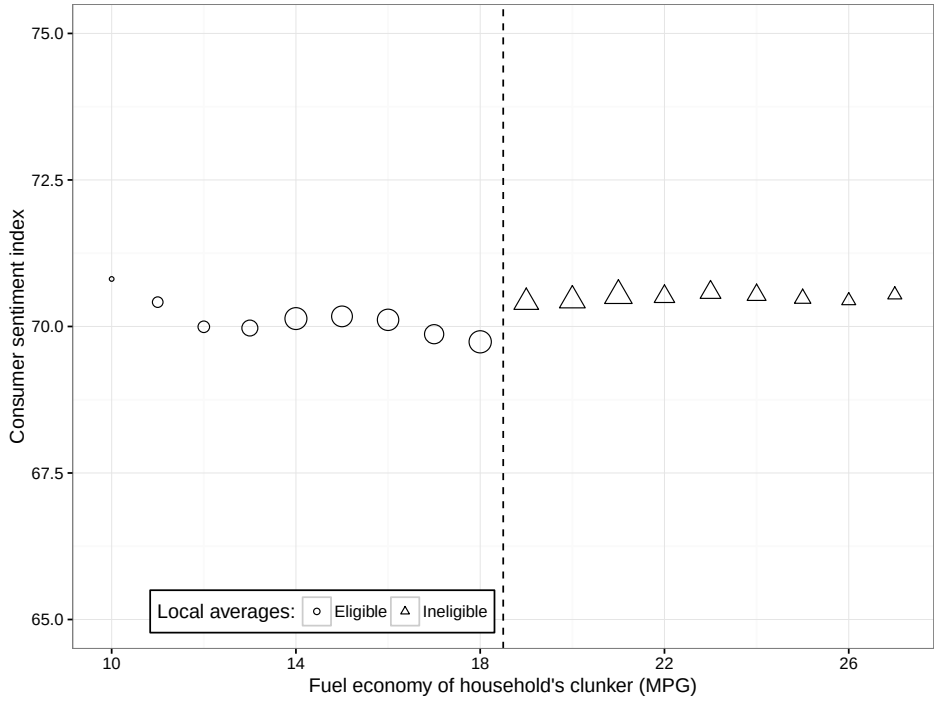


Figure C.5: Exploring alternate mechanisms for treatment effect

(a) Purchase price of vehicle greater than $45,000



(b) Consumer sentiment at time of purchase



Data source for consumer sentiment index: University of Michigan.

Table C.1: Estimated discontinuities for NHTS

	Estimated discontinuity				
	(1)	(2)	(3)	(4)	(5)
Number of adults in home	−0.1342***	−0.1888***	−0.0244	−0.0745**	−0.1836***
	(0.0374)	(0.0451)	(0.0274)	(0.0316)	(0.0419)
Weekly travel days	−0.1307	−0.0690	−0.1170	−0.1024	−0.0737
	(0.1163)	(0.1379)	(0.0836)	(0.0960)	(0.1287)
Log of annual household income	−0.3034***	−0.4421***	−0.0938***	−0.2240***	−0.3509***
	(0.0472)	(0.0566)	(0.0345)	(0.0400)	(0.0541)
Live in urban area (%)	0.0436*	0.0246	0.0355*	0.0288	0.0349
	(0.0257)	(0.0300)	(0.0182)	(0.0205)	(0.0279)
Live in single family home (%)	0.0004	−0.0142	0.0088	0.0020	−0.0154
	(0.0206)	(0.0246)	(0.0150)	(0.0171)	(0.0228)
White (%)	−0.0186	−0.0120	−0.0241	−0.0273	0.0103
	(0.0206)	(0.0245)	(0.0149)	(0.0173)	(0.0227)
Bandwidth	5 MPG	4 MPG	4 MPG	3 MPG	2 MPG
Polynomial	Quadratic	Quadratic	Linear	Linear	Linear
Observations	11,914	9,650	9,650	7,391	4,733

*p<0.1; **p<0.05; ***p<0.01 Each coefficient represents a separate regression of the dependent variable (in rows) on an indicator for CARS eligibility, which yields an estimate of β_3 in Equation (1). Columns vary the bandwidth and included control terms. Standard errors are reported in parentheses.

Table C.2: Estimated discontinuities for households during July 2008 - April 2009

	Estimated discontinuity				
	(1)	(2)	(3)	(4)	(5)
Purchased any new vehicle	−0.0051***	−0.0059***	−0.0028***	−0.0040***	−0.0048***
	(0.0006)	(0.0007)	(0.0004)	(0.0004)	(0.0006)
Fuel economy (MPG)	0.1026	−0.0473	0.1306**	0.0930	−0.0735
	(0.0759)	(0.0893)	(0.0548)	(0.0625)	(0.0825)
Sale price ($ '000s)	−0.7691***	−0.9518***	−0.7525***	−0.8339***	−0.7895***
	(0.1453)	(0.1714)	(0.1052)	(0.1217)	(0.1651)
Bandwidth	5 MPG	4 MPG	4 MPG	3 MPG	2 MPG
Polynomial	Quadratic	Quadratic	Linear	Linear	Linear
Observations (households)	4,985,537	4,116,971	4,116,971	3,355,489	2,197,352
Observations (purchases)	209,679	170,801	170,801	136,675	87,277

*p<0.1; **p<0.05; ***p<0.01 Each coefficient represents a separate regression of the dependent variable (in rows) on an indicator for CARS eligibility, which yields an estimate of β_3 in Equation (1). Columns vary the bandwidth and included control terms. Standard errors are reported in parentheses.

Table C.3: Estimated discontinuities for buyers during July 2009 - April 2010

	Estimated discontinuity				
	(1)	(2)	(3)	(4)	(5)
Number of vehicles owned	0.1254***	0.0556**	0.1318***	0.1277***	0.0027
	(0.0198)	(0.0232)	(0.0142)	(0.0162)	(0.0217)
Non-clunker fuel economy	−0.1679**	−0.3360***	0.1043**	−0.0757	−0.1684**
	(0.0657)	(0.0770)	(0.0472)	(0.0535)	(0.0701)
Non-clunker MSRP ('000s)	−0.6471***	−0.5282***	−0.8363***	−0.7204***	−0.5852***
	(0.1399)	(0.1646)	(0.1010)	(0.1164)	(0.1585)
Tract median income ('000s)	−2.8961***	−3.0402***	−2.7219***	−2.8449***	−2.8343***
	(0.3563)	(0.4184)	(0.2567)	(0.2957)	(0.3995)
Tract median age	−0.1477**	−0.1288	−0.2377***	−0.2104***	−0.1055
	(0.0735)	(0.0862)	(0.0529)	(0.0604)	(0.0807)
Tract percent white	−1.0872***	−0.8782***	−1.1346***	−1.2685***	−0.2839
	(0.2389)	(0.2811)	(0.1724)	(0.1978)	(0.2641)
Bandwidth	5 MPG	4 MPG	4 MPG	3 MPG	2 MPG
Polynomial	Quadratic	Quadratic	Linear	Linear	Linear
Observations	197,745	160,918	160,918	127,869	81,200

*p<0.1; **p<0.05; ***p<0.01 Each coefficient represents a separate regression of the dependent variable (in rows) on an indicator for CARS eligibility, which yields an estimate of β_3 in Equation (1). Columns vary the bandwidth and included control terms. Standard errors are reported in parentheses.