Do gasoline price shocks during adolescence reduce driving as an adult? A replication exercise

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Abstract

Severen and van Benthem (2022b) studies the effect of gasoline price changes during adolescence on driving behavior as an adult. They find that price changes at ages 15-18 lead to reduced driving during adulthood. In this comment, I replicate the effect on miles travelled using unrestricted data, test whether price decreases and increases have symmetric effects, and test for heterogeneous treatment effects along several dimensions. I find that the extensive margin is driven by price increases, while the intensive margin is explained by price decreases. The effect of price changes varies by region and race, highlighting the need for further investigation into mechanisms. Overall, I find supporting evidence for the main findings.

1 Introduction

Severen and van Benthem (2022b), henceforth SB, studies the effect of gasoline price changes at formative driving ages on later-life driving behavior. They use data on gas prices from the United States, with driving behavior from the census. They use a difference-in-differences estimator with a continuous treatment variable, with treatment variation from cohort-state differences in gasoline prices. If gas price shocks while learning to drive affect preferences for driving, then price changes should be correlated with driving behavior as an adult. SB show that this holds for the extensive margin (driving, public transit usage, and vehicle ownership) as well as the intensive margin (vehicle miles travelled). This result is robust to different definitions of price changes, and is driven specifically by price changes at ages 15-18, corresponding to when people learn to drive. The effect is driven by price changes rather than price levels, and SB rule out income and the cost of learning to drive as mechanisms. Overall, this evidence suggests that gasoline price shocks while learning to drive affect driving behavior over one's lifetime.

SB describe their main results as follows: "A doubling of the real price of gasoline between the ages of 15 and 17 leads to a 0.3-0.4 percentage point reduction in the probability of driving to work later in life and a 0.2-0.3 percentage point increase in transit usage [...] [and] drive 3.4-8.2 percent fewer annual miles as adults." (p.257) In specifications with full controls, these effects are significant at the 1% level.

In this comment, I perform several robustness checks on the results in SB. I obtained the original code and data from the replication archive (Severen and van Benthem, 2022a). SB used restricted data to estimate the effect of gasoline price changes on miles driven. I repeat their analysis using the publicly available datasets, and find very similar results. SB focus on price increases, but their analysis uses price changes (including decreases). I test whether price increases and decreases have symmetric effects; I find that price increases matter for the extensive margin, while price decreases explain the intensive margin.

I test for heterogeneity in the effect of gasoline price changes by time period, region, sex, and race. I find that the effect of price changes is stronger in the Northeast and for Blacks, while the effects by time period and sex are more homogeneous. I also repeat SB's analysis of heterogeneous effects by age for transit usage and vehicle ownership, and find consistent results. I use logistic regression instead of a linear probability model for the binary dependent variables (driving, transit usage, and vehicle ownership), and find consistent results. Finally, I investigate an opposite effect on miles travelled when using cohort fixed effects, and find evidence supporting the main results.

2 Computational reproducibility

The Stata configuration file (config_stata.do) has a bug that prevents loading Stata packages. Otherwise, I am able to exactly reproduce the main results using census data using the original data and code.

2.1 Replication using public NHTS data

SB report intensive margin effects on miles travelled using data from the National Household Travel Survey (NHTS, Federal Highway Administration (2017)). They use the restricted data from survey years 1990, 1995, 2001, and 2009, along with the unrestricted 2017 survey. I downloaded the unrestricted datasets for all years, and requested from NHTS the interview date variable (perindt2) from the restricted 2009 dataset. The restricted datasets are updated and appear to have slightly larger sample sizes. Despite this, I obtain very similar results using the public, unrestricted data. Table 1 replicates SB's Table 3. For reference, the Table 3 Column 1 estimate is -0.0776 (0.0267). My estimates are almost identical, with differences driven by a slightly smaller sample size (213,839 vs 216,343 in the original Column 1). Table 2 replicates the NHTS results from SB's Table 4. Again, the results are similar, with the largest effects occurring for ages 15-18.

Table 1: Replication of Table 3: public NHTS data

	(1)	(2)	(3)	(4)	(5)
Δ Price	-0.0754***	-0.0791***	-0.0767***	-0.0748***	-0.0592**
	(0.0270)	(0.0266)	(0.0266)	(0.0264)	(0.0261)
Observations	213839	213803	203798	203798	203798
Adjusted R^2	0.008	0.022	0.049	0.052	0.053
Sample year FEs	Yes	Yes	Yes		
State FEs	Yes	Yes	Yes		
Controls		Yes	Yes	Yes	Yes
Income-by-year bin FEs			Yes	Yes	Yes
State × year FEs				Yes	Yes
Quad. birth year					Yes

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 3 using public NHTS data. Dependent variable is log person vehicle miles travelled. Sample includes all respondents aged 25-54 with positive person VMT. Demographics include race, urbanization, and family size. Observations weighted by person sample weights. Standard errors clustered by state.

Table 2: Replication of Table 4: public NHTS data

	(1)	(2)
$\Delta P(13,12)$		-0.0626
		(0.0544)
$\Delta P(14,13)$	0.0316	0.0387
	(0.0347)	(0.0441)
$\Delta P(15,14)$	-0.0274	-0.0399
	(0.0421)	(0.0424)
$\Delta P(16,15)$	-0.0796*	-0.0688
	(0.0468)	(0.0498)
$\Delta P(17,16)$	-0.0912**	-0.1072**
	(0.0447)	(0.0451)
$\Delta P(18,17)$	-0.0737*	-0.0523
	(0.0380)	(0.0374)
$\Delta P(19,18)$	-0.0549	-0.0711
	(0.0505)	(0.0477)
$\Delta P(20,19)$		-0.0057
		(0.0428)
Observations	206993	203433
Adjusted R^2	0.008	0.008

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of Table 4 Columns 3-4 using public NHTS data. Dependent variable is log person vehicle miles travelled. Fixed effects for sample year, state, and age. Observations weighted by person sample weights. Standard errors clustered by state.

3 Robustness replication

3.1 Do price increases and decreases have symmetric effects?

SB start their paper using a case study of the 1979 oil crisis, which increased the price of gasoline, while their main results use the percentage change in gasoline prices during adolescence. This treatment variable is more general and can include price decreases as well as increases. However, SB focus only on the effect of price increases, implicitly assuming that price increases and decreases have symmetric effects.[1] Under symmetric effects, if rising gas prices during formative years reduce later-life driving, then falling gas prices should increase later-life driving. That is, rising prices deter driving, while falling prices encourage more driving. This symmetry assumption is not examined by SB. Hence, their results could be consistent with either (i) price increases leading to less later-life driving, (ii) price decreases leading to more later-life driving, or (iii) both.[2]

To test for symmetric effects, I reproduce their main results in Tables 1-3 using interaction terms to separately estimate the effects for price decreases and increases:

$$Y = \beta_1 \Delta P \times \mathbb{1}\{\Delta P < 0\} + \beta_2 \Delta P \times \mathbb{1}\{\Delta P > 0\} + \beta_3 \mathbb{1}\{\Delta P > 0\} + \text{FEs} + \varepsilon \quad (1)$$

Here ΔP is the percentage change in price between age 15 and 17. Under symmetry, the coefficients on the interaction terms are equal and negative: $\beta_1 = \beta_2 < 0$. That is, bigger price decreases are associated with more driving compared to smaller decreases (β_1), and bigger price increases are associated with less driving compared to smaller price increases (β_2). Note that this regression is equivalent to including an interaction term between the price change and an indicator variable for the price change being positive. Equation 1 tests whether the absolute effects are different from zero, while the interaction model tests whether the difference in effects is different from zero.

Table 3 tests for symmetric effects on driving behavior. For reference, the original result in Table 1, Column 1 is -0.0038 (0.0010). I find nonsignificant effects for price decreases, and large negative effects for price increases. (Table A1

[1] SB interpret their findings exclusively in terms of price increases: "Commuters in the United States who experience a positive shock to the price of gasoline while coming of driving age—and thus first experiencing driving—are less likely to drive to work in a private automobile decades later in life" (p.256); "drivers who experience a doubling of real gasoline prices between ages 15 and 17 drive 3.4-8.2 percent fewer annual miles as adults. [...] Furthermore, drivers that were exposed to gas price hikes early in life are somewhat less likely to own fuel-inefficient, light-duty trucks." (p.257)

[2] Note that SB interpret their main coefficient in terms of a price doubling: "The results in column 1 indicate that a doubling in the price of gasoline between the ages of 15 and 17 ($P_{cs}^{\Delta 17,15} = 1$) leads to a 0.38 percentage point (0.43 percent) reduction in driving to work later in life". (p.269-270) This interpretation is inaccurate, and should refer to a one-unit change in the percentage-change in price. For example, moving from $P_{cs}^{\Delta 17,15} = -0.5$ to $P_{cs}^{\Delta 17,15} = 0.5$ also corresponds to a 0.38 percentage point reduction in driving, but is not a doubling in price.

shows the interaction model; the difference between price increases and decreases is nonsignificant.)

Table 3: Replication of Table 1: separate effects for price increases and decreases

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ Price × Δ Price<0	-0.0049	-0.0107*	0.0006	-0.0029	-0.0033	-0.0029	-0.0046
	(0.0080)	(0.0060)	(0.0036)	(0.0063)	(0.0064)	(0.0067)	(0.0068)
Δ Price × Δ Price>0	-0.0078***	-0.0052***	0.0029	-0.0080***	-0.0081***	-0.0082***	-0.0085***
	(0.0014)	(0.0010)	(0.0022)	(0.0018)	(0.0018)	(0.0017)	(0.0015)
Observations	9140380	14380213	14342435	9140380	9102140	9102140	9102140
Adjusted R^2	0.036	0.017	0.017	0.049	0.050	0.051	0.051
Census year FEs	Yes	Yes	Yes	Yes	Yes		
State of birth FEs	Yes	Yes	Yes	Yes	Yes		
Demographics				Yes	Yes	Yes	Yes
ln HH income					Yes	Yes	Yes
State × year FEs						Yes	Yes
Quad. birth year							Yes
Price in state of	Birth	Birth	Res	Birth	Birth	Birth	Birth
Sample	Stay	All	All	Stay	Stay	Stay	Stay

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 1 using $\Delta P \times \mathbb{1}\{\Delta P < 0\}$, $\Delta P \times \mathbb{1}\{\Delta P > 0\}$, and $\mathbb{1}\{\Delta P > 0\}$ (estimates from the latter are omitted). Dependent variable is an indicator for driving to work. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

Table 4 repeats this analysis for transit use and vehicle ownership. For reference, the original estimate in Table 2, Column 1 is 0.0029 (0.0007), and the original estimate in Column 3 is -0.0014 (0.0008). Again, we find clear effects for price increases, while the effects for price decreases have the expected sign but are nonsignificant. Overall, the extensive margin effects appear to be driven by price increases. (Table A2 shows the interaction model; the differential effect is not significant.)

Table 5 shows the results for the intensive margin of vehicle miles travelled. For reference, the Table 3, Column 1 estimate is -0.0776 (0.0267). In this case, we see the opposite pattern, with a negative correlation for price decreases and a null result for price increases. (Table A3 shows the interaction model; the difference between price decrease and increase effects is significant at the 10% level only in Columns 1-2.) So for miles travelled, SB's original result should be interpreted as gasoline price decreases inducing more driving behavior, rather than price increases deterring driving.[3] This asymmetry in price effects suggests

[3]In Appendix A.3, SB consider whether price increases are a proxy for recessions, with the price effect mediated by income. In this case, it could be that gas price decreases lead to economic expansions, indirectly affecting the intensive margin of driving behavior.

Table 4: Replication of Table 2: separate effects for price increases and decreases

	(1)	(2)	(3)	(4)	(5)	(6)
	$\mathbb{1}$[transit]	$\mathbb{1}$[transit]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]
Δ Price × Δ Price<0	0.0114*	0.0061	-0.0077	-0.0066	-0.0057	-0.0074
	(0.0064)	(0.0058)	(0.0074)	(0.0056)	(0.0071)	(0.0053)
Δ Price × Δ Price>0	0.0043***	0.0044***	-0.0025**	-0.0020*	-0.0051***	-0.0041***
	(0.0010)	(0.0013)	(0.0012)	(0.0011)	(0.0016)	(0.0014)
Observations	9140380	9102140	9114339	9102140	11850221	11756310
Adjusted R^2	0.066	0.091	0.025	0.077	0.022	0.130
Census year FEs	Yes		Yes		Yes	
State of birth FEs	Yes		Yes		Yes	
Demographics		Yes		Yes		Yes
ln HH income		Yes		Yes		Yes
State × year FEs		Yes		Yes		Yes
Quad. birth year		Yes		Yes		Yes
Sample	Empl	Empl	Empl	Empl	All	All

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 2 using $\Delta P \times \mathbb{1}\{\Delta P < 0\}$, $\Delta P \times \mathbb{1}\{\Delta P > 0\}$, and $\mathbb{1}\{\Delta P > 0\}$ (estimates from the latter are omitted). Dependent variable is an indicator for transit usage or whether a vehicle is present in the household. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

that a richer underlying model is generating the results, which could be explored in future research.

Table 5: Reanalysis of Table 3: separate effects for price increases and decreases

	(1)	(2)	(3)	(4)	(5)
Δ Price × Δ Price<0	-0.1667*	-0.1689*	-0.1533*	-0.1537	-0.0488
	(0.0892)	(0.0875)	(0.0893)	(0.0935)	(0.0896)
Δ Price × Δ Price>0	0.0155	0.0060	0.0076	-0.0013	-0.0074
	(0.0450)	(0.0459)	(0.0467)	(0.0461)	(0.0476)
Observations	213839	213803	203798	203798	203798
Adjusted R^2	0.008	0.022	0.049	0.052	0.053
Sample year FEs	Yes	Yes	Yes		
State FEs	Yes	Yes	Yes		
Controls		Yes	Yes	Yes	Yes
Income-by-year bin FEs			Yes	Yes	Yes
State × year FEs				Yes	Yes
Quad. birth year					Yes

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 3 using $\Delta P \times \mathbb{1}\{\Delta P < 0\}$, $\Delta P \times \mathbb{1}\{\Delta P > 0\}$, and $\mathbb{1}\{\Delta P > 0\}$ (estimates from the latter are omitted). Dependent variable is log person vehicle miles travelled. Sample includes all respondents aged 25-54 with positive person VMT. Demographics include race, urbanization, and family size. Observations weighted by person sample weights. Standard errors clustered by state.

3.2 Heterogeneity by birthyear

While SB test for heterogeneity by age of price exposure (Table 4), they do not investigate how the effect of price changes varies over time. I test how the effect of price changes differs above and below the median birthyear in the sample. The sample includes birthyears 1951-1992, which I split at 1971. The effect is similar across time periods, as shown in Tables 6-8.

Table 6: Reanalysis of Table 1: heterogeneity by birthyear

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ Price	-0.0044***	-0.0024***	-0.0014*	-0.0049***	-0.0050***	-0.0051***	-0.0052***
	(0.0011)	(0.0008)	(0.0008)	(0.0011)	(0.0011)	(0.0010)	(0.0010)
Δ Price × Birthyear≥1971	0.0010	-0.0014	-0.0059**	0.0027	0.0027	0.0028	0.0020
	(0.0024)	(0.0020)	(0.0028)	(0.0020)	(0.0020)	(0.0020)	(0.0020)
Observations	9140380	14380213	14342435	9140380	9102140	9102140	9102140
Adjusted R^2	0.036	0.017	0.017	0.049	0.050	0.051	0.051
Census year FEs	Yes	Yes	Yes	Yes	Yes		
State of birth FEs	Yes	Yes	Yes	Yes	Yes		
Demographics				Yes	Yes	Yes	Yes
ln HH income					Yes	Yes	Yes
State × year FEs						Yes	Yes
Quad. birth year							Yes
Price in state of	Birth	Birth	Res	Birth	Birth	Birth	Birth
Sample	Stay	All	All	Stay	Stay	Stay	Stay

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 1 including an interaction term for birthyear ≥ 1971. Dependent variable is an indicator for driving to work. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

Table 7: Reanalysis of Table 2: heterogeneity by birthyear

	(1)	(2)	(3)	(4)	(5)	(6)
	$\mathbb{1}$[transit]	$\mathbb{1}$[transit]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]
Δ Price	0.0022***	0.0025***	-0.0014*	-0.0009	-0.0034***	-0.0018**
	(0.0007)	(0.0008)	(0.0007)	(0.0006)	(0.0012)	(0.0007)
Δ Price × Birthyear≥1971	0.0027	0.0001	0.0002	-0.0000	0.0044**	-0.0004
	(0.0018)	(0.0016)	(0.0017)	(0.0012)	(0.0017)	(0.0012)
Observations	9140380	9102140	9114339	9102140	11850221	11756310
Adjusted R^2	0.066	0.091	0.025	0.077	0.022	0.130
Census year FEs	Yes		Yes		Yes	
State of birth FEs	Yes		Yes		Yes	
Demographics		Yes		Yes		Yes
ln HH income		Yes		Yes		Yes
State × year FEs		Yes		Yes		Yes
Quad. birth year		Yes		Yes		Yes
Sample	Empl	Empl	Empl	Empl	All	All

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 2 including an interaction term for birthyear $\geq$ 1971. Dependent variable is an indicator for transit usage or whether a vehicle is present in the household. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

Table 8: Reanalysis of Table 3: heterogeneity by birthyear

	(1)	(2)	(3)	(4)	(5)
Δ Price	-0.0697**	-0.0738**	-0.0648**	-0.0640**	-0.0662**
	(0.0288)	(0.0290)	(0.0272)	(0.0269)	(0.0273)
Δ Price × Birthyear≥1971	0.0148	0.0137	-0.0315	-0.0271	0.0563
	(0.0745)	(0.0740)	(0.0750)	(0.0749)	(0.0817)
Observations	213839	213803	203798	203798	203798
Adjusted R^2	0.008	0.022	0.049	0.052	0.053
Sample year FEs	Yes	Yes	Yes		
State FEs	Yes	Yes	Yes		
Controls		Yes	Yes	Yes	Yes
Income-by-year bin FEs			Yes	Yes	Yes
State × year FEs				Yes	Yes
Quad. birth year					Yes

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 3 including an interaction term for birthyear ≥ 1971. Dependent variable is log person vehicle miles travelled. Sample includes all respondents aged 25-54 with positive person VMT. Demographics include race, urbanization, and family size. Observations weighted by person sample weights. Standard errors clustered by state.

3.3 Heterogeneity by region

I test how the effect of gas price changes varies geographically, repeating the analysis of Tables 1-3 while including interaction terms for census regions. The results are in Tables 9-11. The extensive margin effect (on driving, transit, and vehicle ownership) is stronger in the Northeast, while the intensive margin effect (miles travelled) is stronger in both the Northeast and Midwest. The Northeast effect in Table 9 Column 1 (0.0038-0.0235=-0.0197) is roughly five times larger than the original effect in SB's Table 1 (-0.0038). This heterogeneity is somewhat surprising, since the mechanism of preference formation does not seem to depend on geography.

Table 9: Reanalysis of Table 1: heterogeneity by region

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ Price	0.0038	0.0048	0.0046	0.0039	0.0033	0.0024	0.0019
	(0.0033)	(0.0033)	(0.0030)	(0.0032)	(0.0035)	(0.0030)	(0.0032)
Δ Price × Northeast	-0.0235***	-0.0215***	-0.0219***	-0.0219***	-0.0224***	-0.0204***	-0.0203***
	(0.0060)	(0.0045)	(0.0043)	(0.0056)	(0.0058)	(0.0054)	(0.0054)
Δ Price × Midwest	-0.0048	-0.0038	-0.0039	-0.0052	-0.0043	-0.0035	-0.0034
	(0.0032)	(0.0030)	(0.0028)	(0.0033)	(0.0035)	(0.0032)	(0.0032)
Δ Price × South	-0.0036	-0.0049*	-0.0050*	-0.0043*	-0.0034	-0.0026	-0.0026
	(0.0024)	(0.0027)	(0.0025)	(0.0025)	(0.0027)	(0.0026)	(0.0026)
Observations	9140380	14380213	14342435	9140380	9102140	9102140	9102140
Adjusted R^2	0.036	0.017	0.017	0.049	0.050	0.051	0.051
Census year FEs	Yes	Yes	Yes	Yes	Yes		
State of birth FEs	Yes	Yes	Yes	Yes	Yes		
Demographics				Yes	Yes	Yes	Yes
ln HH income					Yes	Yes	Yes
State × year FEs						Yes	Yes
Quad. birth year							Yes
Price in state of	Birth	Birth	Res	Birth	Birth	Birth	Birth
Sample	Stay	All	All	Stay	Stay	Stay	Stay

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 1 including interaction terms for census regions. Region=West is the omitted category. Dependent variable is an indicator for driving to work. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

Table 10: Reanalysis of Table 2: heterogeneity by region

	(1)	(2)	(3)	(4)	(5)	(6)
	$\mathbb{1}$[transit]	$\mathbb{1}$[transit]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]
Δ Price	0.0002	-0.0002	0.0037	0.0029	0.0067***	0.0035
	(0.0027)	(0.0022)	(0.0024)	(0.0025)	(0.0025)	(0.0024)
Δ Price × Northeast	0.0164**	0.0145***	-0.0143*	-0.0129*	-0.0172***	-0.0139**
	(0.0063)	(0.0052)	(0.0075)	(0.0072)	(0.0061)	(0.0059)
Δ Price × Midwest	0.0009	0.0012	-0.0045	-0.0026	-0.0108***	-0.0060***
	(0.0030)	(0.0029)	(0.0027)	(0.0026)	(0.0025)	(0.0021)
Δ Price × South	-0.0030**	-0.0024*	-0.0021	-0.0010	-0.0059***	-0.0023*
	(0.0013)	(0.0014)	(0.0014)	(0.0012)	(0.0020)	(0.0013)
Observations	9140380	9102140	9114339	9102140	11850221	11756310
Adjusted R^2	0.066	0.091	0.025	0.077	0.022	0.130
Census year FEs	Yes		Yes		Yes	
State of birth FEs	Yes		Yes		Yes	
Demographics		Yes		Yes		Yes
ln HH income		Yes		Yes		Yes
State × year FEs		Yes		Yes		Yes
Quad. birth year		Yes		Yes		Yes
Sample	Empl	Empl	Empl	Empl	All	All

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 2 including interaction terms for census regions. Region=West is the omitted category. Dependent variable is an indicator for transit usage or whether a vehicle is present in the household. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

Table 11: Reanalysis of Table 3: heterogeneity by region

	(1)	(2)	(3)	(4)	(5)
Δ Price	-0.0161	-0.0172	-0.0171	-0.0180	-0.0009
	(0.0204)	(0.0220)	(0.0212)	(0.0232)	(0.0228)
Δ Price × Northeast	-0.1434*	-0.1384*	-0.1280**	-0.1315**	-0.1340**
	(0.0718)	(0.0689)	(0.0575)	(0.0528)	(0.0511)
Δ Price × Midwest	-0.1071***	-0.1192***	-0.1222**	-0.1145**	-0.1168**
	(0.0376)	(0.0380)	(0.0483)	(0.0487)	(0.0487)
Δ Price × South	-0.0257	-0.0271	-0.0254	-0.0215	-0.0222
	(0.0358)	(0.0342)	(0.0352)	(0.0360)	(0.0363)
Observations	213839	213803	203798	203798	203798
Adjusted R^2	0.008	0.022	0.049	0.053	0.053
Sample year FEs	Yes	Yes	Yes		
State FEs	Yes	Yes	Yes		
Controls		Yes	Yes	Yes	Yes
Income-by-year bin FEs			Yes	Yes	Yes
State × year FEs				Yes	Yes
Quad. birth year					Yes

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 3 including interaction terms for census regions. Region=West is the omitted category. Dependent variable is log person vehicle miles travelled. Sample includes all respondents aged 25-54 with positive person VMT. Demographics include race, urbanization, and family size. Observations weighted by person sample weights. Standard errors clustered by state.

3.4 Heterogeneity by sex

I test whether the effect of gasoline price changes varies by men and women. The effects on driving and miles travelled (Tables 12 and 14) are homogeneous, while the effects on transit usage and vehicle ownership are slightly stronger for women (Table 13).

Table 12: Reanalysis of Table 1: heterogeneity by sex

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ Price	-0.0036***	-0.0025***	-0.0029***	-0.0027**	-0.0030***	-0.0030***	-0.0034***
	(0.0010)	(0.0009)	(0.0009)	(0.0010)	(0.0010)	(0.0010)	(0.0009)
Δ Price × Female	-0.0005	-0.0007	-0.0006	-0.0022	-0.0019	-0.0018	-0.0018
	(0.0024)	(0.0019)	(0.0020)	(0.0027)	(0.0027)	(0.0027)	(0.0027)
Observations	9140380	14380213	14342435	9140380	9102140	9102140	9102140
Adjusted R^2	0.036	0.017	0.017	0.049	0.050	0.051	0.051
Census year FEs	Yes	Yes	Yes	Yes	Yes		
State of birth FEs	Yes	Yes	Yes	Yes	Yes		
Demographics				Yes	Yes	Yes	Yes
ln HH income					Yes	Yes	Yes
State × year FEs						Yes	Yes
Quad. birth year							Yes
Price in state of	Birth	Birth	Res	Birth	Birth	Birth	Birth
Sample	Stay	All	All	Stay	Stay	Stay	Stay

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 1 including an interaction term for Female. Dependent variable is an indicator for driving to work. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

Table 13: Reanalysis of Table 2: heterogeneity by sex

	(1) $\mathbb{1}$[transit]	(2) $\mathbb{1}$[transit]	(3) $\mathbb{1}$[vehicle]	(4) $\mathbb{1}$[vehicle]	(5) $\mathbb{1}$[vehicle]	(6) $\mathbb{1}$[vehicle]
Δ Price	0.0017***	0.0006	-0.0007	0.0004	-0.0012	-0.0007
	(0.0006)	(0.0005)	(0.0008)	(0.0006)	(0.0011)	(0.0007)
Δ Price $\times$ Female	0.0026*	0.0037**	-0.0014*	-0.0027***	-0.0014	-0.0022***
	(0.0015)	(0.0017)	(0.0007)	(0.0008)	(0.0008)	(0.0008)
Observations	9140380	9102140	9114339	9102140	11850221	11756310
Adjusted R^2	0.066	0.091	0.025	0.077	0.023	0.130
Census year FEs	Yes		Yes		Yes	
State of birth FEs	Yes		Yes		Yes	
Demographics		Yes		Yes		Yes
ln HH income		Yes		Yes		Yes
State $\times$ year FEs		Yes		Yes		Yes
Quad. birth year		Yes		Yes		Yes
Sample	Empl	Empl	Empl	Empl	All	All

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 2 including an interaction term for Female. Dependent variable is an indicator for transit usage or whether a vehicle is present in the household. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

Table 14: Reanalysis of Table 3: heterogeneity by sex

	(1)	(2)	(3)	(4)	(5)
Δ Price	-0.0804*	-0.0839*	-0.0911*	-0.0885*	-0.0726
	(0.0428)	(0.0425)	(0.0466)	(0.0461)	(0.0465)
Δ Price × Female	0.0092	0.0098	0.0290	0.0274	0.0270
	(0.0559)	(0.0551)	(0.0577)	(0.0577)	(0.0578)
Observations	213803	213803	203798	203798	203798
Adjusted R^2	0.010	0.022	0.049	0.052	0.053
Sample year FEs	Yes	Yes	Yes		
State FEs	Yes	Yes	Yes		
Controls		Yes	Yes	Yes	Yes
Income-by-year bin FEs			Yes	Yes	Yes
State × year FEs				Yes	Yes
Quad. birth year					Yes

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 3 including interaction terms for Female. Male is the omitted category. Dependent variable is log person vehicle miles travelled. Sample includes all respondents aged 25-54 with positive person VMT. Demographics include race, urbanization, and family size. Observations weighted by person sample weights. Standard errors clustered by state.

3.5 Heterogeneity by race

I test whether the effect of gasoline price changes varies by race. The effects on driving, transit usage, and vehicle ownership are much stronger for Blacks (Tables 15 and 16). The effect on miles travelled is also stronger for Blacks, but is not statistically different (Table 17).[4] The driving effect for Blacks (-0.0018-0.0179=-0.0197, Table 15 Column 1) is roughly five times larger than the average effect in SB's Table 1 (-0.0038). Again, this heterogeneity is surprising, and suggests that a deeper investigation into mechanisms is warranted.

Table 15: Reanalysis of Table 1: heterogeneity by race

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ Price	-0.0018*	-0.0009	-0.0013	-0.0012	-0.0015	-0.0015	-0.0020**
	(0.0010)	(0.0008)	(0.0008)	(0.0010)	(0.0009)	(0.0009)	(0.0008)
Δ Price × Black	-0.0179***	-0.0168***	-0.0166***	-0.0192***	-0.0181***	-0.0179***	-0.0180***
	(0.0038)	(0.0034)	(0.0035)	(0.0042)	(0.0043)	(0.0043)	(0.0043)
Observations	9140380	14380213	14342435	9140380	9102140	9102140	9102140
Adjusted R^2	0.043	0.020	0.020	0.049	0.050	0.051	0.051
Census year FEs	Yes	Yes	Yes	Yes	Yes		
State of birth FEs	Yes	Yes	Yes	Yes	Yes		
Demographics				Yes	Yes	Yes	Yes
ln HH income					Yes	Yes	Yes
State × year FEs						Yes	Yes
Quad. birth year							Yes
Price in state of	Birth	Birth	Res	Birth	Birth	Birth	Birth
Sample	Stay	All	All	Stay	Stay	Stay	Stay

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 1 including an interaction term for Black. Dependent variable is an indicator for driving to work. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

[4]Note that race is measured at the individual level in the ACS data, but by household in the NHTS data.

Table 16: Reanalysis of Table 2: heterogeneity by race

	(1)	(2)	(3)	(4)	(5)	(6)
	$\mathbb{1}$[transit]	$\mathbb{1}$[transit]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]
Δ Price	0.0015***	0.0007	-0.0001	0.0007	0.0002	0.0007
	(0.0004)	(0.0005)	(0.0008)	(0.0005)	(0.0008)	(0.0005)
Δ Price × Black	0.0129***	0.0132***	-0.0124***	-0.0124***	-0.0164***	-0.0171***
	(0.0042)	(0.0048)	(0.0025)	(0.0025)	(0.0034)	(0.0031)
Observations	9140380	9102140	9114339	9102140	11850221	11756310
Adjusted R^2	0.083	0.091	0.045	0.077	0.058	0.130
Census year FEs	Yes		Yes		Yes	
State of birth FEs	Yes		Yes		Yes	
Demographics		Yes		Yes		Yes
ln HH income		Yes		Yes		Yes
State × year FEs		Yes		Yes		Yes
Quad. birth year		Yes		Yes		Yes
Sample	Empl	Empl	Empl	Empl	All	All

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 2 including an interaction term for Black. Dependent variable is an indicator for transit usage or whether a vehicle is present in the household. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

Table 17: Reanalysis of Table 3: heterogeneity by race

	(1)	(2)	(3)	(4)	(5)
Δ Price	-0.0625**	-0.0657**	-0.0616**	-0.0598**	-0.0439*
	(0.0256)	(0.0249)	(0.0258)	(0.0255)	(0.0247)
Δ Price × Black	-0.1417	-0.1407	-0.1558	-0.1570	-0.1578
	(0.1183)	(0.1188)	(0.1245)	(0.1246)	(0.1244)
Observations	212675	212646	202794	202794	202794
Adjusted R^2	0.011	0.022	0.049	0.053	0.053
Sample year FEs	Yes	Yes	Yes		
State FEs	Yes	Yes	Yes		
Controls		Yes	Yes	Yes	Yes
Income-by-year bin FEs			Yes	Yes	Yes
State × year FEs				Yes	Yes
Quad. birth year					Yes

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 3 including an interaction term for Black. Dependent variable is log person vehicle miles travelled. Sample includes all respondents aged 25-54 with positive person VMT. Demographics include race, urbanization, and family size. Observations weighted by person sample weights. Standard errors clustered by state.

3.6 Effects by age: transit and vehicle ownership

In Table 4, SB test for the effect of price changes at different ages, showing that the formative window is around ages 15-18. However, they show only the effect on the probability of driving and miles travelled. Since they also investigate the effect on transit usage and vehicle ownership (in Table 2), I repeat the Table 4 analysis for those outcomes. Table 18 finds similar results.

Table 18: Replication of Table 4: effects on transit and vehicle ownership

	(1) $\mathbb{1}$[transit]	(2) $\mathbb{1}$[transit]	(3) $\mathbb{1}$[vehicle]	(4) $\mathbb{1}$[vehicle]
$\Delta P(13, 12)$		0.0030***		-0.0020
		(0.0011)		(0.0013)
$\Delta P(14, 13)$	0.0015	0.0014	-0.0014	-0.0008
	(0.0010)	(0.0009)	(0.0016)	(0.0014)
$\Delta P(15, 14)$	0.0008	0.0007	-0.0014	-0.0024
	(0.0007)	(0.0008)	(0.0016)	(0.0015)
$\Delta P(16, 15)$	0.0049***	0.0058***	-0.0008	-0.0001
	(0.0013)	(0.0015)	(0.0016)	(0.0015)
$\Delta P(17, 16)$	0.0028***	0.0030***	-0.0028*	-0.0031*
	(0.0010)	(0.0009)	(0.0016)	(0.0016)
$\Delta P(18, 17)$	0.0027***	0.0032***	0.0006	0.0014
	(0.0010)	(0.0012)	(0.0017)	(0.0019)
$\Delta P(19, 18)$	0.0027**	0.0022*	0.0022	0.0018
	(0.0013)	(0.0013)	(0.0018)	(0.0018)
$\Delta P(20, 19)$		0.0044***		0.0019
		(0.0014)		(0.0014)
Observations	8643233	8358711	11199902	10826173
Adjusted R^2	0.066	0.066	0.022	0.022

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of Table 4 Columns 1-2 using transit usage and vehicle ownership as the dependent variable. Fixed effects for sample year, state, and age. Observations weighted by person sample weights. Standard errors clustered by state.

3.7 Logistic regression

For the results using binary dependent variables (driving, transit use, and vehicle ownership), SB use a linear probability model. Since the base rates of these variables are far from 0.5 (the average rates are 0.90, 0.03, and 0.95, respectively), we might worry that a LPM will be a poor approximation of the true probabilities. To test this, I repeat the analysis in Tables 1 and 2 using logistic regression. Reassuringly, I find effects of the same sign and significance in Table 19 (driving) and Table 20 (transit usage and vehicle ownership). (Since the regression includes fixed effects, the marginal effects are not straightforward to compute.)

Table 19: Reanalysis of Table 1: logistic regression

	(1)	(2)	(3)	(4)	(5)
Δ Price	-0.0387***	-0.0205***	-0.0236***	-0.0399***	-0.0420***
	(0.0105)	(0.0069)	(0.0072)	(0.0103)	(0.0099)
Observations	9140380	14380213	14342435	9140380	9102140
Census year FEs	Yes	Yes	Yes	Yes	Yes
State of birth FEs	Yes	Yes	Yes	Yes	Yes
Demographics				Yes	Yes
ln HH income					Yes
Price in state of	Birth	Birth	Res	Birth	Birth
Sample	Stay	All	All	Stay	Stay

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 1 using logistic regression (Columns 6-7 omitted due to computational constraints). Dependent variable is an indicator for driving to work. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

Table 20: Reanalysis of Table 2: logistic regression

	(1)	(2)	(3)
	$\mathbb{1}$[transit]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]
Δ Price	0.0689***	-0.0480**	-0.0397**
	(0.0199)	(0.0191)	(0.0159)
Observations	9140380	9114339	11850221
Census year FEs	Yes	Yes	Yes
State of birth FEs	Yes	Yes	Yes
Sample	Empl	Empl	All

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 (Columns 1, 3, 5) in Table 2 using logistic regression. Dependent variable is an indicator for driving to work. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Observations weighted by person sample weights. Standard errors clustered by state of birth.

3.8 Cohort fixed effects

In Appendix Table A.12, SB show results including cohort fixed effects. They caution that these results are using a different source of identifying variation, since most variation in gasoline prices is temporal rather than geographical, and this variation is absorbed by cohort fixed effects. However, it is noteworthy that the effect on miles travelled changes sign and is significant at the 10% level in some specifications. These results use the minimum driving age to define price changes, while the main results also use the price change from age 15 to 17.

In Table 21 I repeat the Table A.12 analysis using the price change between age 15 and 17. In this case, the estimates have the expected negative sign, and are not statistically significant. The positive estimates in Table A.12 appear to be driven by the use of minimum driving age, and possibly the variation from changes in driver license age requirements over time. (Note that these regression include fixed effects for cohort, year, and age, but SB calculate age using the census reference day, so that there are multiple ages per birthyear and survey year, thereby avoiding a dummy variable trap.)

Table 21: Reanalysis of Table A.12: price change between age 15 and 17

	(1)	(2)	(3)	(4)
Δ Price	-0.0495	-0.0630	-0.1175	-0.1185
	(0.1294)	(0.1249)	(0.1178)	(0.1206)
Observations	213839	213803	203798	203798
Adjusted R^2	0.008	0.022	0.049	0.053
Sample year FEs	Yes	Yes	Yes	
State FEs	Yes	Yes	Yes	
Controls		Yes	Yes	Yes
Income-by-year bin FEs			Yes	Yes
State × year FEs				Yes

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table A.12 using price change between age 15 and 17. Dependent variable is log person vehicle miles travelled. Age and cohort fixed effects. Sample includes all respondents aged 25-54 with positive person VMT. Demographics include race, urbanization, and family size. Observations weighted by person sample weights. Standard errors clustered by state.

4 Conclusion

Overall, my robustness tests support the main finding that gasoline price shocks while learning to drive affect driving behavior as an adult. My findings point to two areas for future research. First, what is the theoretical basis for whether price increases and decreases have symmetric effects, and why do these differ for the extensive and intensive margins? Second, what underlying mechanisms can explain why the effects vary by region and race?

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A Appendix

A.1 Testing symmetry of price changes

Table A1: Replication of Table 1: separate effects for price increases and decreases (interaction model)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ Price	-0.0049	-0.0107*	0.0006	-0.0029	-0.0033	-0.0029	-0.0046
	(0.0080)	(0.0060)	(0.0036)	(0.0063)	(0.0064)	(0.0067)	(0.0068)
Δ Price $\times$ Δ Price>0	-0.0029	0.0055	0.0023	-0.0052	-0.0048	-0.0054	-0.0039
	(0.0077)	(0.0058)	(0.0047)	(0.0057)	(0.0057)	(0.0062)	(0.0065)
Observations	9140380	14380213	14342435	9140380	9102140	9102140	9102140
Adjusted R^2	0.036	0.017	0.017	0.049	0.050	0.051	0.051
Census year FEs	Yes	Yes	Yes	Yes	Yes		
State of birth FEs	Yes	Yes	Yes	Yes	Yes		
Demographics				Yes	Yes	Yes	Yes
ln HH income					Yes	Yes	Yes
State $\times$ year FEs						Yes	Yes
Quad. birth year							Yes
Price in state of	Birth	Birth	Res	Birth	Birth	Birth	Birth
Sample	Stay	All	All	Stay	Stay	Stay	Stay

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 1, with additional terms for $\Delta P \times \mathbb{1}\{\Delta P > 0\}$ and $\mathbb{1}\{\Delta P > 0\}$ (estimates from the latter are omitted). Dependent variable is an indicator for driving to work. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

Table A2: Replication of Table 2: separate effects for price increases and decreases (interaction model)

	(1)	(2)	(3)	(4)	(5)	(6)
	$\mathbb{1}$[transit]	$\mathbb{1}$[transit]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]	$\mathbb{1}$[vehicle]
Δ Price	0.0114*	0.0061	-0.0077	-0.0066	-0.0057	-0.0074
	(0.0064)	(0.0058)	(0.0074)	(0.0056)	(0.0071)	(0.0053)
Δ Price × Δ Price>0	-0.0071	-0.0017	0.0051	0.0047	0.0006	0.0032
	(0.0061)	(0.0052)	(0.0066)	(0.0052)	(0.0064)	(0.0051)
Observations	9140380	9102140	9114339	9102140	11850221	11756310
Adjusted R^2	0.066	0.091	0.025	0.077	0.022	0.130
Census year FEs	Yes		Yes		Yes	
State of birth FEs	Yes		Yes		Yes	
Demographics		Yes		Yes		Yes
ln HH income		Yes		Yes		Yes
State × year FEs		Yes		Yes		Yes
Quad. birth year		Yes		Yes		Yes
Sample	Empl	Empl	Empl	Empl	All	All

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 2, with additional terms for $\Delta P \times \mathbb{1}\{\Delta P > 0\}$ and $\mathbb{1}\{\Delta P > 0\}$ (estimates from the latter are omitted). Dependent variable is an indicator for transit usage or whether a vehicle is present in the household. Age fixed effects. Sample includes all native-born persons actively working in the census between the ages of 25-54, and excludes farm workers and those coded N/A for transportation mode. Demographics include sex, marital status, educational attainment, and race. Observations weighted by person sample weights. Standard errors clustered by state of birth.

Table A3: Reanalysis of Table 3: separate effects for price increases and decreases (interaction model)

	(1)	(2)	(3)	(4)	(5)
Δ Price	-0.1667*	-0.1689*	-0.1533*	-0.1537	-0.0488
	(0.0892)	(0.0875)	(0.0893)	(0.0935)	(0.0896)
Δ Price × Δ Price>0	0.1822*	0.1749*	0.1609	0.1524	0.0414
	(0.1014)	(0.1011)	(0.1047)	(0.1074)	(0.1063)
Observations	213839	213803	203798	203798	203798
Adjusted R^2	0.008	0.022	0.049	0.052	0.053
Sample year FEs	Yes	Yes	Yes		
State FEs	Yes	Yes	Yes		
Controls		Yes	Yes	Yes	Yes
Income-by-year bin FEs			Yes	Yes	Yes
State × year FEs				Yes	Yes
Quad. birth year					Yes

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Replication of row 1 in Table 3, with additional terms for $\Delta P \times \mathbb{1}\{\Delta P > 0\}$ and $\mathbb{1}\{\Delta P > 0\}$ (estimates from the latter are omitted). Dependent variable is log person vehicle miles travelled. Sample includes all respondents aged 25-54 with positive person VMT. Demographics include race, urbanization, and family size. Observations weighted by person sample weights. Standard errors clustered by state.