Formative Experiences and the Price of Gasoline

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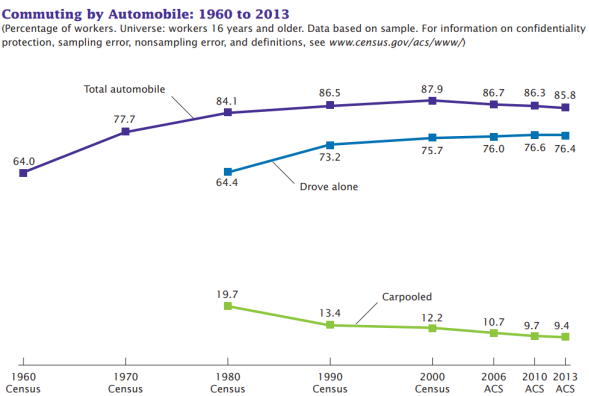
Cars offer high levels of mobility, but come with high costs

- Congestion, air pollution, affordability, traffic deaths, segregation, heat islands

Driving share in the US is high and has been essentially flat since 1980 (McKenzie 2015 ↓)

- Significant investment in substitutes in US
- Most still choose to drive (Knittel & Murphy 2019, Leard et al. 2019)



Persistence in *demand* for driving?

- Most public transit research focuses on supply
- But, observable differences in driving across cohorts...

Persistent Demand Effects?

Most people drive, some people do not. Why?

- Standard controls typically do not fully explain behavior.
- *Where do idiosyncratic differences in behavior come from?*

Focus on **formative experiences**: Do early experiences have long-lasting effects?

- Effects of early experiences consistent with existing behavioral theory?
- Do these initial interactions influence 'deep' parameters?

Do persistent early impacts suggest useful policy levers?

This Paper

Motivating evidence: Cohorts that turn 15 in 1974 & 1979 drive less in 2000 $\Rightarrow$
Suggests early experiences of gasoline prices may matter in the long run

Model: $f(\text{teen gasoline prices}) \rightarrow$ later life commuting/driving behavior

- Combine $>$40 years of state-year gas prices with Census and NHTS data
  - Price levels vs. price shocks, substitutes for driving, asset purchases
  - Extensive and intensive margins
- Inject more variation by exploiting state differences in minimum driving age
- Compare gas prices early driving years with nearby years (placebo)
- Fit parametric cumulative exposure model to test against effect of recent prices

Interpretation

- Mediation? Early-life gas prices could influence macroeconomic conditions...
- Examine consistency with existing mechanisms

Preview of Findings

Formative experiences during **narrow window** shape later-life behavior

- Doubling of gas prices during first three year at driving age $\rightarrow$
  a) 0.4pp less likely to drive to work as adult
  b) Drive 7% fewer VMT as adult; somewhat less likely to drive SUV
- Price *changes* (rather than levels) drive behavior
- Price changes outside formative windows **have no significant effect**
- Age 15 price shock matters 25x more than last years' for ext. margin (3x for int.)

Non-behavioral mechanisms/mediators **do not explain** differences

- Graduating into a recession, costly skill acquisition

Contrasts with standard behavioral theories and findings

- Inconsistent with mental plasticity and recency bias; habit formation link tenuous

Literature

1. Experiences accumulate to shape later-life behavior
   - Risk, equity, consumption, labor outcomes ← recessions (Malmendier & Nagel 2011, & Shen 2018; Oreopoulus et al. 2012; Giuliano & Spilimbergo 2013; Stuart 2019)
   - Inflation expectations ← recent, lived inflation (Malmendier & Nagel 2015)
   - Risk ← violence (Callen et al. 2012)

2. Determinants of driving
   - Are driving behaviors changing?
     - No, though demographics are (Leard et al. 2019)
     - Millennials aren't really different (Knittel & Murphy 2019)
   - Effect of gas prices on VMT and fuel economy (Hughes et al. 2008; Knittel & Tanaka 2019; Li et al. 2009; Busse et al. 2013; Gillingham et al. 2015)

3. Path-dependent effects of transportation
   - Mostly studying supply (e.g. Bleakley & Lin 2012; Brooks & Lutz 2016)
   - A few study demand (Anderson et al. 2015; Larcom et al. 2017; Simonsohn 2006; Yang & Lim 2017)

Roadmap

1. Data
2. Visible patterns in raw data: the 1970s
3. Long run effects of gasoline price movements
   - Extensive margin
   - Intensive margin
   - Additional sources of variation
4. Formative window and cumulative experience (placebo tests)
   - Effect only in narrow age window
   - Weighting of early-life cumulative experience
5. Interpretation – mediation and mechanisms

Data

Census 'Journey to Work' for extensive margin (1980–2000 Census, 2006-17 ACS)

- Workers: Commute mode to work; All people: Car in household
- Sample limited to non-farm, native-born, prime age at time of survey
- Often restrict to people currently residing in state of birth
- We know age and (sometimes) survey date to infer 'year turned 15', etc.

NHTS for intensive margin results/vehicle choice (1990, 1995, 2001, 2009, 2017)

Gasoline prices, state-X-year post tax average price (1966-2017) (Small & Van Dender 2007; Li, Linn, & Muehlegger 2014)

Construct a panel of driving license regulations back to 1966

- DL-101 in Highway Statistics (FHWA), IIHS, DMV histories

Cohorts coming of age in the 1970s

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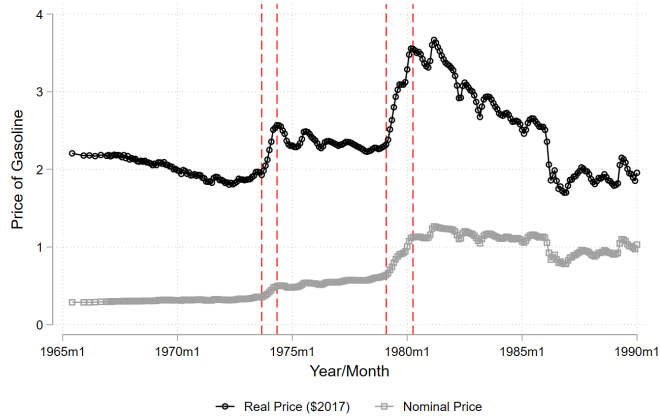
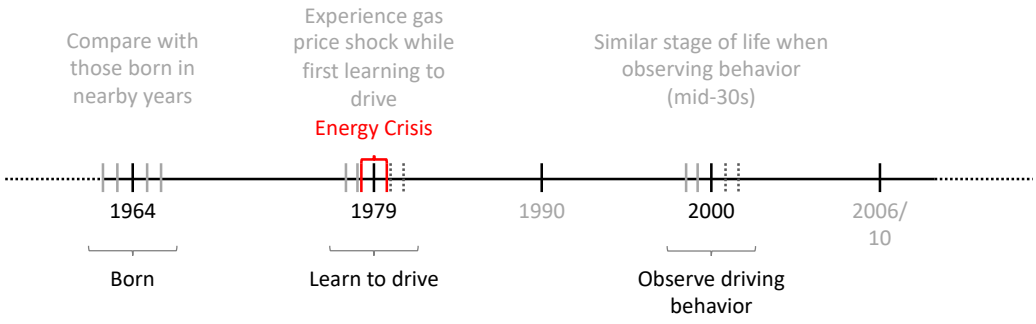


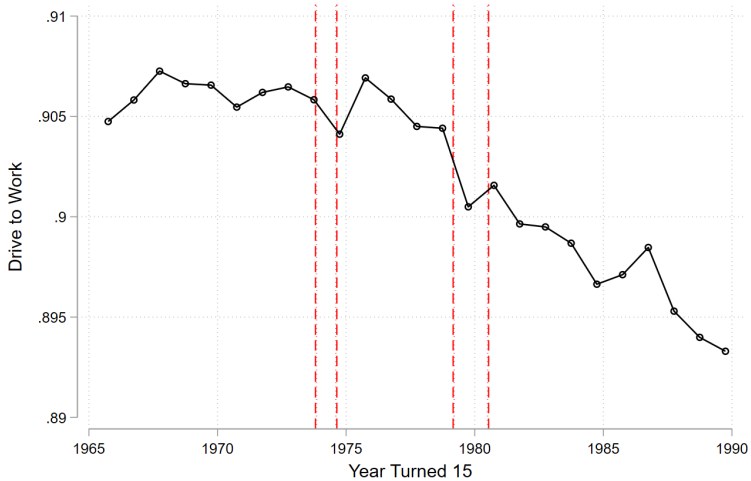
- Two periods of rapid (and mostly unexpected) increases in gasoline price
- Compare **year 2000** driving behavior by age-15 cohort
- Everyone faces same economic conditions in year 2000

Timing


Compare with those born in nearby years
Experience gas price shock while first learning to drive
Energy Crisis
Similar stage of life when observing behavior (mid-30s)
1964
1979
1990
2000
2006/ 10
Born
Learn to drive
Observe driving behavior

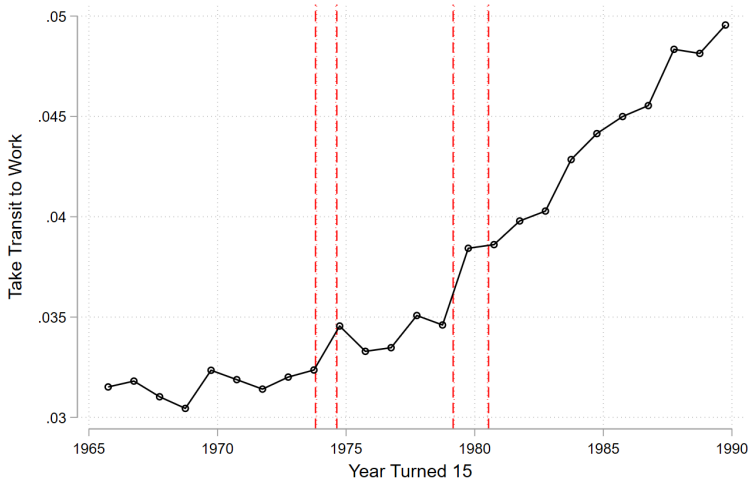
Drive to Work in 2000

Employed and at work



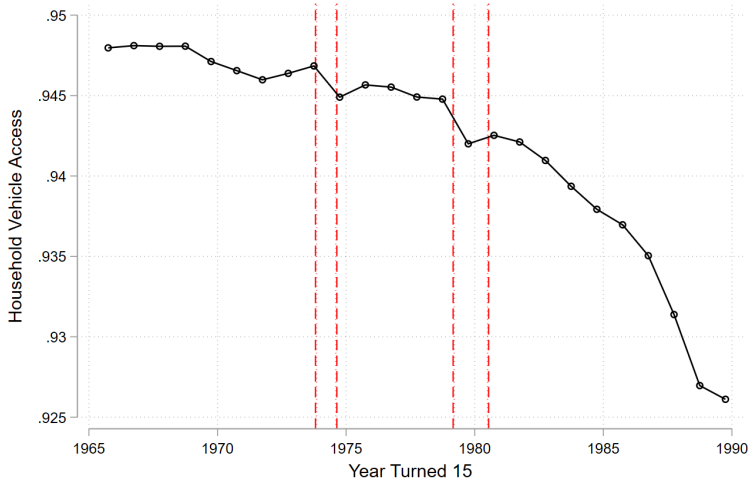
Transit to work in 2000

Employed and at work



No Car Access in 2000

All people



- Large declines in 15-in-late-80s group; in their mid-late 20s

Event Study Estimates/Heterogeneity

Simple exercise: What is size of jump in 1979?

- Event study estimates $\rightarrow$ **(-0.21,-0.50)pp**
- Robust to bandwidth choice, linear/quadratic running variables
- Observables do not show discontinuity

Results are intuitive:

- Between 50-100% substitution to mass transit

Heterogeneity – effects are stronger for

- Urban core residents: (-0.9,-1.9)pp
- Lowest decile of income: -1.3pp

Generalizing: Long Run Effects of Gas Price

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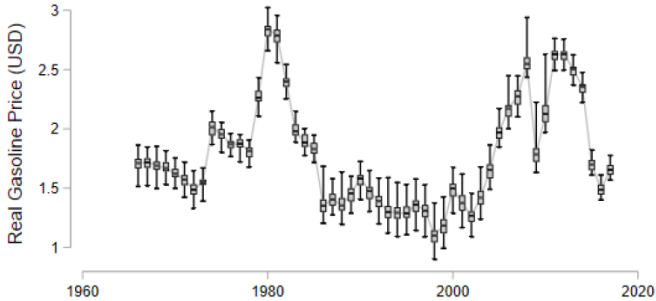
Goal: Match age$\in$[25,54] driving behavior to state-$\times$-year **teen** gas prices

- Exploit interstate price variation (though most variation is temporal)
- Price Source: Updated version of data in Li, Linn, & Muehlegger 2014

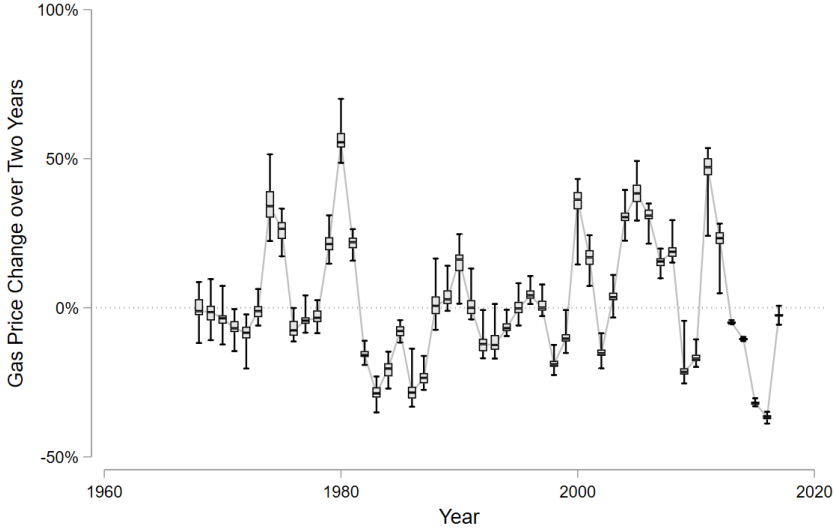
Treatment T_{cs} of cohort c in state s is in levels OR changes of real gas price:

$P_{cs}^{a} =$ at age a

$$P_{cs}^{\Delta(a+j,a-k)} = \frac{P_{cs}^{a+j} - P_{cs}^{a-k}}{P_{cs}^{a}}$$



Two year delta



Gas prices somewhat AR(1) $\rightarrow$ differences like white noise

Generalizing: Long Run Effects of Gas Price

Match age$\in$[25,54] driving behavior to state-X-year gas price during **teen** years

$$Y_{icst} = \theta T_{cs} + \delta_{st} + \eta_a + X'_{it}\lambda + \varepsilon_{icst}$$

Outcomes/Sample: Extensive and Intensive margins

- Extensive: 1[Drive] in Census 1980-2017 (has state of birth)
- Intensive: ln(VMT) in NHTS 1990-2017 (only state of res)

Fixed Effects:

- η_a: Age-specific FEs flexibly control for life cycle trends
- δ_{st}: State-$\times$-year of survey FEs control for contemporaneous conditions

Controls:

- 'Good' (exogenous): Sex, race
- 'Bad' (colliders): Income, state of residence, education, marital status

Generalizing: Long Run Effects of Gas Price

Identification: No latent differences between cohorts correlated with outcomes

Show robustness to a wide variety of tests

1. Add in quadratic birth year trends
2. Add *additional source of variation* — merge by **minimum DL age**
3. Later: Placebo tests on alternative ages
4. Later: Probe mediating stories

Additional measures of exposure to gasoline price variation based on DL age:

$$P_{cs}^{m_{cs}} = \text{gas price at min. driving age } m_{cs}, \quad P_{cs}^{\Delta(m_{cs}+j, m_{cs}-k)} = \frac{P_{cs}^{m_{cs}+j} - P_{cs}^{m_{cs}-k}}{P_{cs}^{m_{cs}}}$$

Main Results

	1[drive]				ln(VMT)	
Exposure defined by age						
$P_{cs}^{\Delta 17,15}$	-0.0038***	-0.0028**	-0.0031***	-0.0043***	-0.079**	-0.062*
	(0.0010)	(0.0008)	(0.0009)	(0.0009)	(0.026)	(0.026)
P_{cs}^{16}	-0.0007	0.0012+	-0.0029***	-0.0011	0.021+	0.003
	(0.0010)	(0.0006)	(0.0007)	(0.0008)	(0.011)	(0.010)
Exposure defined by minimum driver license age						
$P_{cs}^{\Delta(m_{cs}+1,m_{cs}-1)}$	-0.0041***	-0.0038***	-0.0040***	-0.0045***	-0.050*	-0.034+
	(0.0010)	(0.0008)	(0.0008)	(0.0010)	(0.019)	(0.020)
$P_{cs}^{m_{cs}}$	-0.0012	0.0006	-0.0012	-0.0015+	0.015	-0.003
	(0.0010)	(0.0006)	(0.0010)	(0.0008)	(0.012)	(0.011)
+ Demographics/lnHHI	-	-	-	Y	-	Y
+ St×Yr & Quad. birth year	-	-	-	Y	-	Y
Price in state of	Birth	Birth	Res	Birth	Res	Res
Sample	Stay	All	All	Stay	All	All

- Price shocks (not levels!) matter (Haushofer & Fehr 2019)
- Intensive margin effect larger than it may seem given stable drive share
- A *general phenomenon*: robust to leaving out 1970s crises

Other Effects: Transit and Vehicle Choice

- Compensating shift to transit use
- Weaker evidence that households less likely to have vehicle
- Changes in vehicles...

	Transit usage		Vehicle available			
	1[transit] (1)	1[transit] (2)	1[vehicle] (3)	1[vehicle] (4)	1[vehicle] (5)	1[vehicle] (6)
Exposure defined by age						
$P_{cs}^{\Delta 17,15}$	0.0029***	0.0024**	-0.0014	-0.0009	-0.0019*	-0.0018**
	(0.0007)	(0.0009)	(0.0008)	(0.0006)	(0.0009)	(0.0006)
P_{cs}^{16}	0.0001	0.0004	0.0004	0.0007	-0.0007	-0.0001
	(0.0007)	(0.0005)	(0.0007)	(0.0005)	(0.0009)	(0.0007)
Exposure defined by minimum driver license age						
$P_{cs}^{\Delta(m_{cs}+1,m_{cs})}$	0.0028*	0.0021	-0.0025	-0.0023+	-0.0019	-0.0022
	(0.0012)	(0.0013)	(0.0016)	(0.0013)	(0.0016)	(0.0013)
$P_{cs}^{m_{cs}}$	0.0006	0.0008	0.0001	0.0003	-0.0008	-0.0005
	(0.0007)	(0.0005)	(0.0007)	(0.0005)	(0.0008)	(0.0006)
Census year FEs	Y	-	Y	-	Y	-
State of birth FEs	Y	-	Y	-	Y	-
Age FEs	Y	Y	Y	Y	Y	Y
Demographics	-	Y	-	Y	-	Y
ln HH income	-	Y	-	Y	-	Y
State-X-year FEs	-	Y	-	Y	-	Y
Quad. birth year	-	Y	-	Y	-	Y
Sample	Empl	Empl	Empl	Empl	All	All

Other Effects: Transit and Vehicle Choice

	Gallons per mile				Truck, SUV, etc.			
	Average GPM (1)	Average GPM (2)	GPM (3)	GPM (4)	Any Big (5)	Any Big (6)	1[Big] (7)	1[Big] (8)
$P_{cs}^{\Delta(18,16)}$	-0.0000	-0.0001	-0.0001	-0.0001	-0.0265**	-0.0245*	-0.0193*	-0.0194+
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0095)	(0.0101)	(0.0092)	(0.0097)
$P_{cs}^{\Delta(17,15)}$	0.0000	-0.0002	-0.0002	-0.0003	-0.0213+	-0.0173	-0.0155	-0.0141
	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0111)	(0.0112)	(0.0106)	(0.0104)
$P_{cs}^{\Delta(m_{cs}+2,m_{cs})}$	0.0001	0.0001	-0.0001	-0.0000	-0.0203*	-0.0169+	-0.0141	-0.0110
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0090)	(0.0085)	(0.0094)	(0.0085)
$P_{cs}^{\Delta(m_{cs}+1,m_{cs}-1)}$	-0.0002	-0.0003	-0.0003	-0.0004	-0.0238+	-0.0209	-0.0193	-0.0179
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0126)	(0.0125)	(0.0117)	(0.0116)
Sample year FEs	Y	-	Y	-	Y	-	Y	-
State FEs	Y	-	Y	-	Y	-	Y	-
Age FEs	Y	Y	Y	Y	Y	Y	Y	Y
Demographics	-	Y	-	Y	-	Y	-	Y
Income-by-year bin FEs	-	Y	-	Y	-	Y	-	Y
State-X-year FEs	-	Y	-	Y	-	Y	-	Y
Vehicle age	-	-	Y	Y	-	-	Y	Y
Quad. vehicle year	-	-	Y	Y	-	-	Y	Y
Sample	Person	Person	Vehicle	Vehicle	Person	Person	Vehicle	Vehicle
Mean of dep. var.	0.0508	0.0508	0.0509	0.0509	0.4681	0.4681	0.4422	0.4422

Defining the formative window (+ Placebo)

Model with many shocks together

- Horserace between ages

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- Effects concentrated in narrow window: between ages 15 to 18

$\Rightarrow$ This is when teens start to drive!

- Similar window for both margins
- Similar using minimum DL age

	Extensive margin		Intensive margin	
	1[drive] (1)	1[drive] (2)	ln(VMT) (3)	ln(VMT) (4)
$P_{cs}^{\Delta 13,12}$		-0.0007		-0.0633
		(0.0018)		(0.0587)
$P_{cs}^{\Delta 14,13}$	-0.0002	-0.0002	0.0009	0.0084
	(0.0015)	(0.0016)	(0.0334)	(0.0415)
$P_{cs}^{\Delta 15,14}$	-0.0002	-0.0003	0.0162	0.0002
	(0.0019)	(0.0022)	(0.0433)	(0.0450)
$P_{cs}^{\Delta 16,15}$	-0.0057**	-0.0057**	-0.1012*	-0.0929+
	(0.0019)	(0.0021)	(0.0480)	(0.0520)
$P_{cs}^{\Delta 17,16}$	-0.0027+	-0.0026	-0.0795+	-0.0960*
	(0.0015)	(0.0017)	(0.0413)	(0.0411)
$P_{cs}^{\Delta 18,17}$	-0.0024	-0.0023	-0.0847*	-0.0658+
	(0.0017)	(0.0019)	(0.0386)	(0.0384)
$P_{cs}^{\Delta 19,18}$	-0.0013	-0.0013	-0.0545	-0.0712
	(0.0017)	(0.0018)	(0.0495)	(0.0465)
$P_{cs}^{\Delta 20,19}$		-0.0006		-0.0143
		(0.0019)		(0.0458)
Sample year FEs	Y	Y	Y	Y
State FEs	Y	Y	Y	Y
Age FEs	Y	Y	Y	Y

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Cumulative Exposure Function

We would like a way to compare effects of early shocks with more recent shocks

- Malmendier & Nagel (2011) propose parametric cumulative exposure function
- Weights on a vector of experience change weakly monotonically into past
- We adapt to our setting $\leftrightarrow$ Compare to prior (less parametric) results

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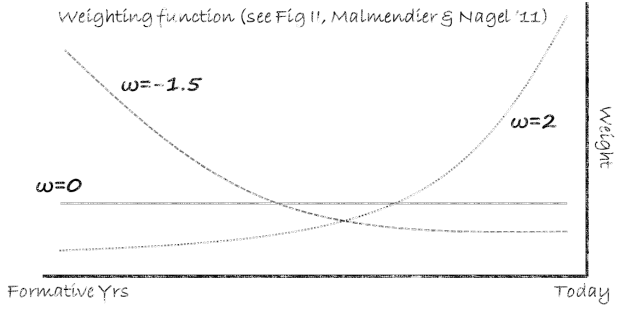
$$Y_{icst} = \beta A_{cst}(\omega, \mathbf{T}_{st}) + \kappa_s + \delta_t + \eta_a + X'_{it}\lambda + \varepsilon_{icst}$$

$$A_{cst}(\omega, \mathbf{T}_{st}) = \sum_{k=15}^{\text{age}_{ct}-1} \frac{(k-14)^{\omega}}{\sum_{k=15}^{\text{age}_{ct}-1}(k-14)^{\omega}} \times T_{s,t-(\text{age}_{ct}-k)}$$



Cumulative Exposure Function

	Extensive margin	Intensive margin
	1[drive]	ln(VMT)
	(1)	(2)
$\beta\ (A_{cst}(\omega, \mathbf{P}_s^{\Delta 1yr}))$	-0.0140**	-0.6796***
	(0.0045)	(0.1809)
ω (shape)	-1.0786***	-0.3294*
	(0.2796)	(0.1617)
Sample year FEs	Y	Y
State FEs	Y	Y
Age FEs	Y	Y

$$\frac{\partial Y_{icst}}{\partial T_{s,t-(\text{age}_{ct}-k)}} = \theta_{[k]} = \beta w_{ct}(k, \omega)$$

Results indicate the early experiences matter much more than recent

- For 39yo, shock at 16 is 25.3x more important than last year (extensive)
- Our results indicate a formative window $\leftrightarrow$ not possible in M&N

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	Extensive margin	Intensive margin
	1[drive]	ln(VMT)
	(1)	(2)
$\beta\left(A_{est}(\omega, \mathbf{P}_s^{\Delta 1yr})\right)$	-0.0140**	-0.6796***
	(0.0045)	(0.1809)
ω (shape)	-1.0786***	-0.3294*
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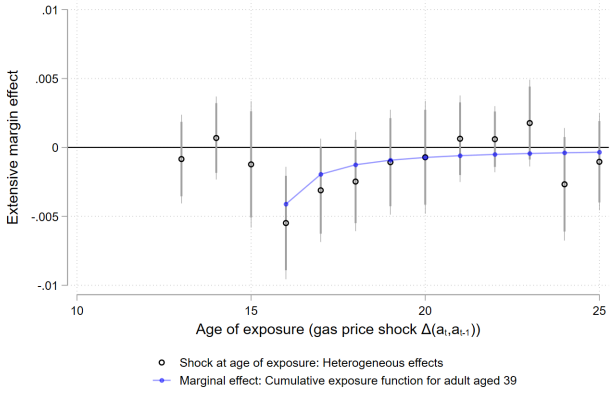

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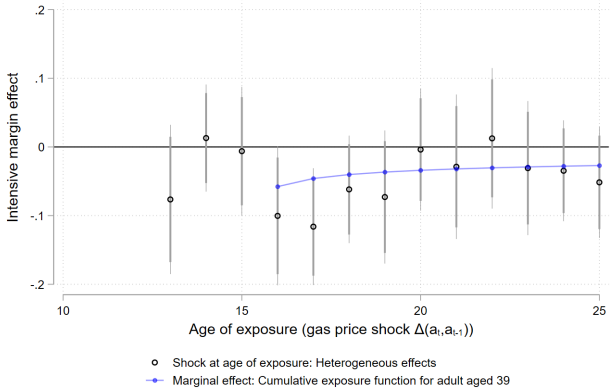

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Further Robustness and Interpretation

A clear link: formative experiences of gasoline prices $\rightarrow$ later life driving

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What is this effect capturing?

1. Graduating into a recession or other scarring
   - Malmendier & Shen 2018; Oreopoulus et al. 2012; Stuart 2019
   - At most a small portion
2. Path dependence due to reduced skill acquisition
   - Not likely

What kind of effect is this?

Recency Bias *Mental Plasticity* *Habit Formation*

Graduating into a recession/scarring?

Are results due to an indirect effect of 'unlucky' timing into adulthood?

1. Controlling for contemporaneous income barely changes coeffs
2. Dropping those 1970s oil crises barely changes coeffs
3. Mediation: *Does mediator M explain effect?* Two flavors:
   - **Unemployment rate at age 18**
   - **Contemporaneous income** (three different measures)

Mediation: graduating into a recession/scarring

Jointly model:

- Effect of both (i) gas price shock T and (ii) mediator M on driving Y
- Effect of gas price shock T on mediator M

$$\begin{pmatrix} Y \\ M \end{pmatrix} = \begin{pmatrix} \theta^Y \\ \theta^M \end{pmatrix} T + \begin{pmatrix} \gamma \\ 0 \end{pmatrix} M + \begin{pmatrix} \delta^Y \\ \delta^M \end{pmatrix} X + \begin{pmatrix} \epsilon^Y \\ \epsilon^M \end{pmatrix}$$

- Also, unique vectors of fixed effects for Y and M equations

Interpret as providing data-consistent bounds on alternative stories

Mediators have little or no effect

Mediator (M):	Unempl. Rate at 18		Household income		Wage income		Personal income	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Effects of M and T on Y	1[drive]	1[drive]	1[drive]	1[drive]	1[drive]	1[drive]	1[drive]	1[drive]
θ^Y	-0.0042***	-0.0044***	-0.0038***	-0.0041***	-0.0032**	-0.0037**	-0.0031**	-0.0037**
	(0.0011)	(0.0010)	(0.0010)	(0.0011)	(0.0009)	(0.0010)	(0.0011)	(0.0012)
γ	0.0001	0.0000	0.0223***	0.0223***	0.0170***	0.0170***	0.0216***	0.0216***
	(0.0002)	(0.0002)	(0.0024)	(0.0024)	(0.0045)	(0.0045)	(0.0044)	(0.0045)
Effect of T on M	M	M	$\ln(M)$	$\ln(M)$	$\ln(M)$	$\ln(M)$	$\ln(M)$	$\ln(M)$
θ^M	1.0286***	0.0451	-0.0053	-0.0062+	-0.0488***	-0.0371***	-0.0460***	-0.0335***
	(0.2875)	(0.3481)	(0.0034)	(0.0036)	(0.0034)	(0.0034)	(0.0035)	(0.0033)
Direct effect (θ^Y)	-0.0042***	-0.0044***	-0.0038***	-0.0041***	-0.0032**	-0.0037**	-0.0031**	-0.0037**
	(0.0011)	(0.0010)	(0.0010)	(0.0011)	(0.0009)	(0.0010)	(0.0011)	(0.0012)
Indirect effect ($\gamma\theta^M$)	0.0001	0.0000	-0.0001	-0.0001	-0.0008**	-0.0006**	-0.0010***	-0.0007***
	(0.0002)	(0.0000)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Total effect ($\theta^Y + \gamma\theta^M$)	-0.0041***	-0.0044***	-0.0040***	-0.0042***	-0.0040***	-0.0043***	-0.0041***	-0.0044***
	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0008)	(0.0043)	(0.0010)	(0.0010)
Treatment definition (T)	$P_{cs}^{\Delta 17,15}$	$P_{cs}^{\Delta(m_{cs}\pm 1)}$	$P_{cs}^{\Delta 17,15}$	$P_{cs}^{\Delta(m_{cs}\pm 1)}$	$P_{cs}^{\Delta 17,15}$	$P_{cs}^{\Delta(m_{cs}\pm 1)}$	$P_{cs}^{\Delta 17,15}$	$P_{cs}^{\Delta(m_{cs}\pm 1)}$

Did Fewer People Learn How to Drive?

Learning to drive is costly (time, vehicles, fuel) & parental/family inputs important…

Do higher learning costs (due to gasoline price shocks) keep people from learning to drive in the long run?

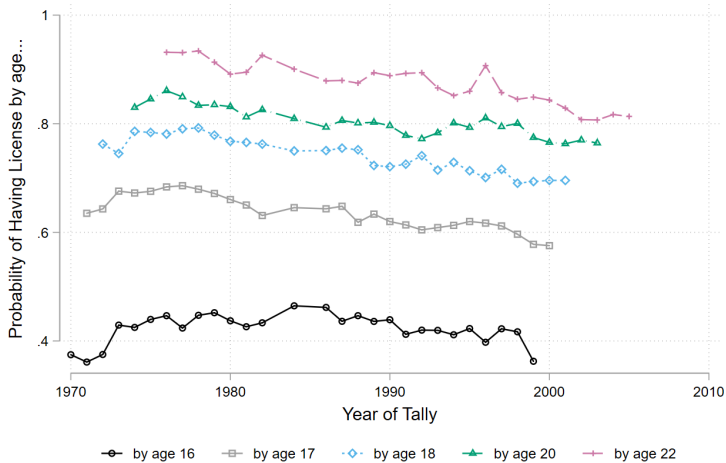
Probably not (if so, not quantitatively large)

1. No straightforward explanation for intensive margin effect
2. No strong evidence teens reduce take up of licenses around ’74/79 crises
   - National level counts of licenses by age shows no dip (picture)
3. Do changes in minimum driver license age (GDL) impact later-life driving?

Did Fewer People Learn How to Drive Due to Oil Crises?

No clear pattern, but noisy

- National counts of licenses by age in FHWA *Highway Statistics*
- States do NOT hold on to DL data...
- 1983/85 data was interpolated to 'reduce regulatory burden' (omitted here)



Do changes in minimum DL age (GDL) impact later-life driving?

An indirect test:

Does delaying driving/increasing costs of skill acquisition generally lead to reduced later life driving?

- If so, interesting policy lever
- If not, then unlikely channel to explain formative experience of gas prices

Construct a panel of driving license regulations back to 1966

- Main source FHWA *Driver License Administration Requirements and Fees* tables, but also IIHS, DMV histories, newspapers
- Intermittent coverage before 1995; assume constant unless see change
- Similar merge to Census/NHTS as gas prices

Do changes in minimum DL age (GDL) impact later-life driving?

An indirect test:

Does delaying driving/increasing costs of skill acquisition generally lead to reduced later life driving?

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We test for the effect of the full-privilege and intermediate minimum driving age on later-life driving and VMT

- Misc. changes in the 70s and 80s
- Widespread GDL adoption starting in the mid-90s

Do changes in minimum DL age (GDL) impact later-life driving?

An indirect test:

Does delaying driving/increasing costs of skill acquisition generally lead to reduced later life driving?

- If so, interesting policy lever
- If not, then unlikely channel to explain formative experience of gas prices

Legal restrictions **more extreme** than gas price hikes

- Youngsters caught driving without a license can be disallowed a license until the age of 18 in most states
- If legal minimum driving age has no effect, unlikely that gas prices affect driving through reduced license takeup

Effects of Driver Licensing Restrictions

	(1)	(2)	(3)	(4)	(5)	(6)
Extensive (1[drive])						
Minimum Full Privilege Age	0.0078	0.0048	0.0071	0.0072	0.0082+	0.0092
	(0.0052)	(0.0040)	(0.0047)	(0.0048)	(0.0048)	(0.0056)
Minimum Intermediate License Age	-0.0107	-0.0088	-0.0091	-0.0097	-0.0137	-0.0124
	(0.0147)	(0.0122)	(0.0136)	(0.0138)	(0.0127)	(0.0121)
Sample	Stay	All	Stay	Stay	Stay	Stay
Intensive (ln(person VMT))						
Minimum Full Privilege Age	0.0012		0.0010	-0.0030	-0.0108	0.0196
	(0.0129)		(0.0132)	(0.0159)	(0.0182)	(0.0143)
Minimum Intermediate License Age	-0.0269		-0.0239	-0.0270	-0.0007	0.0239
	(0.0651)		(0.0565)	(0.0592)	(0.0699)	(0.0588)
Sample year FEs	Y	Y	Y	Y	-	-
State FEs	Y	Y	Y	Y	-	-
Age (FEs)	Y	Y	Y	Y	Y	Y
Dem. Controls	-	-	Y	Y	Y	Y
Income controls	-	-	-	Y	Y	Y
State-X-Yr FEs	-	-	-	-	Y	Y
Quad. birth year	-	-	-	-	-	Y

Interpretation: Some Sort of Standard Behavioral Effect?

Interpretation: Some Sort of Standard Behavioral Effect?

Recency Bias

⇒ Agents overweight recent experience

- We find early experiences matter more in this setting
- Short-window recency bias possible (Knittel & Tanaka 2020)

(Busse et al. 2013; Malmendier & Nagel 2011; Malmendier, Nagel, Shen 2018; Simonsohn 2006)

Mental Plasticity

⇒ Teen years are in decade of impressionable years

⇒ Teens/YAs very receptive to influence

- Our narrow window shows initial interactions matter more
- Could provide general mechanism for mental plasticity

(Alesina & Giuliano 2011; Giuliano & Spilimbergo 2013)

Habit Formation

⇒ Current demand ← past consumption

- More weight on recent prices
- Levels should matter, not shocks
- Hard to rule out, but requires non-standard formulation

(Bronnenberg et al. 2012; Pollak 1970; Becker & Murphy 1988)

Conclusion

Formative experiences of gas prices during ages 15-18 alter later-life behavior

- Graduating into recession/long run income effects do not explain
- Nor due to differences in training/skill acquisition
- Results are mostly **inconsistent** with existing behavioral explanations:
  - Recency bias; Habit formation; Mental plasticity during youth

Our new finding:

Formative experiences of gasoline prices shape commuting behavior and asset purchases for decades into the future.

Thank you!