Household Expense Shocks and Consumption Smoothing: Evidence from Automobile Expenses

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- What models of consumption can match this data?
  - Model with: (1) high time-discount rate and (2) limited borrowing capacity.
- What does this mean for policy aimed at aiding households?
  - Households prefer availability of credit over insurance.
  - Public transportation lowers exposure to risk.

Motivation: Fed Report on Economic Well-Being of US Households

Figure 1. Would cover a $400 emergency expense using cash or its equivalent (by survey year)

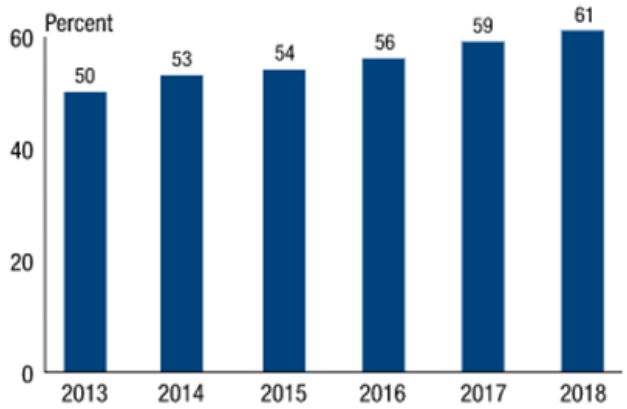
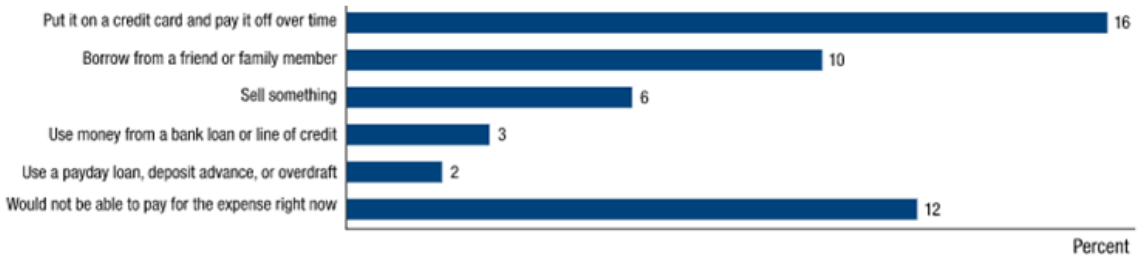


Figure 2. Other ways individuals would cover a $400 emergency expense



Why Auto Expenses:

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2. **Automobile repair expenses are largely uninsured:** Auto insurance coverage is often limited to traffic accidents.
3. **Identification:** Auto related expenses are *transitory* expense shocks.

Related Literature:

- Household finance models that study consumption reponses to predictable income and expense changes.
  - Why do households experience large consumption declines from expected mortgage payment increases? (Jorring 2020)
  - Why do households experience large consumption declines from expected ending of UI benefits? (Ganong et. al., AER 2019)
- Behavioral models of consumption and savings.
  - Present-bias in pay-day lending and repeat borrowing. (Zinman et al., 2021)
  - Present-bias motivation for matching delayed credit card repayment (Kuchler et. al., JFE 2021)
- Labor economics literature on consequences of medical and transportation expense shocks.
  - How do hospital admissions and out-of-pocket health expenses impact labor income, credit capacity and bankruptcy? (Dobkin et. al., AER 2018)
  - How do consequences of traffic violations, fines and license suspensions impact earnings and credit outcomes? (Mello 2018)

Data

- Proprietary credit and checking account data.
  - Individual-level transactions
  - Amount, date, location, category, in-flows and out-flows observable.
  - 23,000 individuals matched on regular observable income and payments to credit card accounts from checking accounts across a cross-section of US banks.
  - Data from January 1st, 2012 to May 30th, 2016.

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  - Data from January 1st, 2012 to May 30th, 2016.
- Mean income and consumption match BLS data, except for the bottom 20% of income.
- Checking account balances are unobservable.
  - Identify **Low liquid wealth individuals** by observing cumulative savings over a rolling 12-month period.
  - 10% individuals in the sample fit this definition of low liquid wealth.

Summary Table

Auto Repair Expenses

- Auto repair expenses greater than $200 occur roughly once every 11 months on average.
  - Those greater than $400 occur once every 19 months.
  - Annually, close to $800 on auto repair spending.

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  - Annually, close to $800 on auto repair spending.
- Individuals living in urban areas with greater public transportation access face this risk less often.
- For low liquid wealth individuals, auto expenses are similar to out-of-pocket medical expenses.

Empirical Design:

I run both an event study and a matched difference-in-difference regression to measure the impact of an auto expense on consumption and credit balances.

$$y_{it} = \beta * \text{auto repair event}_{it} + \sigma_i + \alpha_t + \epsilon_{it} \tag{1}$$

$$y_{it} = \sum_{j=-m}^{n} \gamma_j * \text{auto repair event}_{i,t-j} + \sigma_i + \alpha_t + \epsilon_{it} \tag{2}$$

$$y_{it} = \delta * \text{treat}_{it} + \gamma * \text{auto repair event}_{it} + \tag{3}$$

$$\beta * \text{auto repair event} \times \text{treat}_{it} + \sigma_i + \alpha_t + \epsilon_{it} \tag{4}$$

Difference-in-Difference Regression Table

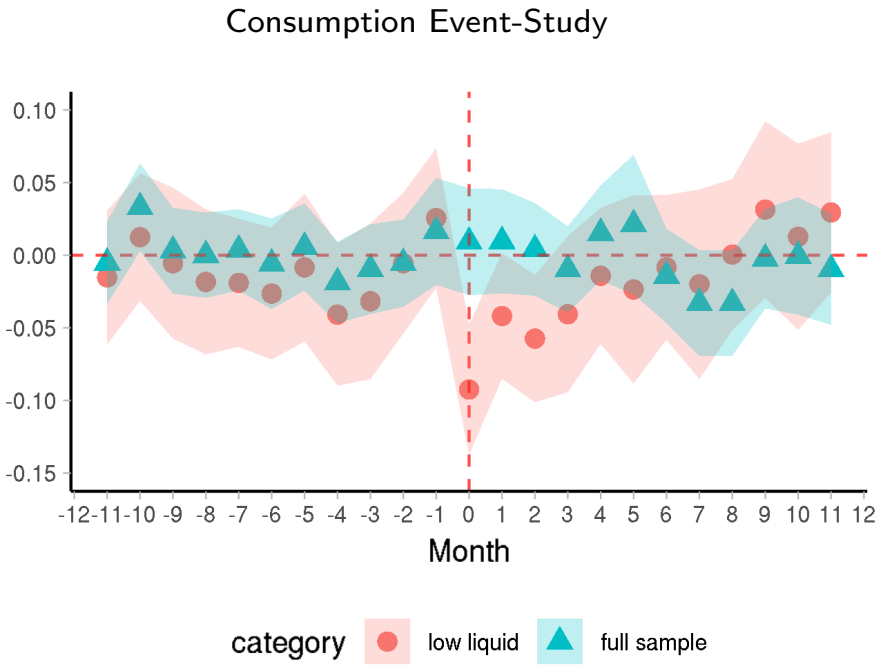
Matched Difference-in-Difference Estimates

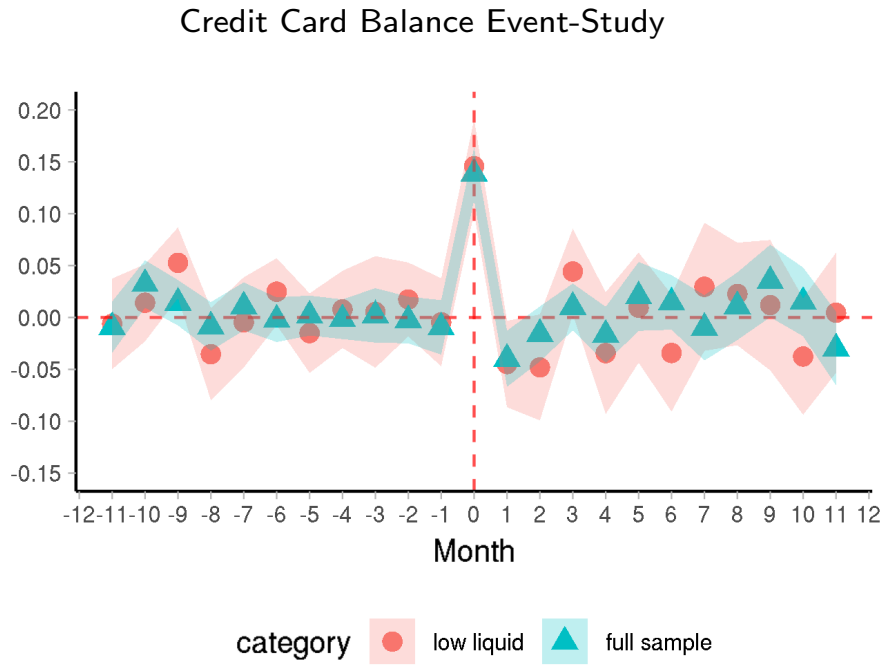
Dependent Variables:	Consumption	Credit Card Balance	Auto Repair Expense
Model:	(1)	(2)	(3)
Variables			
1-Month	-0.0928***	0.129***	0.3158***
	(0.0111)	(0.0143)	(0.008)
Fixed-Effects			
Individual	Yes	Yes	Yes
Month	Yes	Yes	Yes
Year	Yes	Yes	Yes
Matched Control	Yes	Yes	Yes

Sample includes only below median income and low liquid wealth individuals. The mean monthly income is $\approx$ \$2200.

Event-Study

Event-Study Plot





- Low liquid households reduce consumption in the months following the event in order to repay similarly incurred credit card balances.

Matched DnD | Low Liquid Threshold | Robustness #1 | Robustness #2 | Gas & Labor

Low Savings & Borrowing Constraints

Consumption Estimates, Borrowing Constraints and Recent Savings

	Non-savers		Savers	
	Low BC	High BC	Low BC	High BC
Model:	(1)	(2)	(3)	(4)
Dependent Variables:	Mean Checking Account Flow			
Variables				
Matched t_{-6}	-2.49	-3.38	-0.0709	-0.0922
	(0.172)	(0.183)	(0.082)	(0.1199)
Dependent Variables:	Mean Borrowing Limit			
Variables				
Matched t_{-6}	0.6946	1.883	0.7239	1.701
	(0.0221)	(0.059)	(0.021)	(0.0534)
Dependent Variables:	Consumption			
Variables				
1-Month	-0.115***	-0.121***	-0.0804***	-0.0558*
	(0.0235)	(0.0176)	(0.0172)	(0.0192)
Fixed-Effects				
Individual	Yes	Yes	Yes	Yes
Month	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Matched Control	Yes	Yes	Yes	Yes

- Low liquid wealth and borrowing constraints drives consumption response.

Summary:

- Households that are low in liquid wealth reduce consumption and rely on available credit at the time of automobile expenses.
- Under a standard consumption-savings model, this behavior is unexpected. The standard model suggests that households should have enough buffer stock wealth to avoid consumption drops.
- I augment the standard model to explain consumption-savings levels and fit the consumption drop:
  1. Very present focused and risk-tolerant household behavior.
  2. Binding borrowing constraints.

Expense Shock Framework with Endogenous Expenses:

- In each period, a household receives risky income y_t and the realization of an auto expense event e_t.
  - Auto expense events $e_t \in$ (maintenance, emergency, normal)
- In normal states, no auto expense event occurs, the household chooses (c_t, a_t), consumption and savings, subject to a borrowing constraint $-\underline{a} \leq a_t$, where $\underline{a} \geq 0$, such that:

$$V(m_t, e_t) = \max \mathbb{E}_t \sum_{n=0}^{T-t} \beta^n \frac{c_{t+n}^{(1-\rho)}}{1-\rho}$$

  is optimized.
- Furthermore, household cash-on-hand, m_t, evolves each period as:
  - $m_t = Ra_{t-1} + y_t$

Expense Shock Framework with Endogenous Expenses:

- In the event of an emergency expense, the household has the choice to pay the expense ($\tilde{e}_e$) in the same period, or face unemployment:
  - Paying the expense means: $m_t = c_t + a_t + \tilde{e}_e$
  - Unemployment means:
    - ★ An immediate shock to permanent income of p_{ue}.
    - ★ A constant UI payment of $y_t = y_{ue}$ in each period.
    - ★ And a probability, π_{ue}, of transitioning out of unemployment back to a normal state in each period.

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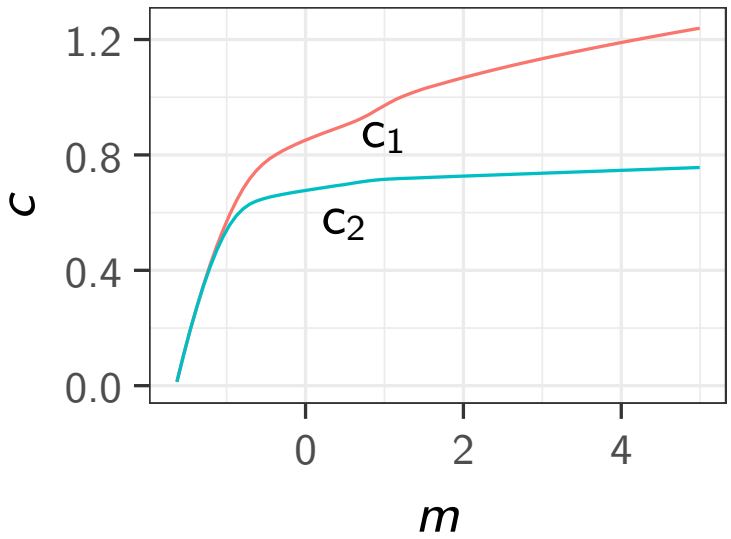
    - ★ And a probability, π_{ue}, of transitioning out of unemployment back to a normal state in each period.
- In the event of a maintenance expense, the household has the chance to pay the expense ($\tilde{e}_m$) in the same period, or not.
  - Paying the expense means:
    - ★ $m_t = c_t + a_t + \tilde{e}_m$.
    - ★ No chance of an emergency/maintenance shock in the next period.
    - ★ And a probability, π_m of transition back to a normal state in each period, otherwise remaining in a state of no emergency/maintenance shock.
  - Not paying the expense means returning to a normal state in the next period.

Structural Model and Present-Focus

Consumption and Cash-on-hand Plot



Structural Model Moments

	$\bar{c}$	$\Delta\bar{m}$	$\Delta\bar{c}_e$	m^*	$c(m^*)$
Sample	0.995	-.033	-0.096	–	–
Model (1): $\beta = 0.4, \rho = 1.1$	1.032	-.031	-0.097	-0.113	0.948
Model (2): $\beta = 0.9, \rho = 1.5$	0.731	0.268	-0.004	27.72	0.966
Model (3): $\beta = 0.9, \rho = 1.5, \pi_e = 0$	0.752	0.247	–	27.01	0.981

Structural Estimation

Using estimated parameters $\hat{\beta}_1 = 0.302$, $\hat{\beta}_2 = 0.694$, $\hat{\rho}_1 = 1.120$, $\hat{\rho}_2 = 1.232$, $\hat{\pi}^s_m = .971$ to fit $(\bar{c}, \sigma_c, \Delta\bar{m}, \sigma_m, \sigma_{\Delta m}, \Delta\bar{c}_e, \bar{\pi}_m, \bar{\pi}_e)$. Calibrated parameters $-\underline{a}^{low} = 1$, $-\underline{a}^{high} = 2$

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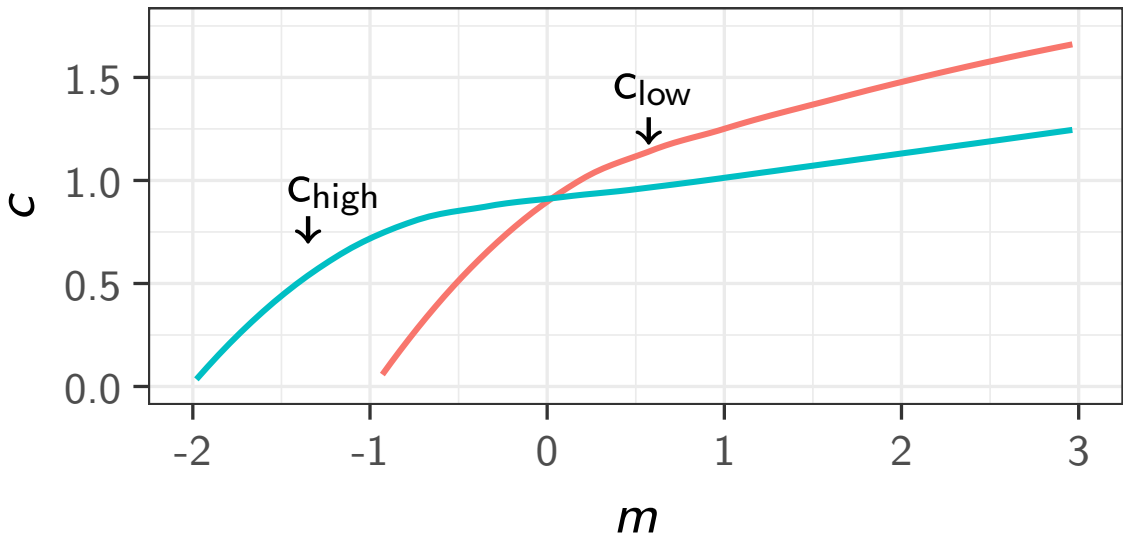
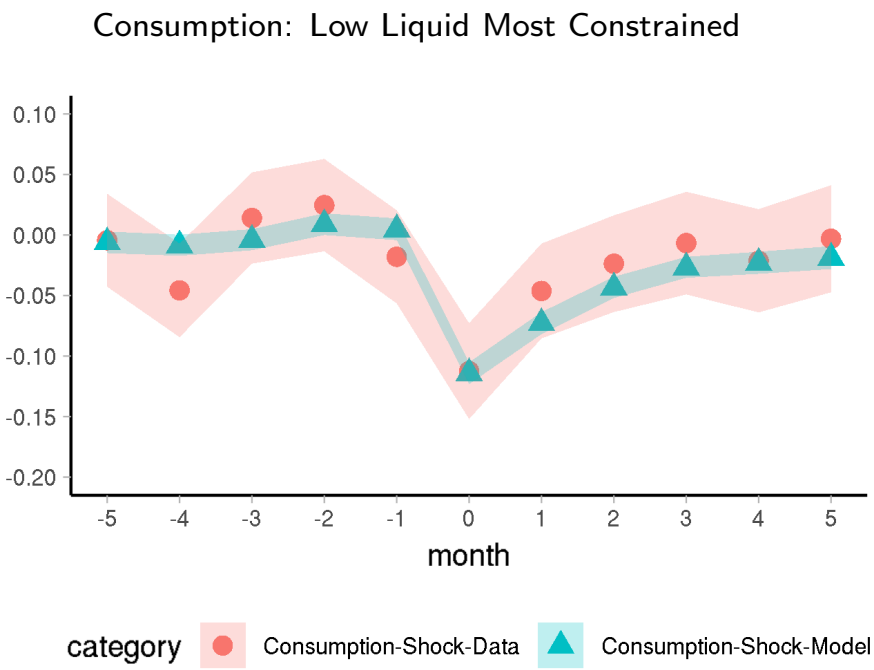


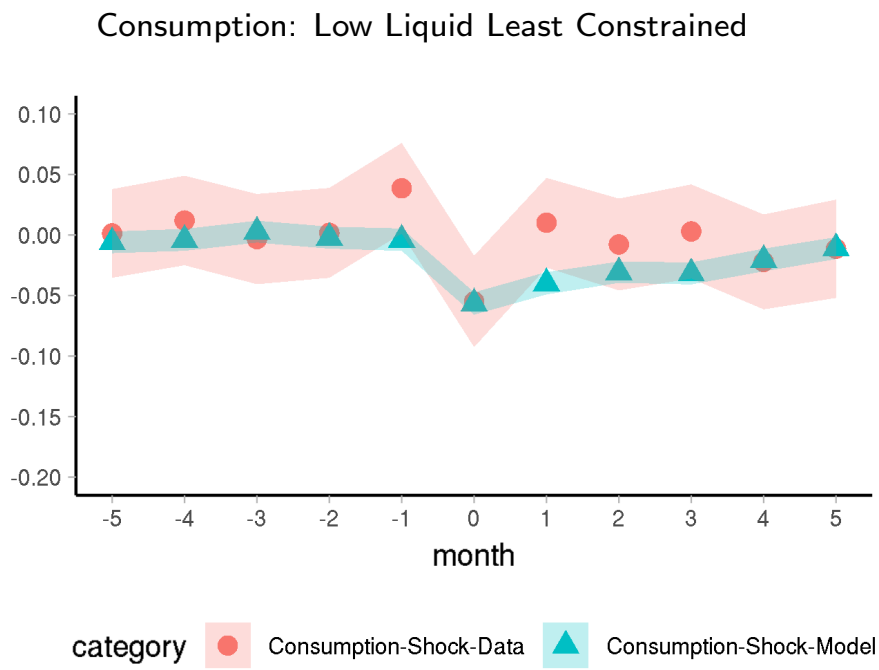
Structural Model Moments

Low BC	$\bar{c}$	σ_c	$\Delta\bar{m}$	$\sigma_{\Delta m}$	$\Delta\bar{c}_e$	$\bar{\pi}_m$	$\bar{\pi}_e$
Sample	1.095	0.332	-0.097	0.381	-0.115	0.004	0.060
Model	1.019	0.389	-0.054	0.374	-0.099	0.000	0.050

High BC	$\bar{c}$	σ_c	$\Delta\bar{m}$	$\sigma_{\Delta m}$	$\Delta\bar{c}_e$	$\bar{\pi}_m$	$\bar{\pi}_e$
Sample	0.938	0.339	0.061	0.391	-0.056	0.016	0.049
Model	0.944	0.334	0.019	0.347	-0.036	0.018	0.046

Structural Model Event-Study Plot





The model can not only match the t_0 consumption response but also the entire path of consumption.

Policy Discussion

1. Insurance
   - Household pays a fixed monthly amount so that any expense shock is payed off by the insurer.
2. Credit
   - An expansion of borrowing limits for the most-constrained group.
   - The additional credit is also offered at a lower, at cost rate instead of at credit card borrowing rates.
3. Alternative Transport
   - A reduction in the frequency of emergency expense risk, which in the data, is a function of total vehicle miles traveled.

Policy Discussion

Policy Intervention Moments

	$\bar{c}$	$\Delta\bar{m}$	$\Delta\bar{c}_e$	$\bar{\pi}_m$	$\bar{\pi}_e$
Sample	1.095	-0.097	-0.115	0.004	0.060
Base Case Low BC	1.019	-0.074	-0.099	0.000	0.050
Credit Expansion	1.034	-0.069	-0.065	0.001	0.051
Insurance	1.018	-0.054	-0.006	0.000	0.050

- Credit expansion and insurance reduce consumption drops at the time of emergency expenses.

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- The insurance scenario is poorly valued by present-focused households. Even when priced at cost, the risk-averse household would still opt-out of insurance (very close to indifferent).
- Insurance reduces the (already small) amount households spend on maintenance.
- Whereas, credit is just, if not more, valuable than removing auto expense risk.

Value Function Plot Policy Valuation

Conclusions:

- Automobile expense risk results in large consumption drops for households low in liquid wealth who are also credit constrained.
- A standard consumption-savings model would not generate this behavior given observable risk.
- High time-discount rate can rationalize household behavior by inducing low savings. In addition to binding credit-constraints, can generate consumption drops.
- Policy alternatives that promote preventative behavior or require reducing consumption would have a hard time overcoming present focus.
- Credit availability can preserve consumption levels and maintain access to employment income.
- Alternative transportation can also implicitly insure employment access.

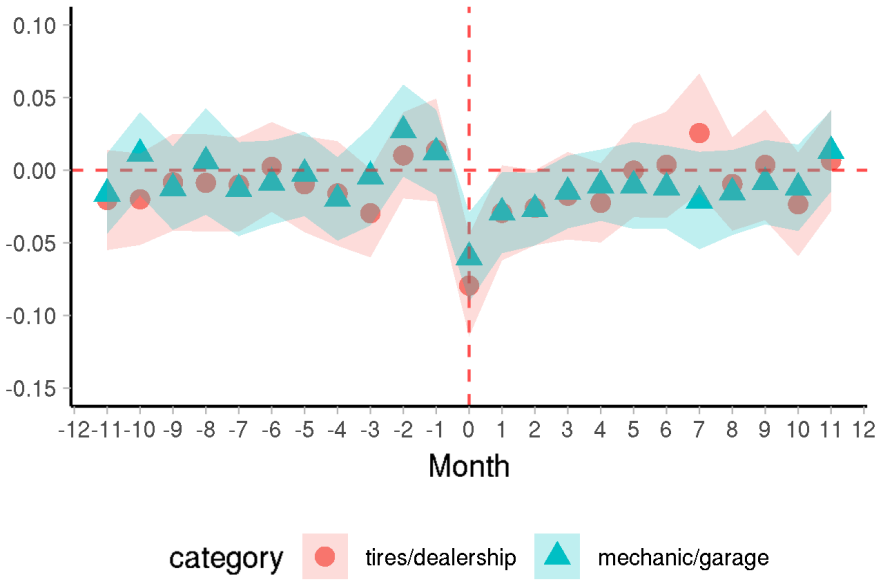
Event-Study & DnD Regression Table

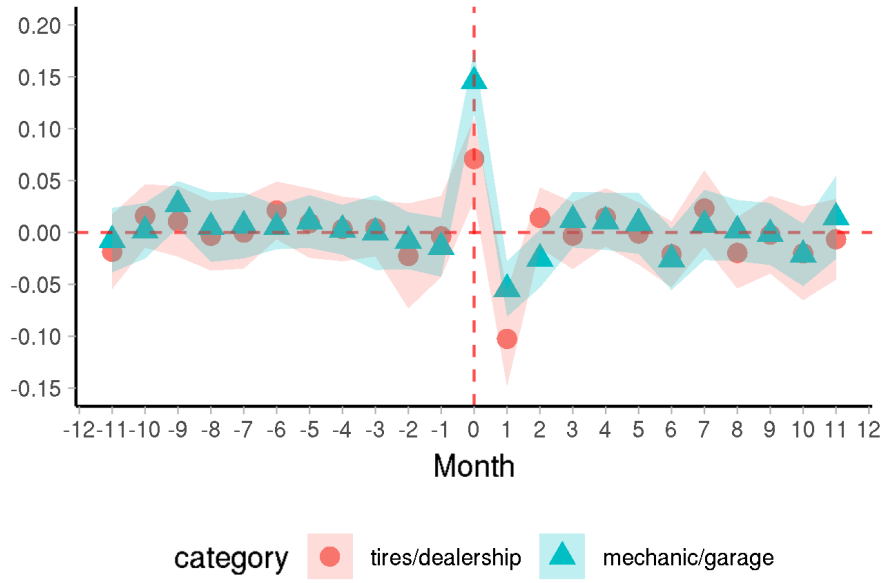
Event-Study Estimates

Dependent Variables:	Consumption	Credit Card Balance	Auto Repair Expense
Model:	(1)	(2)	(3)
Variables			
1-Month	-0.0949***	0.1113***	0.3125***
	(0.0102)	(0.0141)	(0.007)
Fixed-Effects			
Individual	Yes	Yes	Yes
Month	Yes	Yes	Yes
Year	Yes	Yes	Yes
Matched Control	No	No	No

Matched DnD

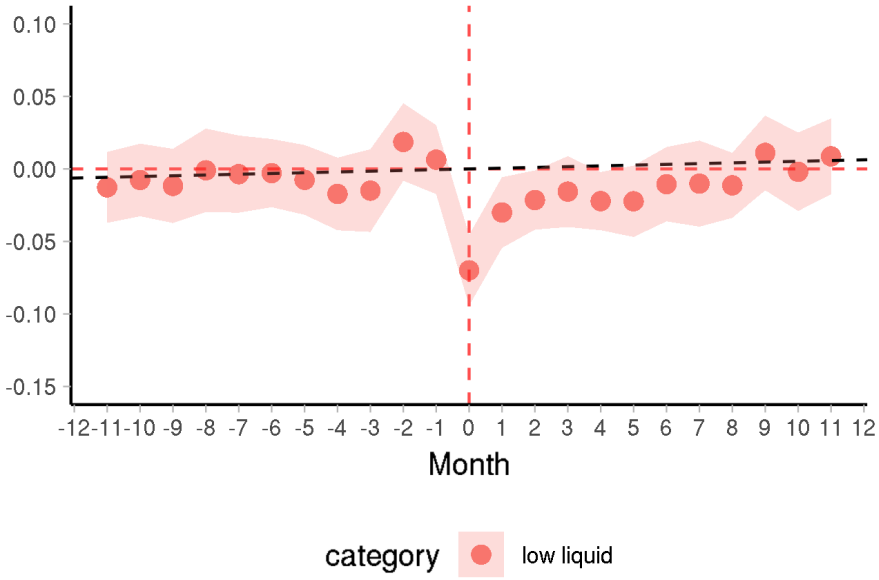
Robustness #1

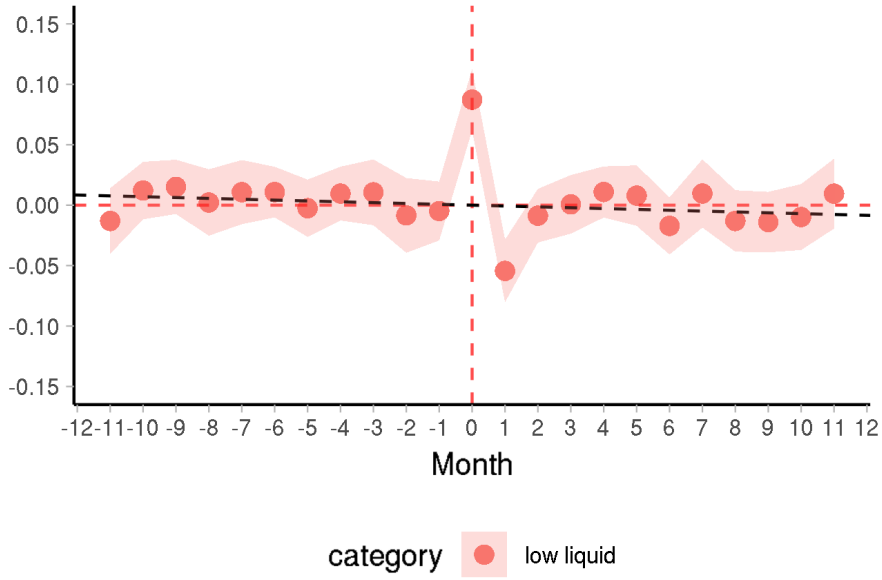




Reduced Form

Robustness #2

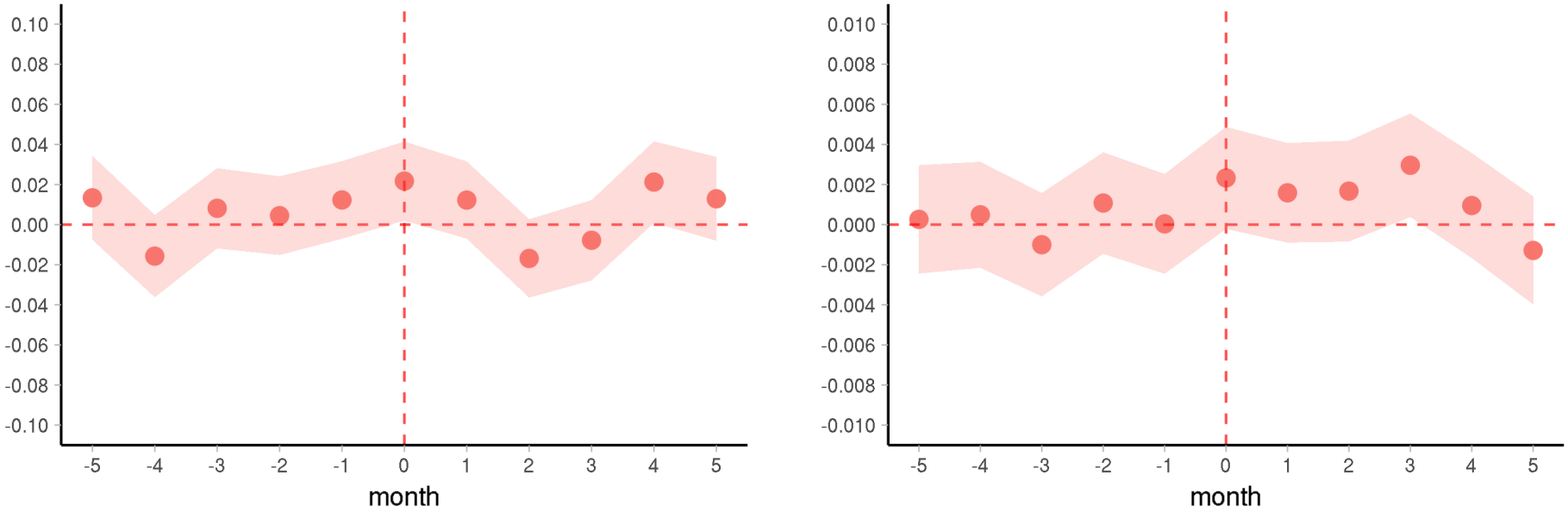




$$y_{it} = \delta j + \sum_{j=0}^{12} \beta_j \text{auto repair event}_{it} + \alpha_i + \alpha_t + \epsilon_{it}$$

Reduced Form

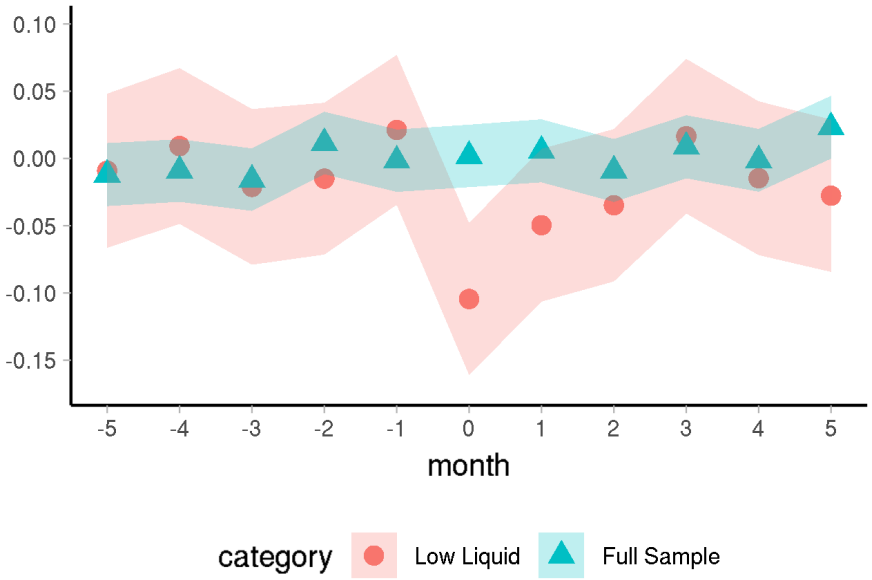
Gas & Labor

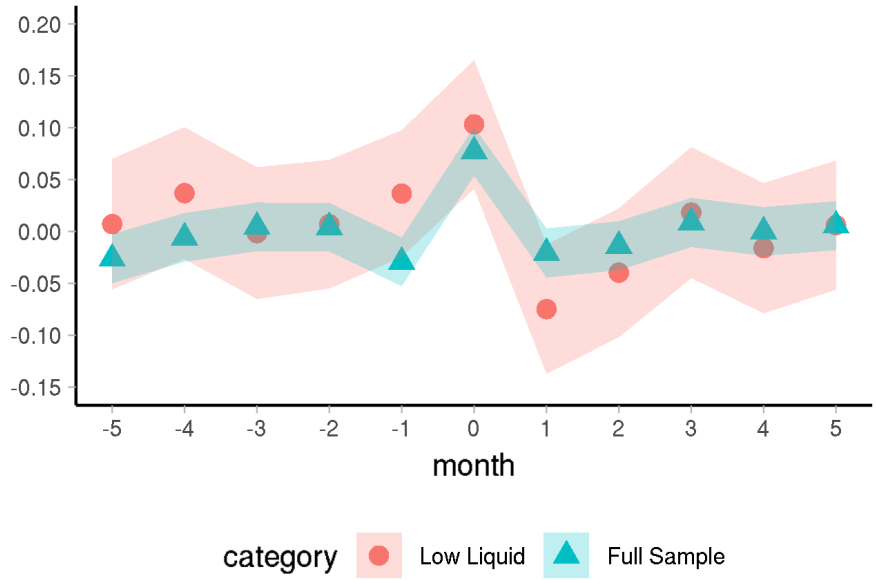


Event-study labor (left) and gas (right) for the low liquid group.

Reduced Form

Reduced Form:





Reduced Form

Reduced Form:

Dependent Variables:	Consumption			
Model:	(1)	(2)	(3)	(4)
Variables				
1-Month	-0.0843***	-0.0928***	-0.0498***	-0.0151
	(0.0202)	(0.0111)	(0.0107)	(0.0094)
Fixed-Effects				
individual	Yes	Yes	Yes	Yes
month	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes
matched control	Yes	Yes	Yes	Yes
$y - c$ Threshold	≤ 0.3	≤ 0.4	$\leq .75$	–
% of Below Median Income Sample	11%	28%	51%	100%
% of Full Sample	5%	10%	20%	50%

Reduced Form

Summary Statistics

	Full Sample	Below Median	Low Liquid Wealth
Labor Income	5461.8	3107.1	2165.1
	(8.332)	(3.965)	(4.26)
Consumption	5225.7	2629.6	1916.5
	(10.5)	(3.942)	(4.685)
Borrowing Limit	7655.6	3623.1	2547.2
	(7.144)	(5.577)	(7.877)
Auto Expense	66.92	36.3	25.15
	(0.5994)	(0.4816)	(0.6223)
1(Auto Expense$\geq$200)	0.0902	0.0640	0.0523
	(0.0003)	(0.0005)	(0.001)
1(Auto Expense$\geq$400)	0.0520	0.03328	0.0243
	(0.0002)	(0.0004)	(0.0006)
Gas Expense	170.1	116.8	98.59
	(0.232)	(0.321)	(0.4611)
Medical Expense	83.88	35.97	23.01
	(0.452)	(0.417)	(0.568)
1(Medical Expense$\geq$200)	0.1527	0.0826	0.0602
	(0.0004)	(0.0006)	(0.0011)
1(Medical Expense$\geq$400)	0.06305	0.0261	0.0155
	(0.0002)	(0.0003)	(0.0005)
N	23121	6190	2553
NT	800420	174838	48544

Summary Statistics

Policy Discussion

- Compensating variation is the present day wealth that the household would require to match to scenario with the policy intervention.

$$V_1(m_1 + \lambda(m_1)) = V_2(m_1)$$

- Average over $\int \lambda(m_1)$dm given the wealth distribution for the most constrainted group.
- Cost is present value of average individual monthly interest payment and monthly insurance premium, calibrated by default rate and expected insurance payout.

	Policy Intervention				
	Credit	Insurance Emergency Only	Insurance Emergency & Maintenance	Insurance Emergency & Maintenance No Deductible	No Risk
Compensating Variation	0.342 ($752)	-.009 (-$20)	-0.033 (-$66)	-0.044 (-$97)	0.188 ($414)
Cost ($\beta = .302$) Present-Value	0.002 ($5)	0.115 ($253)	0.126 ($277)	0.203 ($447)	– –

Policy Comparison