Discussion of "The Real Effects of Liquidity During the Financial Crisis: Evidence from Automobiles"

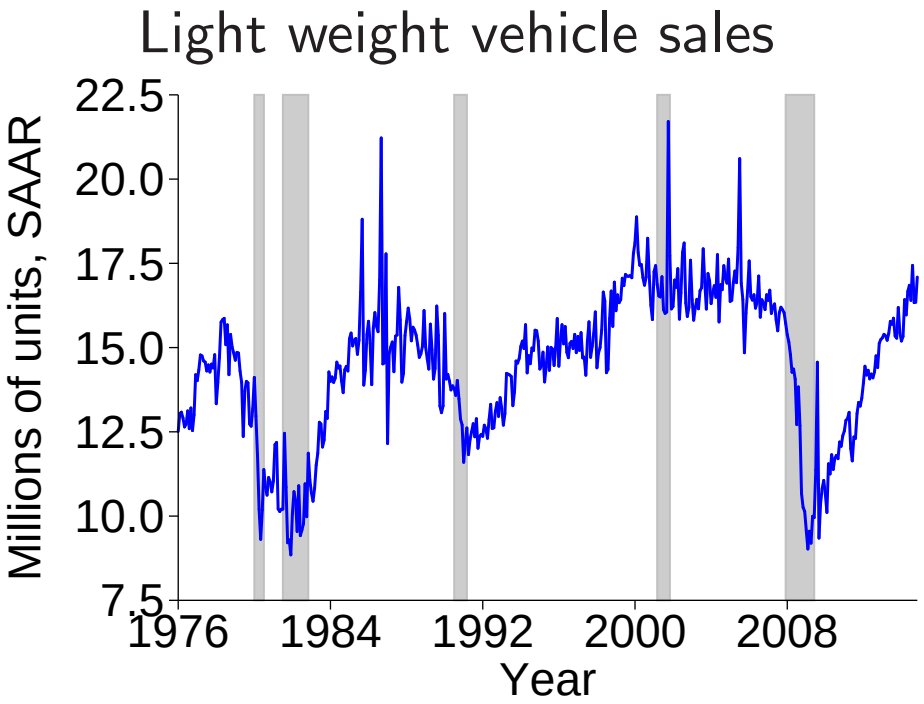
Gabriel Chodorow-Reich
Harvard University and NBER

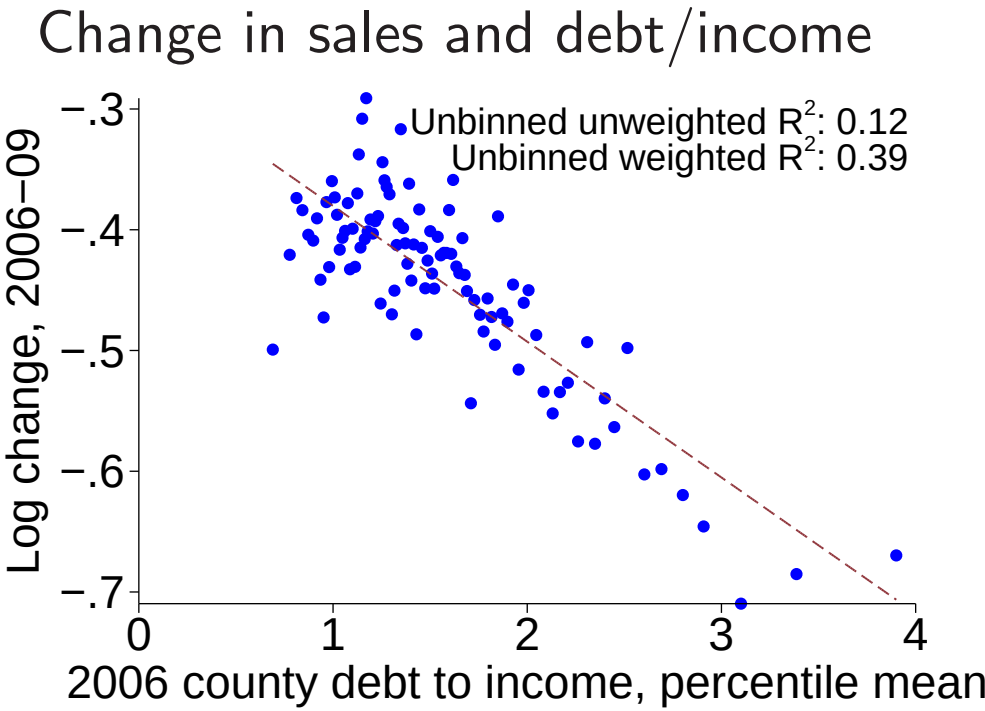
AEA Annual Meeting
January 5, 2015

Overview

1. Background and BMR story.
2. Most convincing result.
3. Puzzling result.
4. Quantitative importance.

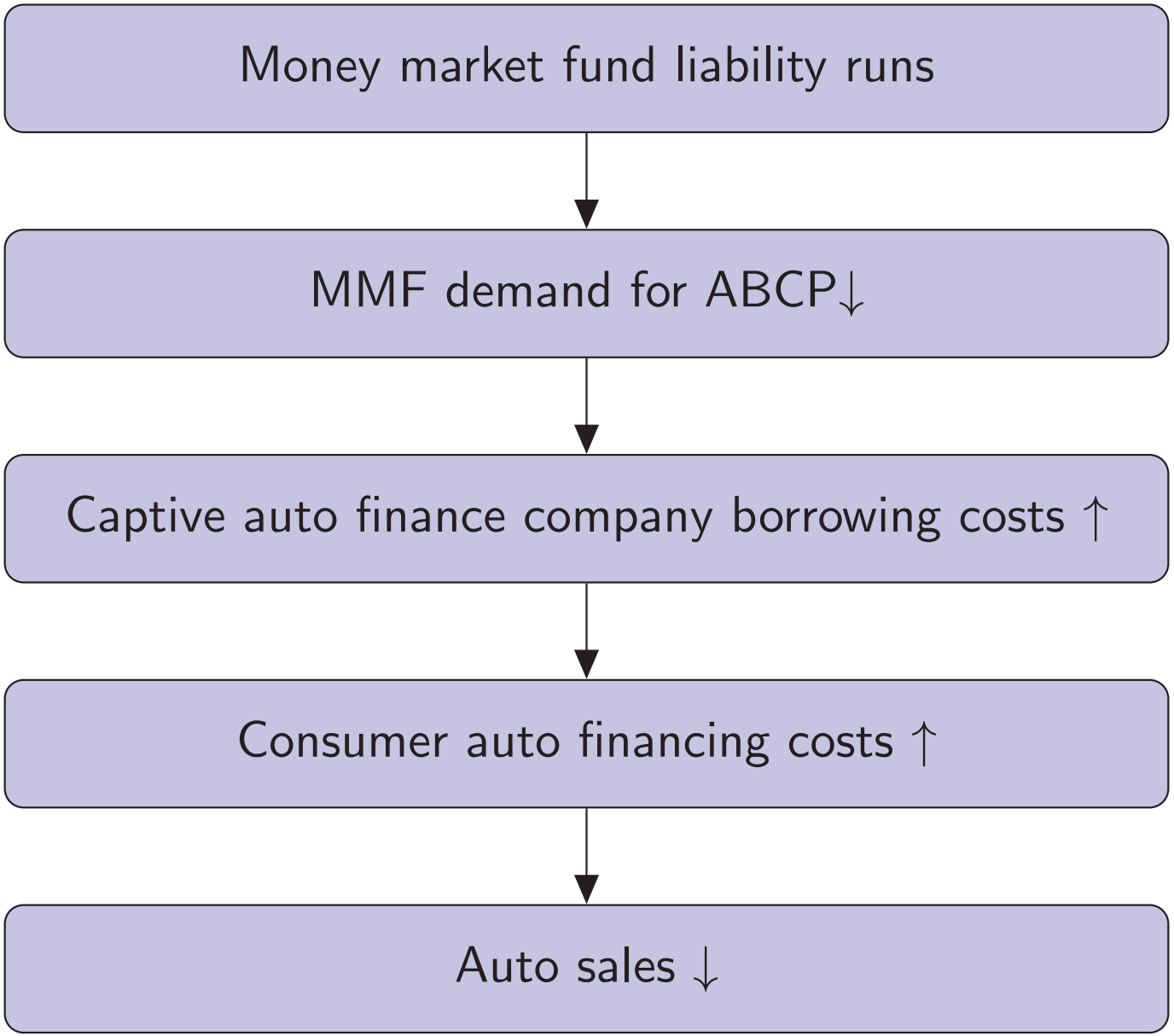
Context





- New auto sales collapse in 2008-09.
- Existing literature finds strong cross-sectional relationship between decline in auto sales and 2006 debt to income, house price decline, etc. (Mian, Rao and Sufi QJE 2013).
- BMR document cross-sectional variation in auto financing.

BMR Story


Money market fund liability runs
MMF demand for ABCP↓
Captive auto finance company borrowing costs ↑
Consumer auto financing costs ↑
Auto sales ↓

A priori plausible?

- GMAC LLC, Ford Credit 6th and 7th heaviest users of CPFF in January 2009, Chrysler Financial Services 18th.
- But CPFF already available in Jan-09, and TALF begins lending against new auto ABS in Mar-09.
- Capital losses could also explain lending contraction.
  - GMAC had substantial exposure to subprime real estate.
- Paper contains nice narrative evidence that financing shock mattered.

Most convincing result

- Specification:

$$\Delta \ln Q_{imst} = \alpha_{is} + \alpha_m + \beta s_{imst-1} + \varepsilon_{imst}.$$

  - Q_{imst}: New cars purchased in county i, of make m in segment s, financed by type $f \in \{\text{captive,non-captive}\}$, at time t.
  - s_{imst-1}: captive finance share for segment s and make m in county i at time $t-1$.

- County-segment and make fixed effects are powerful control.
- Example: [decline in GM sales in mid-size cars in county *i* *relative to* national decline in GM sales] *relative to* [decline in Ford sales in mid-size cars in county *i* *relative to* national decline in Ford sales] *as function of* [captive share of GM mid-size cars in county *i* *relative to* average GM captive share] *relative to* [captive share of Ford mid-size cars in county *i* *relative to* average Ford captive share].

Make, county, segment, and segment*county fixed effects

	All transactions
Captive dependence	-0.0262*
	(0.0145)
Brand market share	0.0412
	(0.0250)
Obs	32,872
R-Squared	0.718

Puzzling result

- Specification:

$$\Delta \ln Q_{it}^{c} = \beta_0^c + \beta_1^c s_{it-1} + X_{it}' \beta_3^c + \varepsilon_{it}^c.$$

  - Dependent variable is log change in cars financed by captives, not total cars sold.

Focus on collapse:
Δcar sales$_i$ (2009 -2008)

	Captive financed transactions	Non-Captive financed transactions	All transactions
Captive dependence	-0.532***	0.461**	-0.138**
	(0.118)	(0.182)	(0.0584)
Obs	2,849	2,849	2,849
R-squared	0.775	0.710	0.684

Controls: race, income, population, inequality, auto employment, credit score, state fixed effects

Puzzling result

- Specification:

$$\Delta \ln Q_{it}^{c} = \beta_0^c + \beta_1^c s_{it-1} + X_{it}' \beta_3^c + \varepsilon_{it}^c.$$

  - Dependent variable is log change in cars financed by captives, not total cars sold.

Puzzling result

- Specification:

$$\Delta \ln Q_{it}^c = \beta_0^c + \beta_1^c s_{it-1} + X_{it}' \beta_3^c + \varepsilon_{it}^c.$$

  - Dependent variable is log change in cars financed by captives, not total cars sold.

- $\beta_1^c < 0$.
- Suppose cost increase results in captive sales falling by $D\%$ in every county. Then $\beta_1^c = 0$.
- Standard model with competitive lenders $\Longrightarrow$ *smaller* decline in captive-financed auto sales in counties with larger initial share, $\beta_2^c > 0$.
- Intuition is general: same % decline generates larger general equilibrium disruption in places where initial market share is higher.

Model with competitive lenders

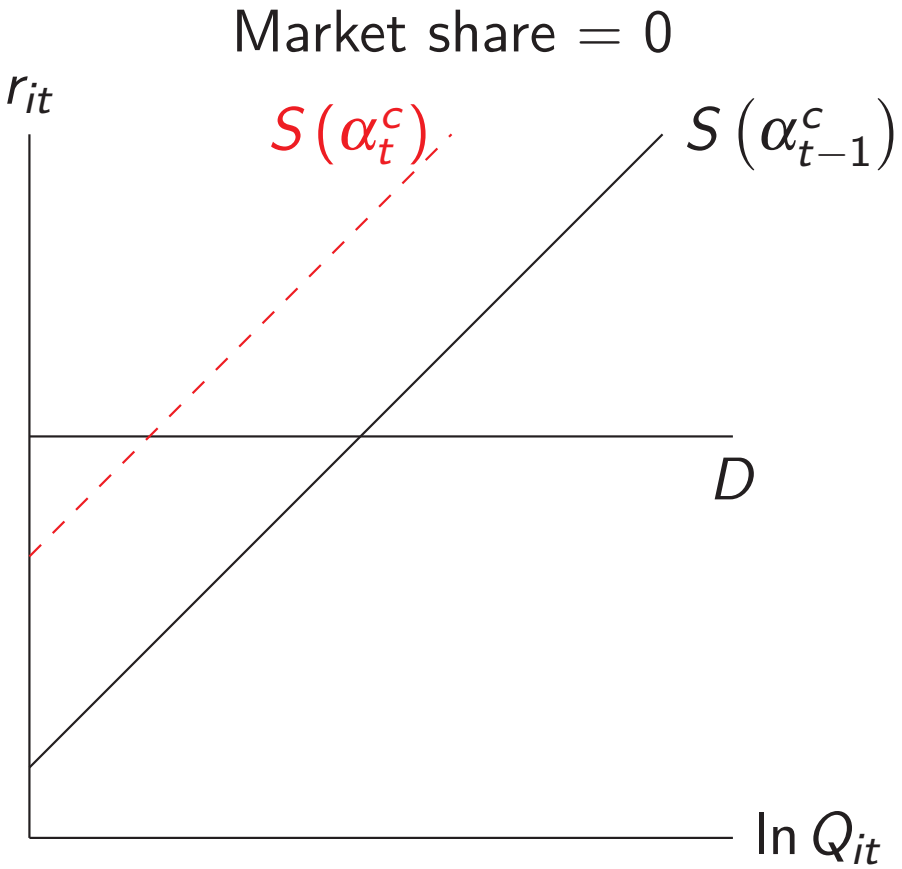
- Captive finance company c, non-captive n, areas indexed by i.
- Upward sloping credit supply:

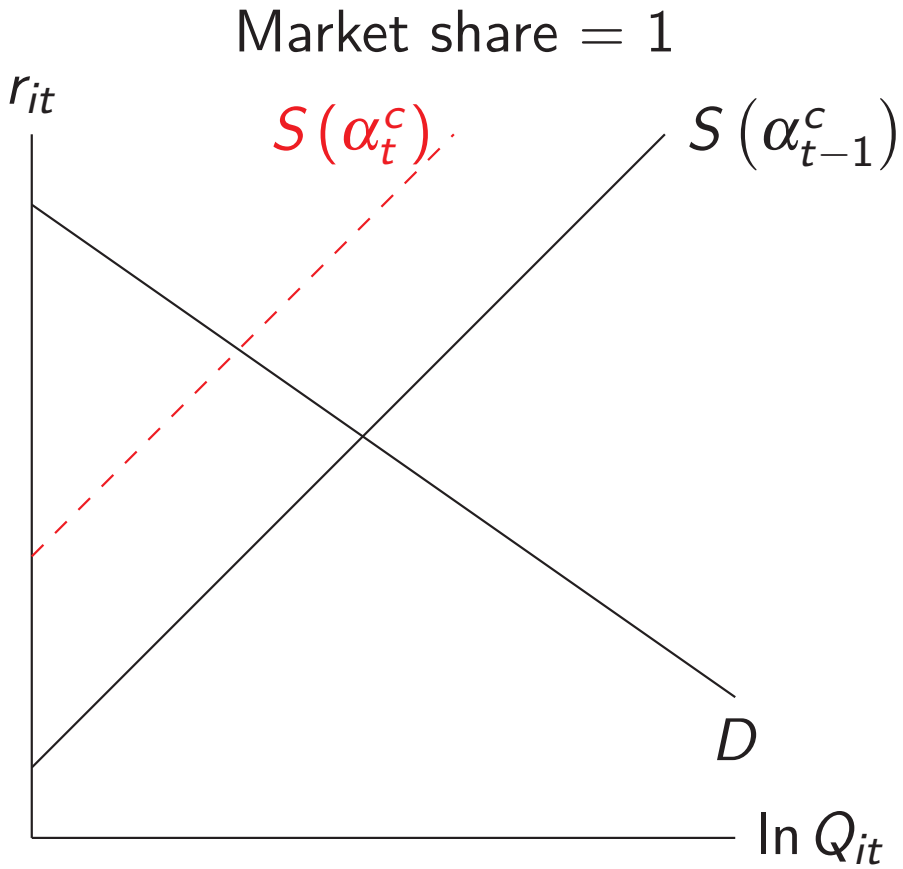
$$r_{it}^c = \alpha_t^c + \gamma\left(\ln Q_{it}^c - \ln \bar{Q}_i^c\right),$$
$$r_{it}^n = \alpha_t^n + \gamma\left(\ln Q_{it}^n - \ln \bar{Q}_i^n\right).$$

  - r_{it}^f: financing rate offered in area i by type $f \in \{c, n\}$.
  - α_t^f: national cost of funds for type $f \in \{c, n\}$.
  - $\bar{Q}_i^f$: area-specific target sales. Interpret as sales infrastructure.
  - $\gamma > 0$: When sales rise above the target, interest rate increases.
  - Captive pricing advantage if $\alpha_t^c < \alpha_t^n$ or $\bar{Q}_i^c > \bar{Q}_i^n$.
- Downward sloping credit demand:

$$\ln Q_{it} = \pi_{it}^0 - \pi^1 r_{it}.$$

- Bertrand competition over interest rate in each area.





- Higher market share $\rightarrow$ steeper demand curve $\rightarrow$ reduce supply by less.
- Economics of why this doesn't hold in the data are interesting:
  - Dealer floor plan financing harder to substitute than retail financing and captive floor plan financing correlated with captive retail financing.
  - Transitory shocks to captive finance share and mean reversion.
  - Other?

Summary

1. I buy the bottom line result that they identify an effect of a credit supply shock.
2. More on the economics would be useful. Why do captive-financed sales fall more in areas with a larger initial captive finance share?
3. Assessing the quantitative magnitude is crucial. Is this a small or big part of the huge decline in auto sales?

Appendix slides

Model solution

- Bertrand competition over interest rates:

$$Q_{it}^n = \kappa_t \left[\frac{\bar{Q}_i^n}{\bar{Q}_i^c} \right] Q_{it}^c, \;\; \kappa_t \equiv \exp \left[\frac{\alpha_t^c - \alpha_t^n}{\gamma} \right].$$

- Equilibrium in car market:

$$Q_{it} = Q_{it}^c + Q_{it}^n \quad \forall i.$$

- Market share s_{it}:

$$s_{it} \equiv \frac{Q_{it}^c}{Q_{it}} = \frac{\bar{Q}_i^c}{\bar{Q}_i^c + \kappa_t \bar{Q}_i^n}.$$

- Solution for quantities:

$$\ln Q_{it}^c = \left[1 + \pi^1 \gamma\right]^{-1} \left[\pi_{it}^0 - \pi^1 \left(\alpha_t^c - \gamma \ln \bar{Q}_i^c\right) + \ln s_{it}\right],$$
$$\ln Q_{it} = \left[1 + \pi^1 \gamma\right]^{-1} \left[\pi_{it}^0 - \pi^1 \left(\alpha_t^c - \gamma \ln \bar{Q}_i^c\right)\right] - \pi^1 \gamma \left[1 + \pi^1 \gamma\right]^{-1} \ln s_{it},$$
$$\ln Q_{it}^n = \ln Q_{it} + \ln(1 - s_{it}).$$

Regression equation, all autos

$$\begin{aligned}\Delta \ln Q_{it} &= \left[1+\pi^1\gamma\right]^{-1}\left[\Delta\pi^0_{it} - \pi^1\Delta\alpha^c_t + \Delta\ln s_{it}\right] - \Delta\ln s_{it} \\ &\approx \left[1+\pi^1\gamma\right]^{-1}\left[\Delta\pi^0_{it} - \pi^1\Delta\alpha^c_t\right] - \frac{\pi^1\gamma}{1+\pi^1\gamma}\left[s_{it-1}-1\right]\left[\frac{\Delta\kappa_t}{\kappa_{t-1}}\right] \\ &= \beta_0 + \beta_2 s_{it-1} + \varepsilon_i,\end{aligned}$$

where:

- $\beta_0 \equiv -\pi^1\left[1+\pi^1\gamma\right]^{-1}\left[\Delta\alpha^c_t - \gamma\left[\frac{\Delta\kappa_t}{\kappa_{t-1}}\right]\right]$: national shock to captive finance cost of credit;
- $\beta_2 \equiv -\frac{\pi^1\gamma}{1+\pi^1\gamma}\left[\frac{\Delta\kappa_t}{\kappa_{t-1}}\right] < 0$;
- $\varepsilon^c_i \equiv \left[1+\pi^1\gamma\right]^{-1}\Delta\pi^0_{it}$: county-specific demand shock;
- $\Delta\ln s_{it} \approx \left[s_{it-1}-1\right]\left[\frac{\Delta\kappa_t}{\kappa_{t-1}}\right]$: first order approximation around $\kappa_t = \kappa_{t-1}$.

Regression equation, captive-financed autos

$$
\begin{aligned}
\Delta \ln Q_{it}^{c} &= \left[1+\pi^{1}\gamma\right]^{-1}\left[\Delta\pi_{it}^{0}-\pi^{1}\Delta\alpha_{t}^{c}+\Delta\ln s_{it}\right] \\
&\approx \left[1+\pi^{1}\gamma\right]^{-1}\left[\Delta\pi_{it}^{0}-\pi^{1}\Delta\alpha_{t}^{c}+\left[s_{it-1}-1\right]\left[\frac{\Delta\kappa_{t}}{\kappa_{t-1}}\right]\right] \\
&= \beta_{0}^{c}+\beta_{2}^{c}s_{it-1}+\varepsilon_{i}^{c},
\end{aligned}
$$

where:

- $\beta_{0}^{c} \equiv -\left[1+\pi^{1}\gamma\right]^{-1}\left[\pi^{1}\Delta\alpha_{t}^{c}+\left[\frac{\Delta\kappa_{t}}{\kappa_{t-1}}\right]\right] < 0$: national shock to captive finance cost of credit;
- $\beta_{2}^{c} \equiv \left[1+\pi^{1}\gamma\right]^{-1}\left[\frac{\Delta\kappa_{t}}{\kappa_{t-1}}\right] > 0$;
- $\varepsilon_{i}^{c} \equiv \left[1+\pi^{1}\gamma\right]^{-1}\Delta\pi_{it}^{0}$: county-specific demand shock;
- $\Delta\ln s_{it} \approx \left[s_{it-1}-1\right]\left[\frac{\Delta\kappa_{t}}{\kappa_{t-1}}\right]$: first order approximation around $\kappa_{t}=\kappa_{t-1}$.

Quantitative importance

- Total sales fall 23.5 log points from 2008 to 2009.
- Coefficient in total sales specification: 1 sd increase in captive dependence $\Rightarrow$ 1.5-2.5% fewer total sales.
- Similar magnitude to effect of household balance sheets in 2008-09:

	Dep.var.: $\Delta \ln$[car purchases]					
	06-09	06-09	06-09	06-07	07-08	08-09
Housing net worth shock	0.106^{**}					
	(0.014)					
2006 debt to income		-0.119^{**}	-0.084^{**}	-0.024^{**}	-0.040^{**}	-0.020^{*}
		(0.012)	(0.014)	(0.006)	(0.005)	(0.008)
Estimator	OLS	OLS	OLS	OLS	OLS	OLS
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.42	0.45	0.35	0.11	0.27	0.18
Observations	919	919	2180	2180	2180	2180

Displayed right hand side variables normalized to have unit variance.

- Similar magnitude to effect of credit availability on employment in Chodorow-Reich (2014): 1 sd $\Rightarrow \approx$ 2% lower employment.