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

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AEA Annual Meeting
January 5, 2015
OVERVIEW

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

\[ \Delta \ln Q_{imst} = \alpha_{is} + \alpha_m + \beta s_{imst-1} + \epsilon_{imst}. \]

- \( Q_{imst} \): 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

<table>
<thead>
<tr>
<th></th>
<th>All transactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captive dependence</td>
<td>-0.0262*</td>
</tr>
<tr>
<td></td>
<td>(0.0145)</td>
</tr>
<tr>
<td>Brand market share</td>
<td>0.0412</td>
</tr>
<tr>
<td></td>
<td>(0.0250)</td>
</tr>
<tr>
<td>Obs</td>
<td>32,872</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.718</td>
</tr>
</tbody>
</table>
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:
\(\Delta \text{car sales}_i (2009 - 2008)\)

<table>
<thead>
<tr>
<th></th>
<th>Captive financed transactions</th>
<th>Non-Captive financed transactions</th>
<th>All transactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captive dependence</td>
<td>-0.532***</td>
<td>0.461**</td>
<td>-0.138**</td>
</tr>
<tr>
<td></td>
<td>(0.118)</td>
<td>(0.182)</td>
<td>(0.0584)</td>
</tr>
<tr>
<td>Obs</td>
<td>2,849</td>
<td>2,849</td>
<td>2,849</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.775</td>
<td>0.710</td>
<td>0.684</td>
</tr>
</tbody>
</table>

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

- Specification:

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

- 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 \( \implies \) 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:

\[
\begin{align*}
    r_{it}^c &= \alpha_t^c + \gamma \left( \ln Q_{it}^c - \ln \bar{Q}_i^c \right), \\
    r_{it}^n &= \alpha_t^n + \gamma \left( \ln Q_{it}^n - \ln \bar{Q}_i^n \right).
\end{align*}
\]

- \( r_{it}^f \): financing rate offered in area \( i \) by type \( f \in \{c, n\} \).
- \( \alpha_t^f \): 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 → steeper demand curve → 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?
I buy the bottom line result that they identify an effect of a credit supply shock.

More on the economics would be useful. Why do captive-financed sales fall more in areas with a larger initial captive finance share?

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

- 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:
  \[
  \ln Q_{it}^c = \left[ 1 + \pi^1 \gamma \right]^{-1} \left[ \pi_{it}^0 - \pi^1 (\alpha^c_t - \gamma \ln \bar{Q}_i^c) + \ln s_{it} \right], \\
  \ln Q_{it} = \left[ 1 + \pi^1 \gamma \right]^{-1} \left[ \pi_{it}^0 - \pi^1 (\alpha^c_t - \gamma \ln \bar{Q}_i^c) \right] - \pi^1 \gamma \left[ 1 + \pi^1 \gamma \right]^{-1} \ln s_{it}, \\
  \ln Q_{it}^n = \ln Q_{it} + \ln(1 - s_{it}).
  \]
\[
\Delta \ln Q_{it} = \left[1 + \pi^1 \gamma\right]^{-1} \left[\Delta \pi^0_{it} - \pi^1 \Delta \alpha^c_t + \Delta \ln s_{it}\right] - \Delta \ln s_{it} \\
\approx \left[1 + \pi^1 \gamma\right]^{-1} \left[\Delta \pi^0_{it} - \pi^1 \Delta \alpha^c_t\right] - \frac{\pi^1 \gamma}{1 + \pi^1 \gamma} [s_{it-1} - 1] \left[\frac{\Delta \kappa_t}{\kappa_{t-1}}\right] \\
= \beta_0 + \beta_2 s_{it-1} + \varepsilon_i,
\]

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;
- \(\Delta \ln s_{it} \approx [s_{it-1} - 1] \left[\frac{\Delta \kappa_t}{\kappa_{t-1}}\right]\): first order approximation around \(\kappa_t = \kappa_{t-1}\).
Regression equation, captive-financed autos

\[
\Delta \ln Q_{it}^c = [1 + \pi^1 \gamma]^{-1} [\Delta \pi_{it}^0 - \pi^1 \Delta \alpha_t^c + \Delta \ln s_{it}]
\approx [1 + \pi^1 \gamma]^{-1} [\Delta \pi_{it}^0 - \pi^1 \Delta \alpha_t^c + [s_{it-1} - 1] \left[ \frac{\Delta \kappa_t}{\kappa_{t-1}} \right]]
= \beta_0^c + \beta_2^c s_{it-1} + \varepsilon_i^c,
\]

where:

- \( \beta_0^c \equiv - [1 + \pi^1 \gamma]^{-1} \left[ \pi^1 \Delta \alpha_t^c + \left[ \frac{\Delta \kappa_t}{\kappa_{t-1}} \right] \right] < 0 \): national shock to captive finance cost of credit;
- \( \beta_2^c \equiv [1 + \pi^1 \gamma]^{-1} \left[ \frac{\Delta \kappa_t}{\kappa_{t-1}} \right] > 0 \);
- \( \varepsilon_i^c \equiv [1 + \pi^1 \gamma]^{-1} \Delta \pi_{it}^0 \): county-specific demand shock;
- \( \Delta \ln s_{it} \approx [s_{it-1} - 1] \left[ \frac{\Delta \kappa_t}{\kappa_{t-1}} \right] \): 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:

<table>
<thead>
<tr>
<th>Dep.var.: $\Delta \ln[\text{car purchases}]$</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-09</td>
</tr>
<tr>
<td>Housing net worth shock</td>
</tr>
<tr>
<td>2006 debt to income</td>
</tr>
<tr>
<td>Estimator</td>
</tr>
<tr>
<td>Demographic controls</td>
</tr>
<tr>
<td>$R^2$</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

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.