Cartels and Coordinated Effects: Recent research
Discuss two recent papers:

- *Learning to coordinate: A Study in Retail Gasoline* by David Byrne and Nick de Roos (forthcoming *AER*)
- *Understanding the Price Effects of the MillerCoors Joint Venture* by Nathan Miller and Matthew Weinberg (*Econometrica* 2017)

What to take away:

- Substantive open questions as to what triggers coordination and how it occurs
- Very different empirical approaches in these two papers
- The carefully targeted nature of the research question
Miller-Weinberg: Miller-Corrs JV

Background

Research question: In data, do we see evidence of mergers leading to coordinated pricing effects?

<table>
<thead>
<tr>
<th>Measure market Impact</th>
<th>Detection</th>
<th>Evaluating theory</th>
<th>Descriptive work</th>
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<tr>
<td>Enforcing agreement</td>
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<td>Splitting the gains</td>
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<td>Entry deterence</td>
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<td>Avoiding detection and countermeasures</td>
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Background

Figure: Industry Basics

<table>
<thead>
<tr>
<th>Year</th>
<th>ABI</th>
<th>MillerCoors</th>
<th>Miller</th>
<th>Coors</th>
<th>Modelo</th>
<th>Heineken</th>
<th>Total</th>
<th>HHI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0.37</td>
<td>–</td>
<td>0.20</td>
<td>0.12</td>
<td>0.08</td>
<td>0.04</td>
<td>0.81</td>
<td>2,043</td>
</tr>
<tr>
<td>2003</td>
<td>0.39</td>
<td>–</td>
<td>0.19</td>
<td>0.11</td>
<td>0.08</td>
<td>0.05</td>
<td>0.82</td>
<td>2,092</td>
</tr>
<tr>
<td>2005</td>
<td>0.36</td>
<td>–</td>
<td>0.19</td>
<td>0.11</td>
<td>0.09</td>
<td>0.05</td>
<td>0.79</td>
<td>1,907</td>
</tr>
<tr>
<td>2007</td>
<td>0.35</td>
<td>–</td>
<td>0.18</td>
<td>0.11</td>
<td>0.10</td>
<td>0.06</td>
<td>0.80</td>
<td>1,853</td>
</tr>
<tr>
<td>2009</td>
<td>0.37</td>
<td>0.29</td>
<td>–</td>
<td>–</td>
<td>0.09</td>
<td>0.05</td>
<td>0.80</td>
<td>2,350</td>
</tr>
<tr>
<td>2011</td>
<td>0.35</td>
<td>0.28</td>
<td>–</td>
<td>–</td>
<td>0.09</td>
<td>0.07</td>
<td>0.79</td>
<td>2,162</td>
</tr>
</tbody>
</table>

This table provides revenue shares and the HHI over 2001–2011. Firm-specific revenue shares are provided for ABI, Miller, Coors, Modelo, and Heineken. The total across these firms is also provided. The HHI is scaled from 0 to 10,000. The revenue shares incorporate changes in brand ownership during the sample period, including the merger of Anheuser-Busch (AB) and InBev to form ABI, which closed in November 2008, and Heineken’s acquisition of the FEMSA brands in April 2010. All statistics are based on supermarket sales recorded in IRI scanner data.
Background

FIGURE 1.—Average retail prices of flagship brand 12 packs. Notes: This figure plots the average prices of a 12 pack over 2001–2011, separately for Bud Light, Miller Lite, Coors Light, Corona Extra, and Heineken. The vertical axis is the natural log of the price in real 2010 dollars. The vertical bar drawn at June 2008 signifies the consummation of the Miller–Coors merger.

Data: IRI Academic Database, scanner data by UPC code, week, and store across the USA, aggregated to region-month (39 regions)
FIGURE 1.—Average retail prices of flagship brand 12 packs.

Notes: This figure plots the average price of a 12-pack over 2001–2011, separately for Bud Light, Miller Lite, Coors Light, Corona Extra, and Heineken. The vertical axis is the natural log of the price in real 2010 dollars. The vertical bar drawn at June 2008 signifies the consummation of the Miller–Coors merger.

The prices of Corona Extra and Heineken do not exhibit any persistent increase and instead continue along a downward trend. The price gap between the cheaper domestic beers and the more expensive imports shrinks over time in the post-merger periods.

The most theoretically interesting aspects of Figure 1 are that (i) the price of Bud Light increases by roughly the same amount as the prices of Miller Lite and Coors Light and (ii) Modelo and Heineken prices do not increase, at least not persistently. Post-merger coordination between ABI and MillerCoors is one possible explanation. Alternatively, the data could be explained solely by unilateral effects, under a particular set of demand elasticities that produces strong strategic complementarity among the prices of domestic beers and weak strategic complementarity between the prices of domestic and imported beers. Specific institutional practices could also be important. As one example, retailers could set equal prices for Bud Light, Miller Lite, and Coors Light, regardless of external circumstances, due to beliefs about the market or pressure from the brewers. Changing macroeconomic conditions are also relevant because the merger coincides with the onset of the Great Recession. Income losses could decrease the demand elasticities of domestic beer for a variety of reasons, including down-market substitution.

The observed price patterns probably are not due exclusively to down-market substitution, however, because the sales of the domestic brands decrease in both absolute and relative terms with the recession. In addition, we note the interesting pattern that Miller Lite prices dip just after the merger. We have confirmed...
3.3. Documentary Record

There is documentary evidence in the public domain that supports coordinated pricing by ABI and MillerCoors. The DOJ Complaint filed to enjoin the acquisition of Grupo Modelo by ABI alleges that ABI and MillerCoors announce (nominal) price increases each year in late summer to take effect in early fall. In most geographic areas, ABI is the market share leader and announces its price increase first; in other areas, MillerCoors announces first. The price increases are usually matched by the follower, and if not, they are rescinded. The Complaint quotes from the normal course documents of ABI as follows:

The specifics of ABI’s pricing strategy are governed by its “Conduct Plan,” a strategic plan for pricing in the United States that reads like a how-to manual for successful price coordination. The goals of the Conduct Plan include “yielding the highest level of followership in the short-term” and “improving competitor conduct over the long-term.” ABI’s Conduct Plan emphasizes the importance of being “Transparent—so competitors can clearly see the plan”; “Simple—so competitors can understand the plan”; “Consistent—so competitors can predict the plan”; and “Targeted—consider competition’s structure.” By pursuing these goals, ABI seeks to “dictate consistent and transparent competitive response.”
Miller-Weinberg: Miller-Corrs JV

Background

Figure: Documents

tors.” SABMiller characterizes price competition as “intense” in its 2006 and 2007 reports. The tenor of the annual reports changes around the time of the merger. In its 2009 report, SABMiller attributes increasing earnings before interest, taxes, and amortization expenses to “robust pricing” and “reduced promotions and discounts.” In its 2010 and 2011 reports, it references “sustained price increases” and “disciplined revenue management with selected price increases.”

9
Getting to coordinated pricing more generally
Green and Porter 1984

We will study a model in which demand fluctuations not directly observed by firms lead to unstable industry performance. Intuitively firms will act monopolistically while prices remain high, but they will revert for a while to Cournot behavior when prices fall. Specifically, it will be assumed that firms agree on a "trigger price" to which they compare the market price when they set their production.

FOOTNOTE: It is logically possible for this agreement to be a tacit one which arises spontaneously. Nevertheless, in view of the relative complexity of the conduct to be specified by this particular equilibrium and of the need for close coordination among its participants, it seems natural to assume here that the equilibrium arises from an explicit agreement.
Research Question: How are cartels initiated? Particularly absent explicit agreement...

(An empirical counterexample to the Green-Porter conjecture)
Byrne and de Roos: Retail Gasoline

Background
Institutional background

- Four major retail players
  - BP 22%
  - Caltex 16%
  - Coles (supermarket) 16%
  - Woolworths (supermarket) 13%
  - Remaining 33% of the market is independent

- Fuelwatch
  - Jan 3 2001 - gas stations must submit next day prices to govt at 2pm
  - When open at 6am must charge the prices submitted to govt the previous day. Prices fixed at these levels for 24hrs.
  - At 2:30pm govt posts tomorrow’s prices online
  - < 1% of households look at the website on any given day

- Data pulled from Fuelwatch website for 2001 to 2015 - daily prices for every gas station in Perth
Byrne and de Roos: Retail Gasoline Analysis

Figure 1: Retail Price Cycles

Retail prices exhibit an asymmetric cycle throughout our sample period. Figure 1 depicts an example cycle between January and April 2011. The figure plots average daily station-level retail prices for the four oil majors and an independent firm, Gull. Retail prices infrequently jump (the *relenting* phase), with daily price cutting between price jumps (the *undercutting* phase). The figure also shows how the level of the cycle trends with wholesale fuel costs (TGP).

For our analysis of retail pricing and coordination, it is helpful to define price jumps and cycles at the station and market levels:

**Definition 1.**

(i) A *station-level price jump* occurs at station $i$ on date $t$ if $\Delta p_i^t \geq \prod_{c=1}^{6} c_{PL}$, where

- We abstract from time-invariant marginal cost components such as quantity discounts and shipping costs, as retailer-specific cost data are unavailable.
- In using the TGP to measure profit margins, we follow previous studies (e.g., Borenstein and Shepard 1996; Lewis 2012).

Retail gasoline price cycles exist in the U.S., Canada, Australia, and Europe (Eckert 2013).
Byrne and de Roos: Retail Gasoline
Analysis: Cycle Definition

- Station price jump: \( \Delta p = p_t - p_{t-1} > 6\text{cpl} \)
- Station price cycle starts on a price jump day

- Market price jump: \( \text{median}(\Delta p) > 6\text{cpl} \)
- Market price cycle starts on a price jump day
Figure 2: Timing and Magnitude of Price Jumps and Cycle Length

(i) Timing of Market Price Jumps by Day of Week

- Prior to 2010, price jumps are dispersed throughout the week.
- After 2010, virtually all market price jumps occur on Thursdays.
- This reveals our first focal point of interest: Thursday jumps.

(ii) Average Station-Level Cycle Length by Firm and Month

- Between 2001 and 2010, average cycle length varies considerably over time, ranging from 7 to 35 days.
- When Thursday jumps emerge as a focal point in 2010, cycle length dispersion collapses.

Structural break tests in Appendix G.2 confirm a structural break exists in 2010 in the probability that a market price jump occurs on Thursday in a given week. More generally, Appendix G.2 contains an exhaustive set of structural break tests for breaks in time series in the timing and magnitude of price jump and cuts, cycle lengths, and margins at the start of 2010. That is, any 2010 break discussed in the paper is confirmed using the structural break tests in Appendix G.2.
Byrne and de Roos: Retail Gasoline Analysis

Figure 5: BP Price Leadership in 2011 and 2013

(i) Number of Station-Level Price Jumps by Firm
(Jan 2011: BP Weds. Price Jump Leadership)

We begin our investigation of focal point formation with Thursday jumps. For our analysis, it is useful to define price jump leadership empirically. Panel (i) of Figure 5 provides an example that motivates our definition. Panel (i) tabulates, for each date and firm, the number of stations engaging in station-level price jumps in January 2011. The weekly spikes in the number of stations engaging in price jumps correspond to Thursday price jumps. However, panel (i) also reveals that a subset of 12 to 14 BP stations engage in price jumps on Wednesdays each week. These stations are price leaders, as their Wednesday jumps help initiate market-wide Thursday jumps.

In line with this example, we define price jump leadership as follows:

Definition 2.

Station $i$ is a price leader on date $t$ if:
1. it engages in a station-level price jump on date $t$;
2. a market cycle begins on dates $t$ or $t+1$; and
3. less than 5% of stations engage in station-level price jumps on date $t-1$.

This definition encompasses instances where a station engages in a price jump that leads to successful market price jumps the next day, and very few other stations engage in price jumps the previous day.

11 John Asker

Cartels and Coordination

June 30, 2018 16 / 25
Returning to Figure 5, we can see two stages in the formation of the Thursday jumps focal point. Whereas panel (i) shows Wednesday price leadership by BP in January 2011, panel (ii) illustrates cycles in January 2013 where BP Wednesday price leadership does not occur. Instead, all stations coordinate market price jumps with their station networks on Thursdays. We reiterate here that the firms eventually achieve this degree of price coordination despite having to set their prices simultaneously each day.

Creating the focal point.

Figure 6 illustrates BP's transition in price jump leaders, and the formation of the Thursday jumps focal point. Panels (i) and (ii) show the rate at which BP and Caltex converge on Thursday jumps. Each panel plots the proportion of station-level price jumps that occur on a given day of the week in a given month. For instance, panel (ii) shows that 22% of Caltex stations' price jumps occur on Thursday in January 2010. By March 2010, this figure jumps to 48%. By June 2010, 91% of Caltex stations' price jumps occur on Thursday. For the next five years, between 75% and 100% of Caltex's stations' price jumps occur on Thursdays month to month.

The dynamics for BP in panel (i) are different. There is a three-year tran...
Figure 7: BP Price Leadership in Creating the Thursday Price Jumps Focal Point

(i) Number of Station-Level Price Jumps on Wednesdays by Firm and Week

<table>
<thead>
<tr>
<th>Week</th>
<th>BP</th>
<th>Caltex</th>
<th>Woolworths</th>
<th>Coles</th>
</tr>
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<tbody>
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<td>2009w40</td>
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<tr>
<td>2010w1</td>
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<tr>
<td>2010w13</td>
<td></td>
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</tr>
<tr>
<td>2010w26</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010w40</td>
<td></td>
<td></td>
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</tbody>
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(ii) Number of Station-Level Price Jumps on Thursdays by Firm and Week

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<tr>
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</tbody>
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Between March and April 2009, nearly 100% of BP stations' price jumps occur on Wednesdays. As per our discussion of context above, this reflects BP's re-initiation of the cycle after its collapse following the 2008–09 crude oil price shock. From this point forward, panel (i) shows a smooth downward sloping trend in BP stations' engagement in Wednesday jumps that spans three-years. In August 2012, BP stops engaging in Wednesday jumps altogether.

Panel (i) further reveals a smooth upward trend in BP stations' engagement in Thursday jumps. Notice that the transition is slower for BP than Caltex. By August 2012, nearly 100% of BP station-level price jumps occur on Thursdays.

In sum, panel (i) shows BP gradually and systematically transitioning from Wednesday jumps to Thursday jumps over a three-year period. Through this transition, BP scales back its price jump leadership until it eventually starts coordinating, simultaneously, with its rivals on Thursday jumps.

Price leadership.

Figure 7 reveals the culmination of the Thursday jumps focal point formation around the start of 2010. Panels (i) and (ii) of the figure zoom in on the transition to Thursday jumps between September 2009 and September 2010. The panels plot, by brand, the number of stations engaging in Wednesday and Thursday price jumps, respectively.
Figure 8: BP Price Experiments in Creating the Thursday Price Jump Focal Point

(i) Number of Stations Leading Market Price Jumps by Firm
Jan 2009 – Jan 2012

(ii) Number of Stations Leading Market Price Jumps by Firm
Jan 2012 – Jan 2013

By contrast, Caltex engages in price jumps, albeit with fewer stations than in the previous 10 weeks. This reveals an important piece of information to the market: Coles and Woolworths do not hold the belief that Thursday jumps are a focal point for coordinating prices among brands. They require BP's price leadership on Wednesdays to coordinate Thursday jumps.

For two reasons, we interpret Gap 2 as a BP price experiment. First, it corresponds to a one-time break in BP's long-run pricing strategy of Wednesday price jump leadership. BP's immediate return to Wednesday price jumps after Gap 2 suggests that Gap 2 is not part of a mixed strategy whereby BP randomizes the day of the week that price jumps occur.

Second, BP runs six additional price experiments like Gap 2 between 2011 and 2013. These are depicted in panels (i) and (ii) of Figure 8, and are labeled Gap 3 to Gap 8. As a point of reference, we also label Gaps 1 and 2 in panel (i).

The plots in Figure 8 are slightly different to those in Figure 7. Figure 8 plots, for each date and firm, the number of stations that successfully lead a market price jump (as per Definition 2), irrespective of whether they lead on a Wednesday, Thursday, or any other day of the week.

The downward sloping line of green triangles in panel (i) of Figure 8 corresponds to Weeks without BP Weds. price jump leadership (firms simultaneously coordinate on price jumps).
Appendix B.4 contains an extensive econometric analysis of the change in margins in Perth at the start of 2010 relative to other Australian markets. The estimated break in Perth's margin in 2010 is robust to the week chosen for the break, and the starting year of the sample. Using information on average volumes of gasoline sold by day of the week from the Australian Competition and Consumer Commission for Australian cities in 2006–07 and 2013–14, we have estimated the break using volume-weighted daily margins. We precisely estimate a large break of 2.48 cpl.

Coordinating an equilibrium transition

How are the Thursday jumps and 2-cpl cuts focal points created? In this section, we uncover two mechanisms used by BP to transition the market to this focal point equilibrium: price leadership and price experiments.

Before delving into these mechanisms, we briefly provide context for when
Miller-Weinberg: Miller-Corrs JV

Background

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Estimate demand using the IRI data
Demand specification is RCNL - a nested logit, with random coefficients on some $x$'s - a sub-case of BLP
Instruments do a lot of work, rely heavily of functions of distance of market to brewery for cost shifters
Estimate a pricing equation with a conduct parameter for CoorsMiller and ABI - captures the extent to which they internalize pricing externalities - get about 25% internalization post merger
Compare pricing data to alternate counterfactual models to validate conjecture regarding coordinated effects
Miller and Weinberg: Miller-Coors JV

Analysis

Figure 4.—Counterfactuals prices for Miller Lite.

Notes: This figure plots the average retail prices of Miller Lite 12 packs in the raw data and under four different counterfactual scenarios. Each dot represents the average prices across the 39 regions.
FIGURE 5.—Counterfactuals prices for Bud Light. Notes: This figure plots the average retail prices of Bud Light 12 packs in the raw data and under three different counterfactual scenarios. Each dot represents the average prices across the 39 regions.

Miller and Weinberg: Miller-Coors JV
Analysis

Even given the large marginal cost reductions: The merger increases prices by about 50 cents, on average, per 12 pack, relative to the “No Merger” scenario.

Table X provides the mean retail prices and markups of ABI, Miller, and Coors 12 packs, along with selected welfare statistics based on all products in our sample. All numbers are for 2011, the final year of the sample. A comparison of columns (i) and (v) reveals that the merger increases ABI prices from $9.43 in the “No Merger” scenario to $10.03 in the raw data, while Miller prices increase from $8.19 to $8.94 and Coors prices increase from $9.26 to $10.18. The analogous comparison of markups shows smaller increases for ABI than for Miller and Coors because only the latter brands benefit from marginal cost reductions.

We now turn to the welfare statistics. All the numbers shown are the percentage differences relative to the “No Merger” counterfactual in which the Miller/Coors merger does not occur. Column (i) shows that the merger increases producer surplus by 22.1% relative to the no merger baseline and comparison to column (iii) reveals that a little more than half of these gains are due to coordination. Column (i) also shows that the merger reduces consumer surplus by 3.7% relative to the no merger baseline. The consumer surplus effects vary substantially and predictably with the roles of coordination and efficiencies. For example, column (iii) shows that without coordinated effects (but with efficiencies), consumer surplus falls by only 0.2% due to the merger. This may well have been the scenario
Takeaways

- What initiates and shapes coordinated prices is poorly understood empirically and theoretically
  - Both these papers are directed at advancing our understanding of this
- Data and theory speak to each other in both papers
- Very different modes of execution
  - Which is the harder to execute?
  - The data and the research question dictate the approach
- Both papers push past the frontier of our theoretical understanding of the phenomena