Learning to Coordinate: A Study in Retail Gasoline[1]

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FTC Microeconomics Conference
November 4, 2016

[1] The views and opinions expressed in our paper and in this talk are strictly those of the authors, and do not necessarily reflect those of the ACCC nor the Western Australian Government.

Research question

- How is collusion initiated?

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Green and Porter (1984):

> *"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."*

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Green, Marshall and Marx (2015), Ivaldi et al. (2003):

- the implementation of collusive agreements, both tacit and explicit, has been explored extensively
- the issue of how collusion is initiated has largely been abstracted from, or presumed to be explicit

This paper

We empirically study the tacit initiation of a collusive pricing structure

Context and data: urban retail gasoline market where we have the universe of daily station-level retail prices for 15 years

Our analysis of the evolution of pricing and conduct reveals 3 interconnected mechanisms for initiating collusion tacitly:

- price leadership
- focal points
- experimentation

Related literature

Ex-post case studies of known cartels and explicit collusion

- Clark and Houde (2013), Asker (2010), Wang (2008), Genesove and Mullin (2001), Roller and Steen (2006), Levenstein and Suslow (2006), Pesendorfer (2000), Ellison (1994), Porter and Zona (1993), Porter (1983)

Empirical studies of tacit collusion and coordinated effects

- Miller and Weinberg (2016) (mergers), Lewis (2015) and Knittel and Stango (focal points), Lewis (2012) and Wang (2009) (price leadership), Ciliberto and Williams (2014) and Busse (2000) (multi-market contact), Borenstein and Shepard (1996) and Slade (1992) (demand fluctuations, price wars)

Learning and coordination dynamics in oligopoly

- lab: Huck et al. (1999), Offerman et al. (2002), Apesteguia et al. (2007), Friedman et. al (2015)
- field: Doraszelski, Lewis and Pakes (2016), Yang (2016)

Roadmap

1. Overview of the context and data
2. 15 years of retail pricing
   - 2001-2009: (comparatively) competitive pricing
   - 2010-today: tacit collusion
3. Mechanisms for initiating tacit collusion
   - price leadership, focal points, experimentation
4. Collusive outcomes
   - price-cost margins, price stability, conflict resolution
5. Summary, policy implications

Context and Data

Context

Retail gasoline market of Perth, Australia

- 1.7 million people, 472 gasoline stations
- 4 major retailers: BP, Caltex, Coles, Woolworths
  - station shares: 22%, 16%, 16%, 13%
  - prices centrally set by the major retailers
  - shares stable from 2004-2015

Price transparency policy - Fuelwatch

- price reporting website
- 24-hour rule

Context and Data

Data

Universe of station-level daily prices for 15 years

- 3 January 2001 - 31 December 2015
- $\approx$1.8 million station-date observations

Marginal cost: terminal gate price (TGP)

Context and Data

Data

Universe of station-level daily prices for 15 years

- 3 January 2001 - 31 December 2015
- $\approx$1.8 million station-date observations

Marginal cost: terminal gate price (TGP)

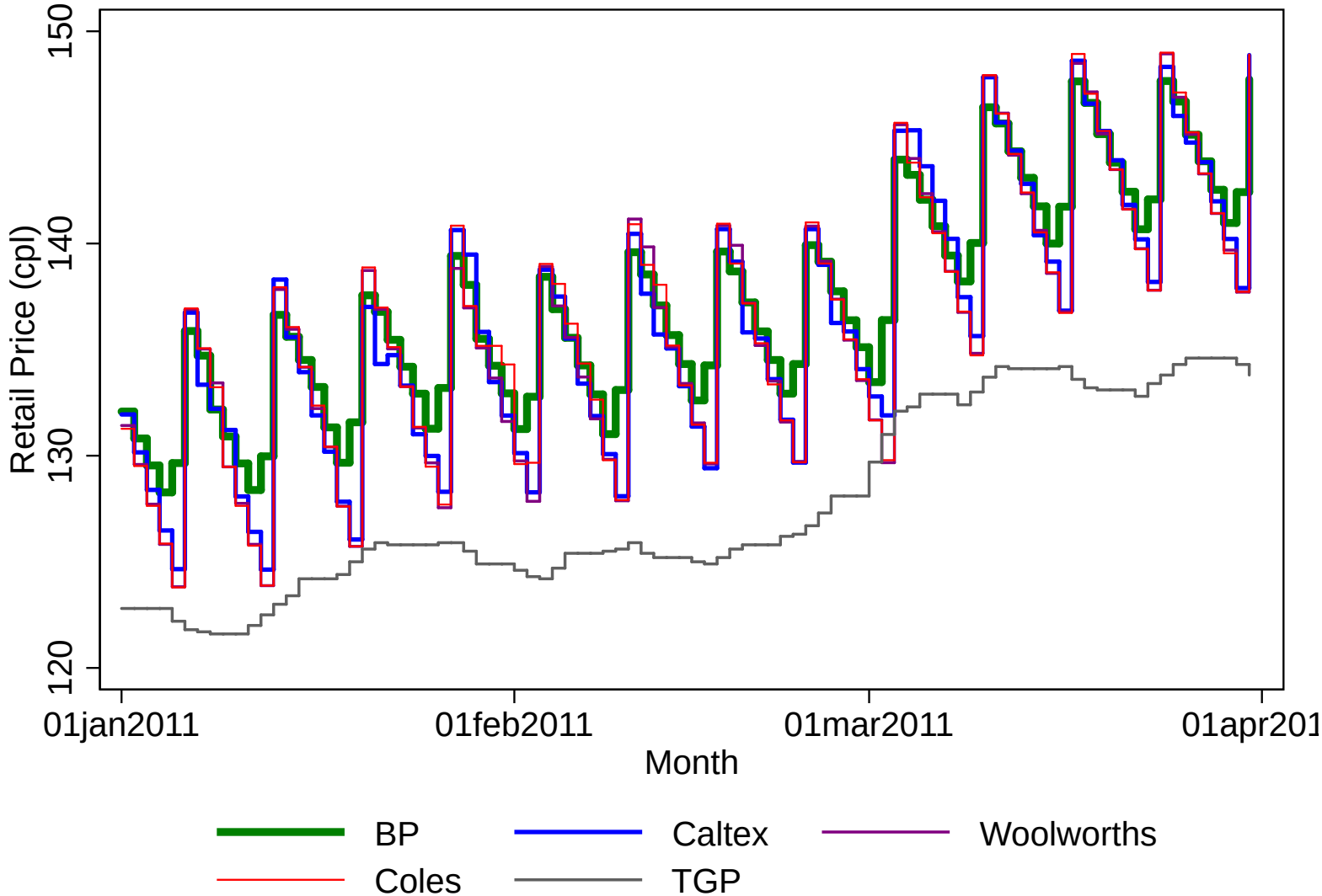
In sum, the data and environment are characterized by

- simultaneous price setting
- perfect monitoring of rivals' current and past actions
- common daily cost shocks

Context aligns well with standard repeated games framework for collusion (Friedman 1977)

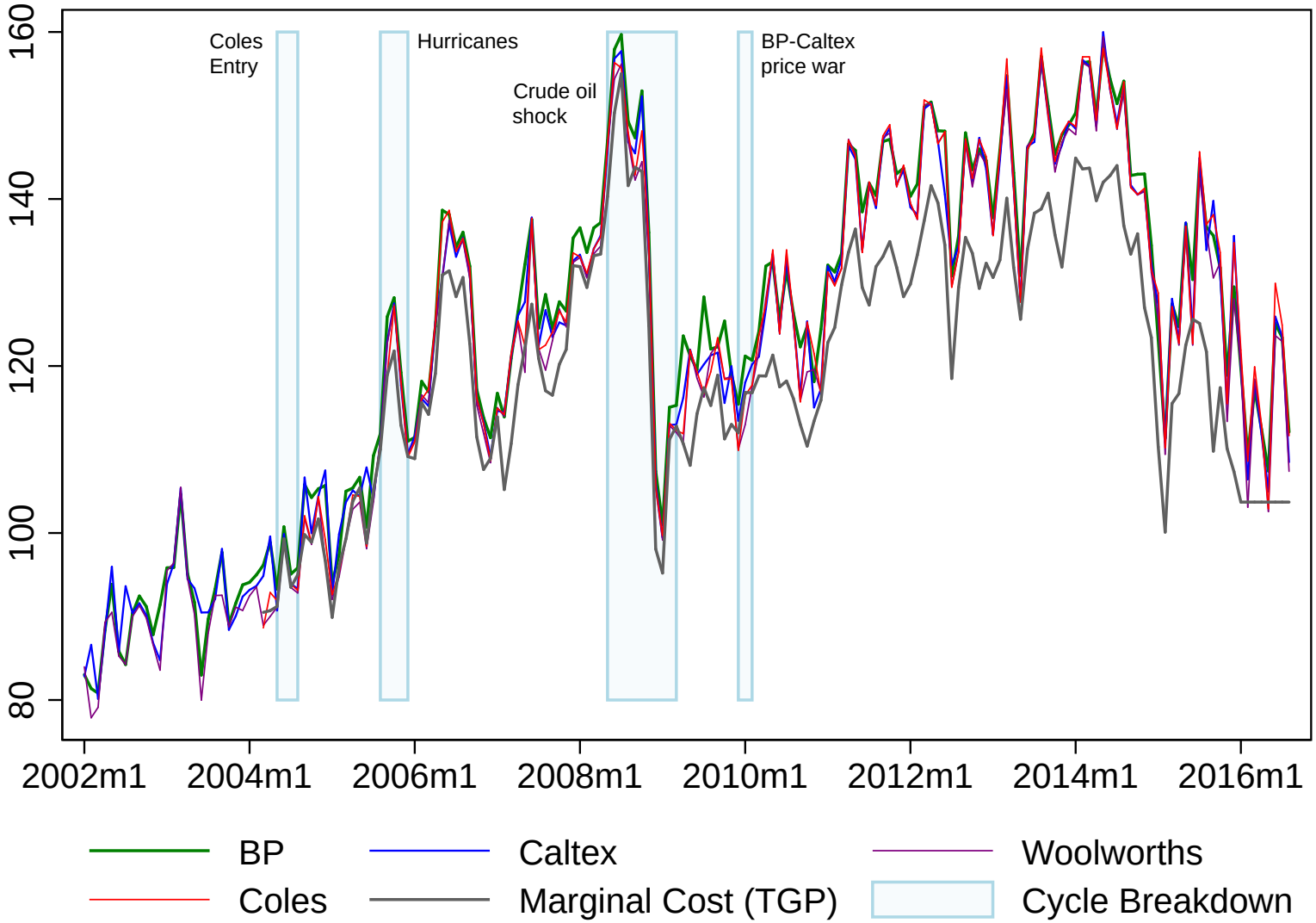
Context and Data

Retail pricing



Context and Data

Monthly average prices, costs and margins



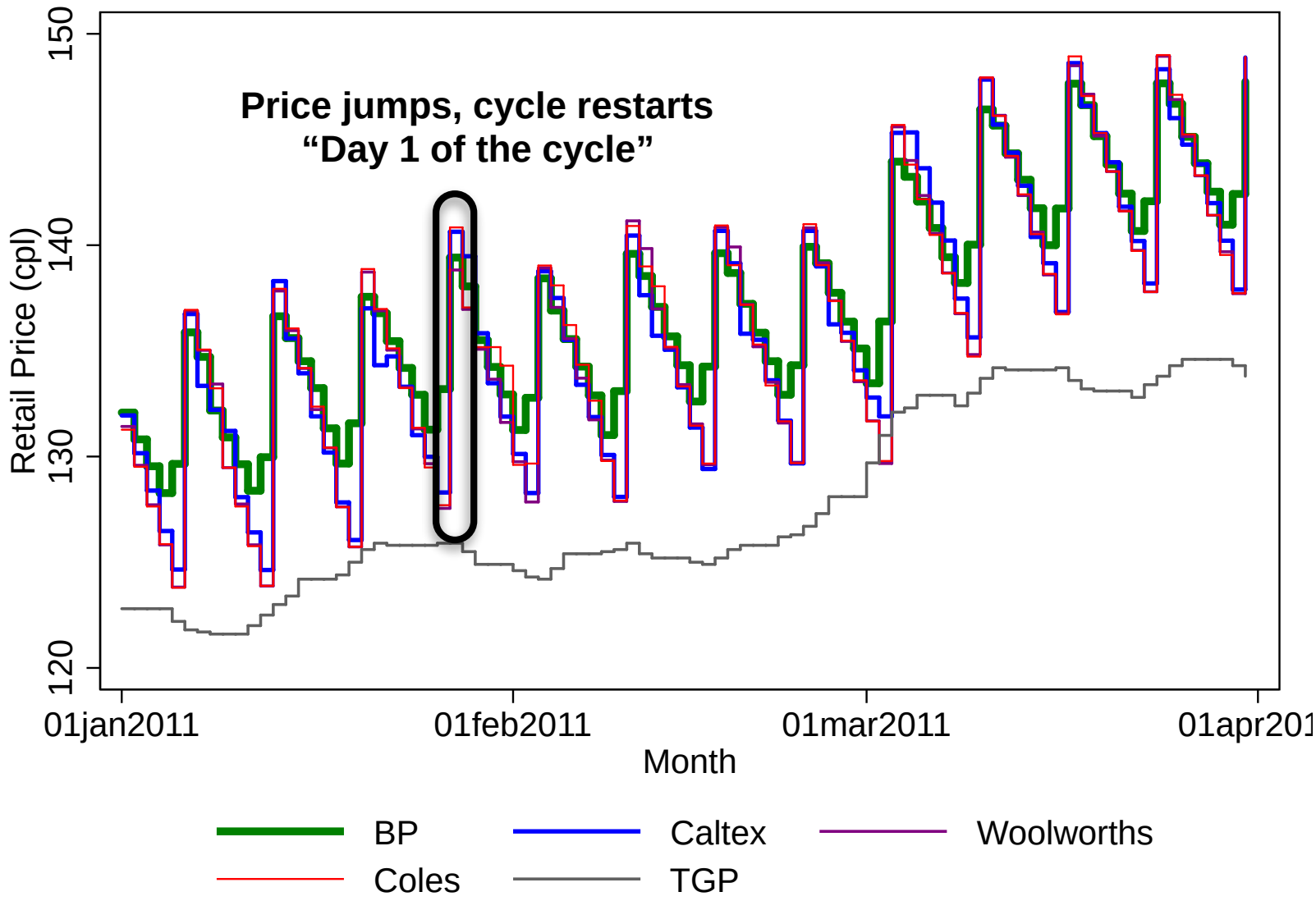
15 Years of Retail Pricing

To study the evolution of pricing, it is helpful breakdown price cycles into two components

- price jumps
- price cuts

15 Years of Retail Pricing

Defining price jumps, cuts and cycle length



15 Years of Retail Pricing

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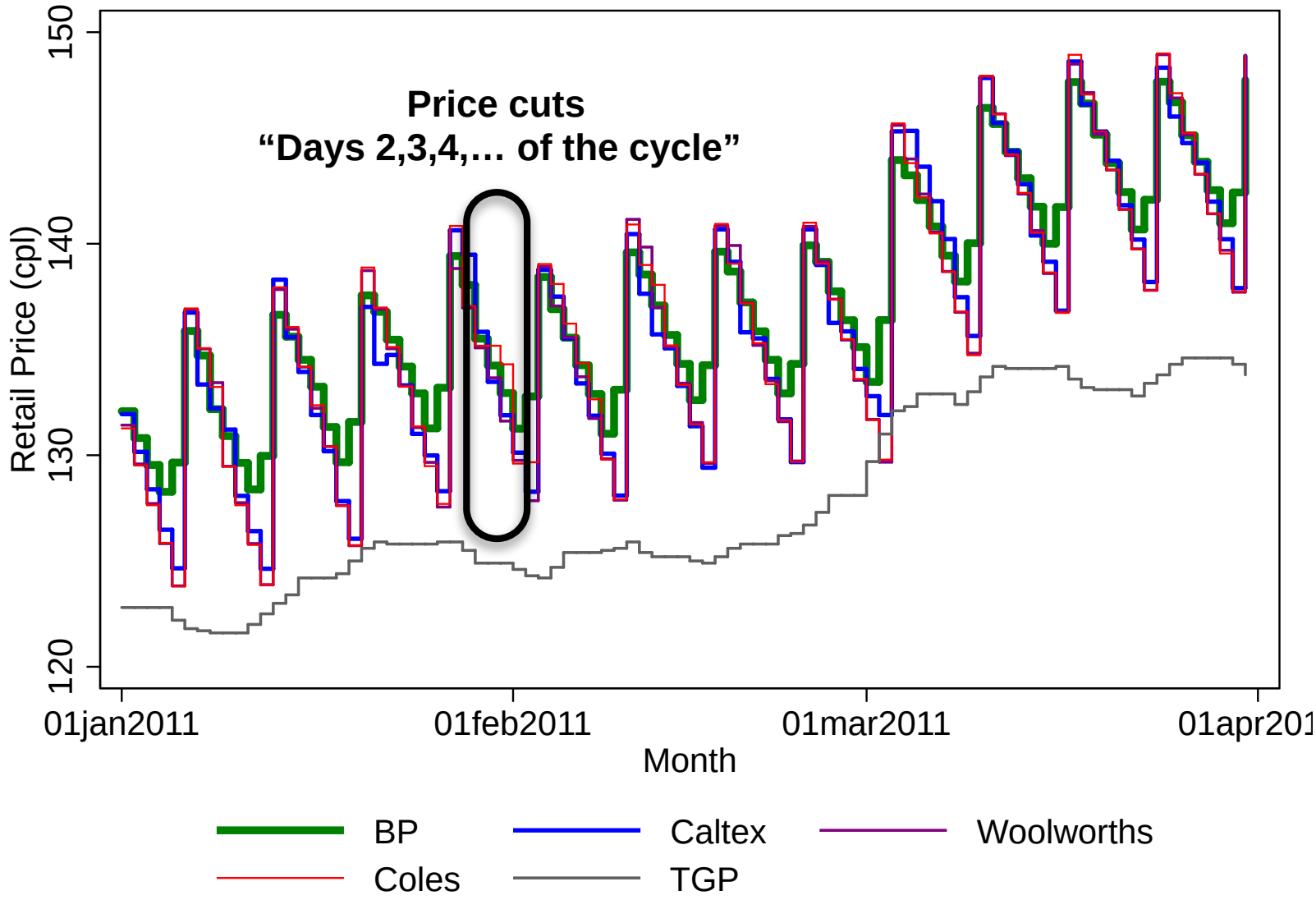
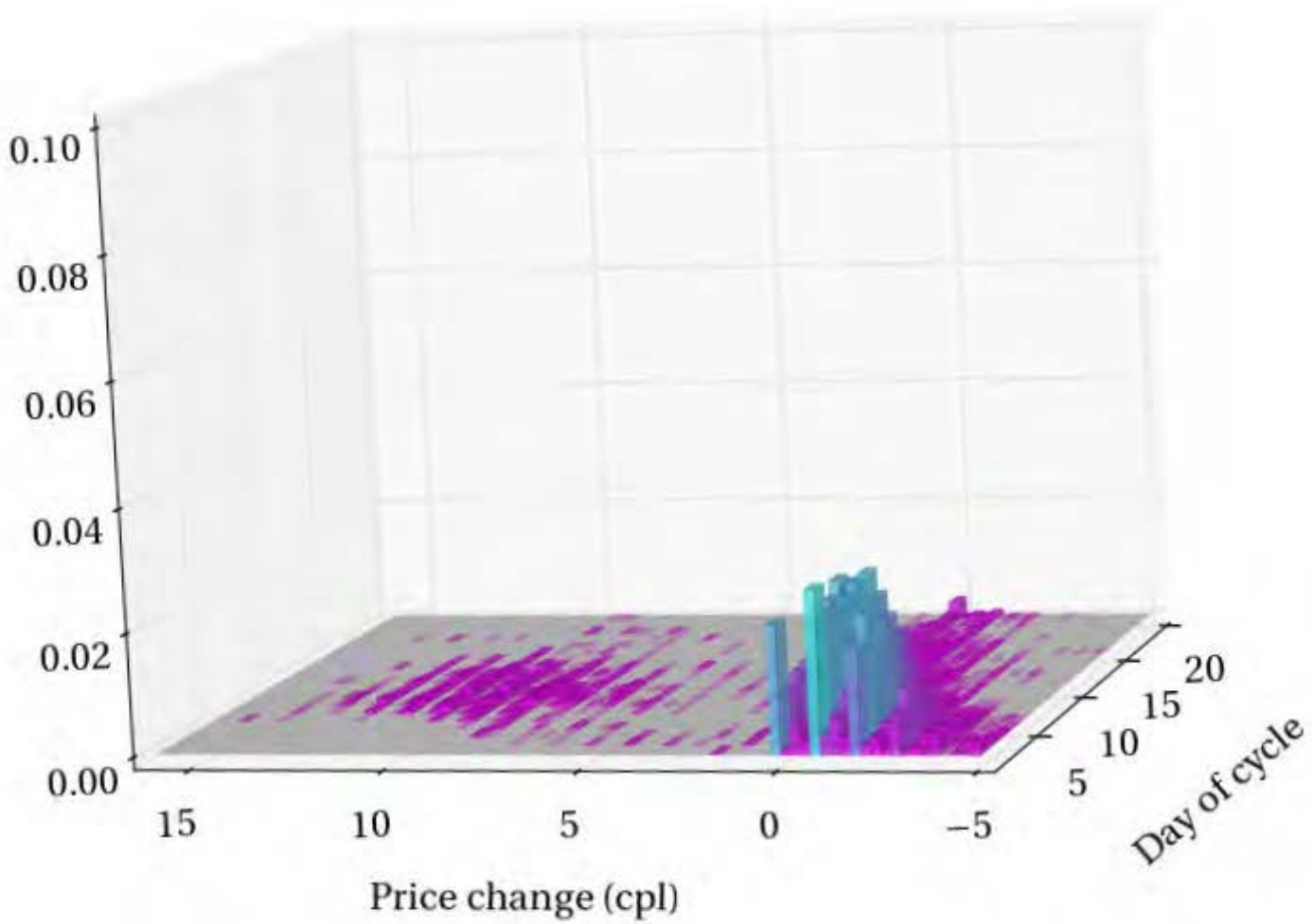


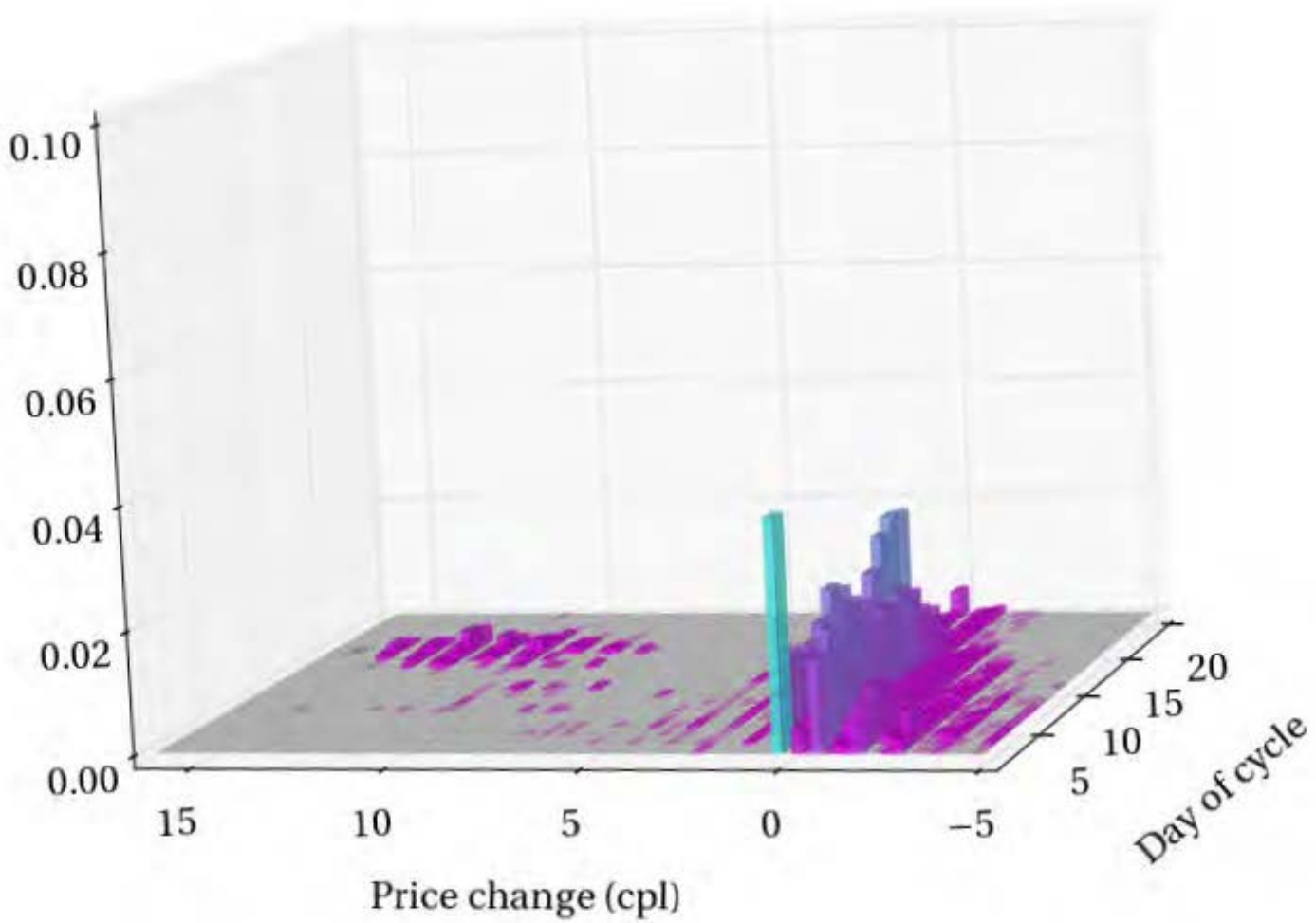
15 Years of Retail Pricing

Distribution of price changes: 2001-2003



15 Years of Retail Pricing

Distribution of price changes: 2006-2007



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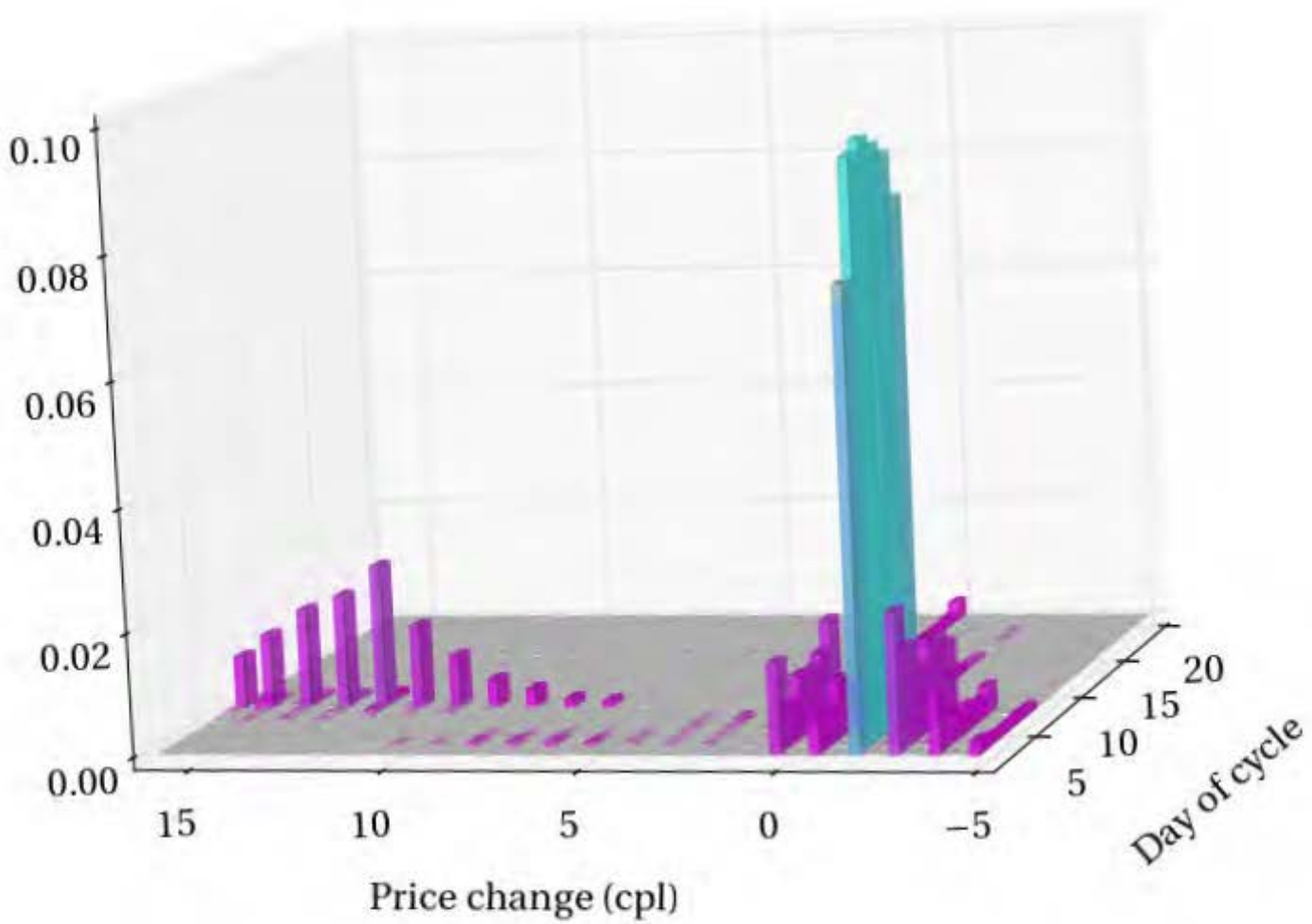
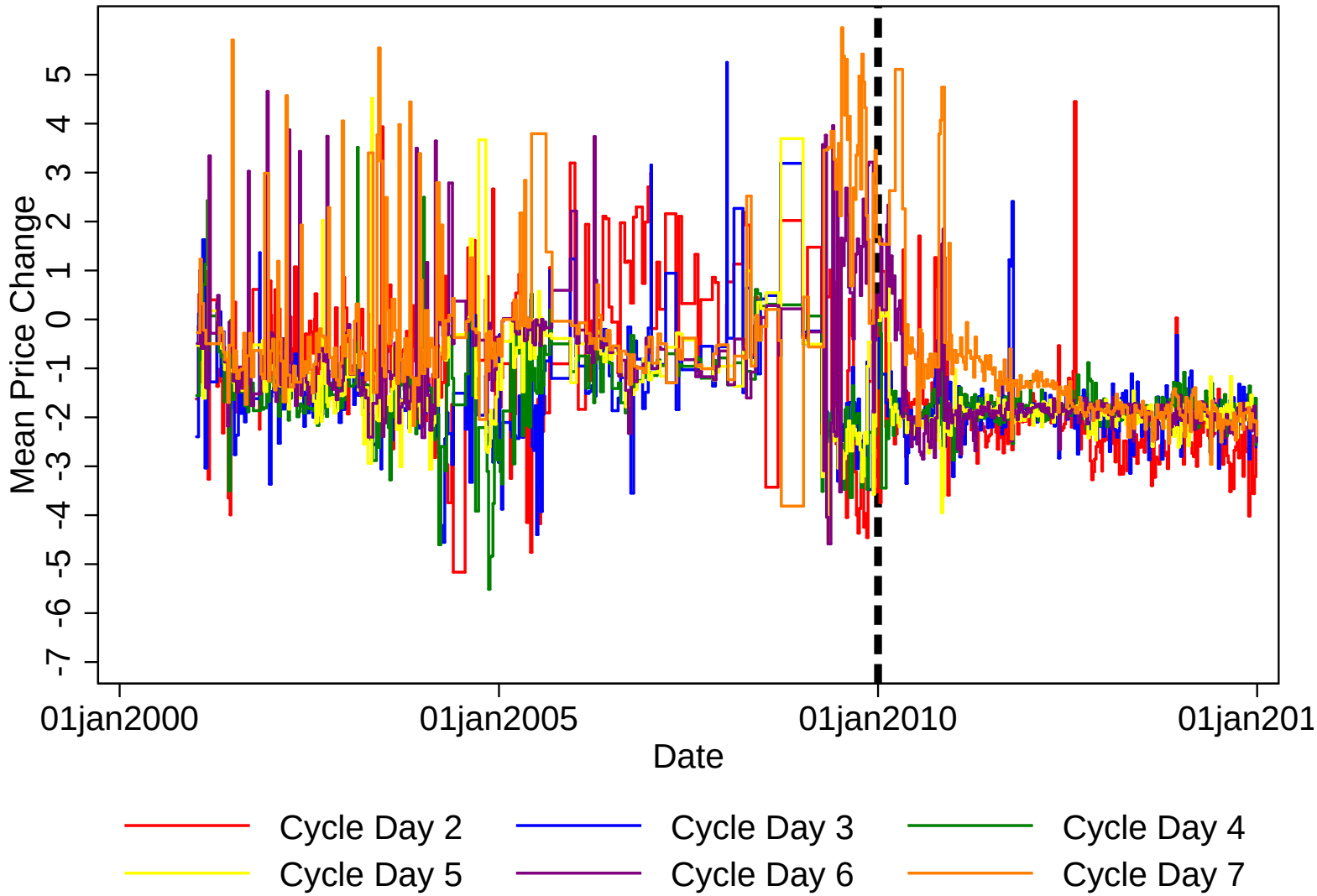
Distribution of price changes: 2009-2015



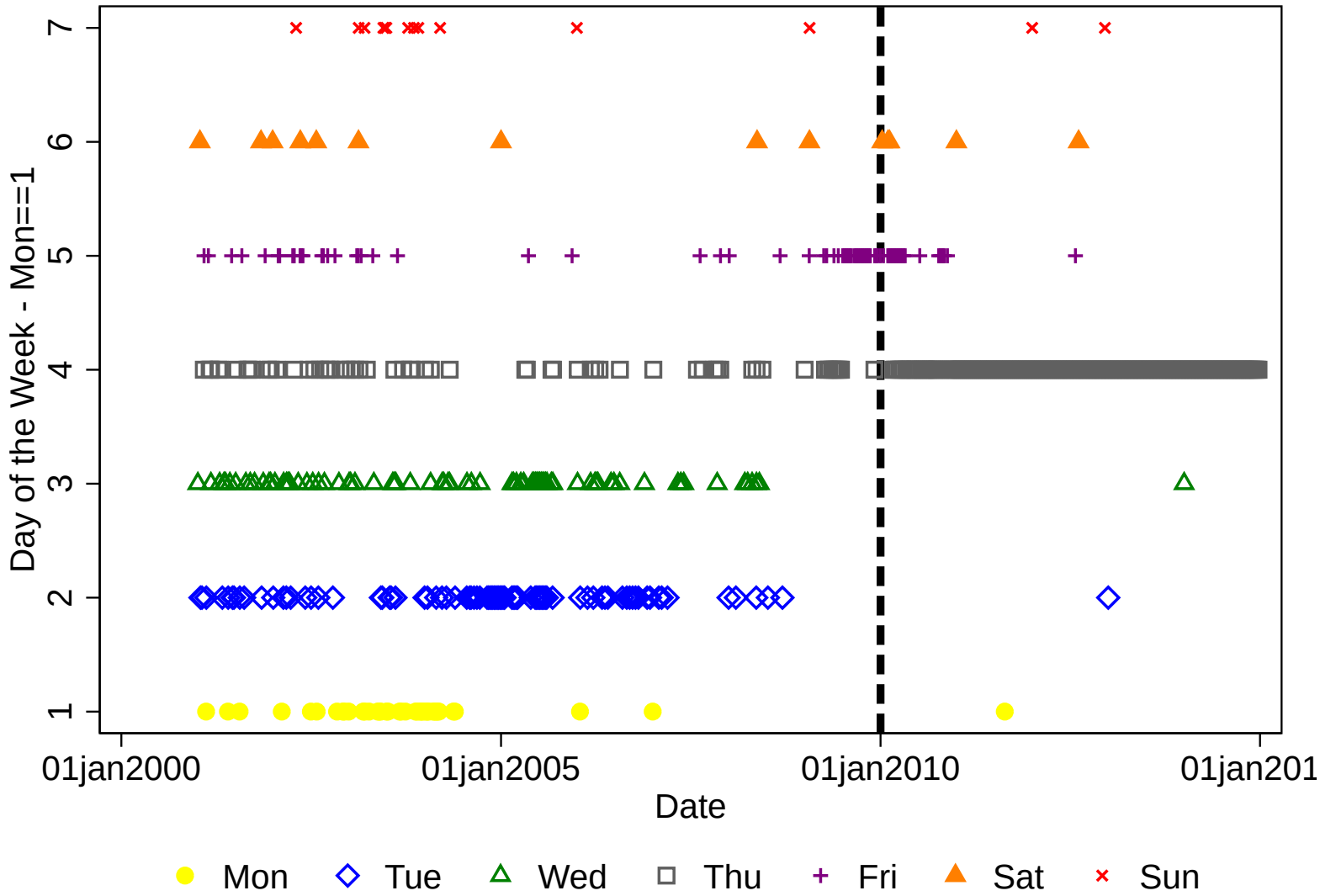
15 Years of Retail Pricing

Inter-temporal variation in price cuts



15 Years of Retail Pricing

Day of the week when price jumps occur



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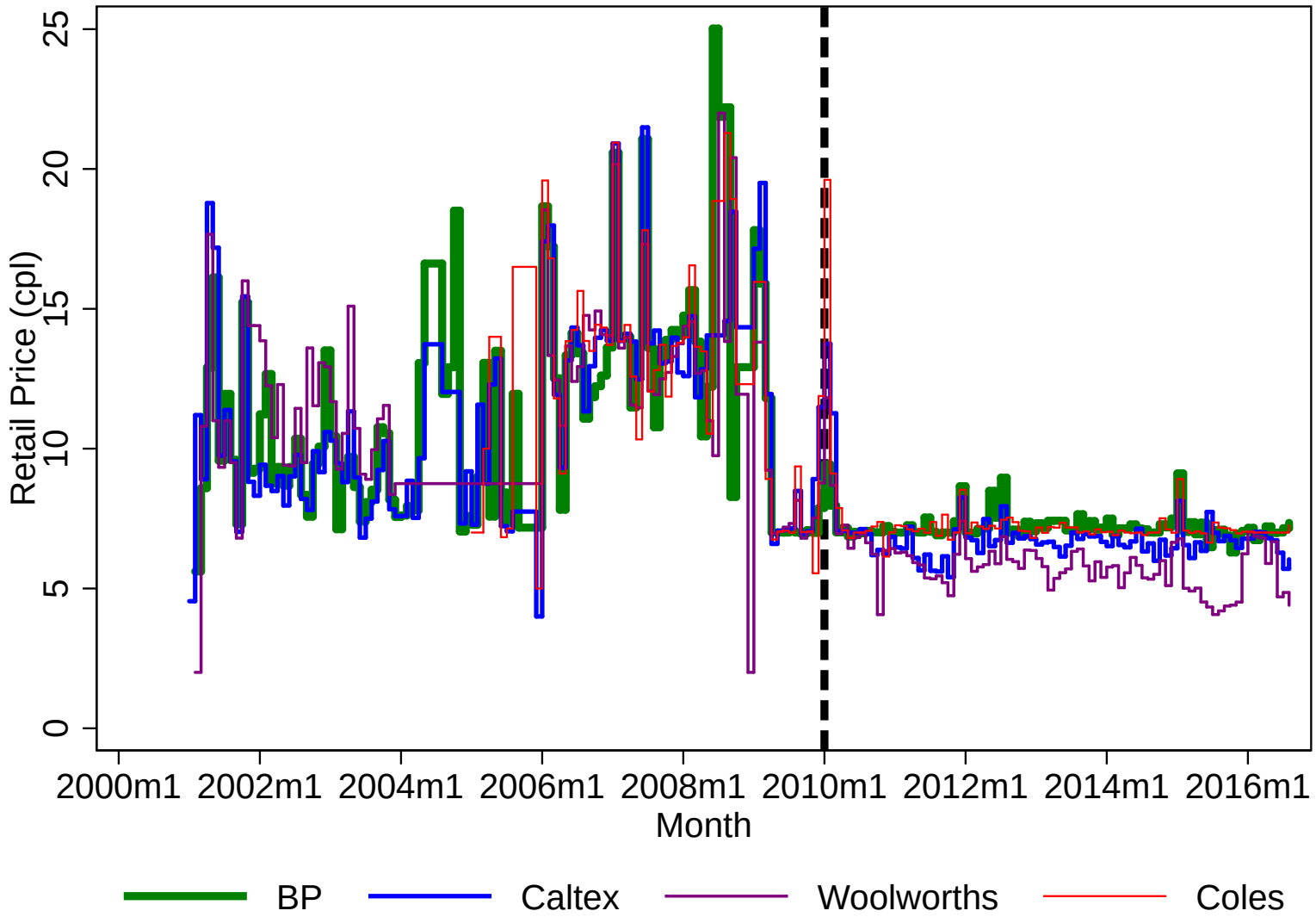
Inter-temporal variation in cycle length



15 Years of Retail Pricing

Summary

In summary, starting in 2010 we observe

- Emergence of 2 focal points
  - 2 cpl daily price cuts
  - Thursday price jumps
- $\approx$ 75% increase in profit margins

This tacitly collusive pricing structure took a long time to emerge - 10 years!

- despite perfect observability/monitoring of own and rivals' daily prices and price history

Initiating Tacit Price Coordination

Overview

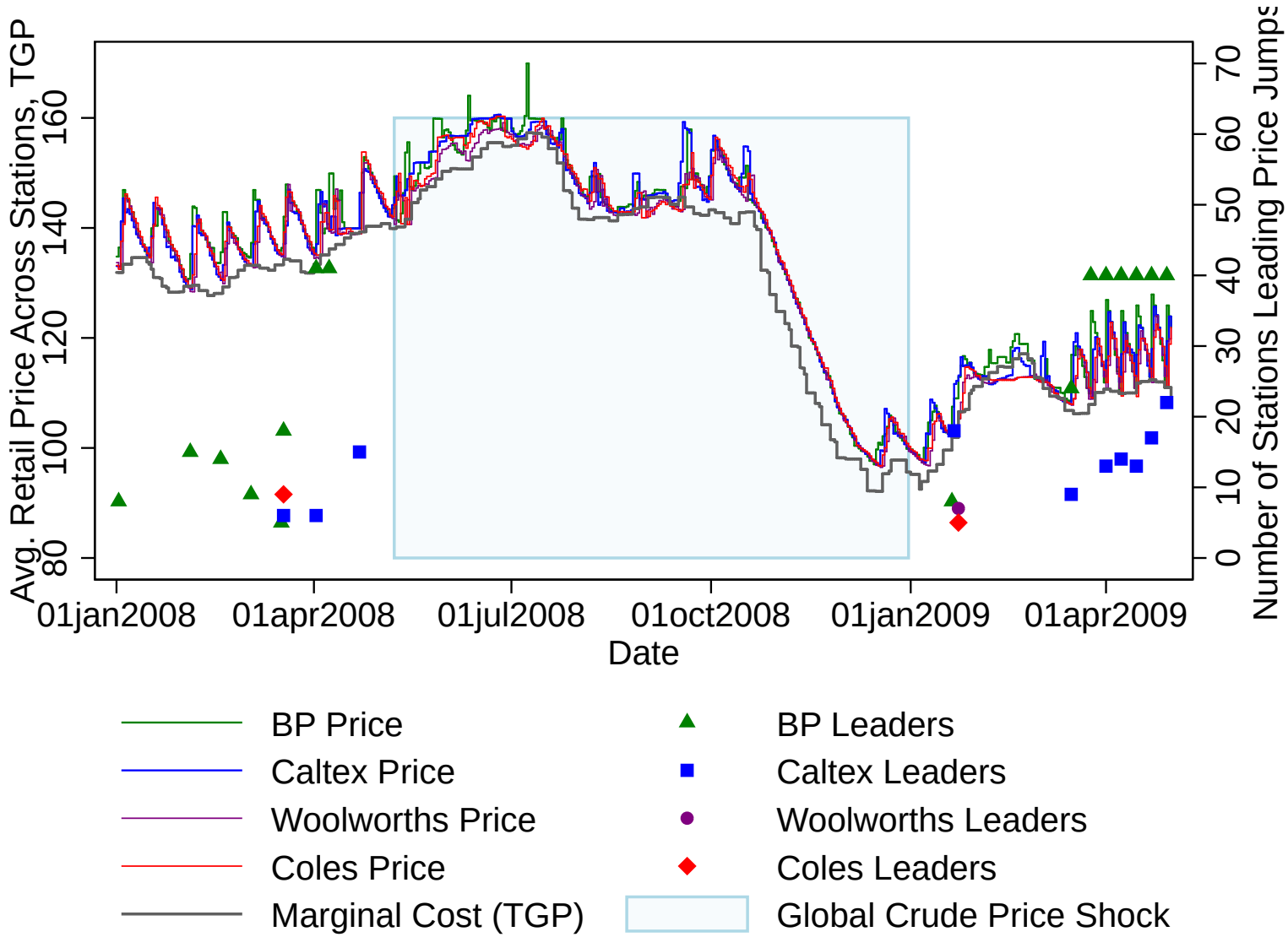
How was tacit collusion initiated?

Analysis consists of 4 parts

1. Aggregate shocks and price leadership (2004, 2006, 2009)
2. Price war (2009-10)
3. Price leadership and experimentation used to establish the focal points (2009-12)
4. Collusive outcomes: price-cost margins, price stability, conflict resolution

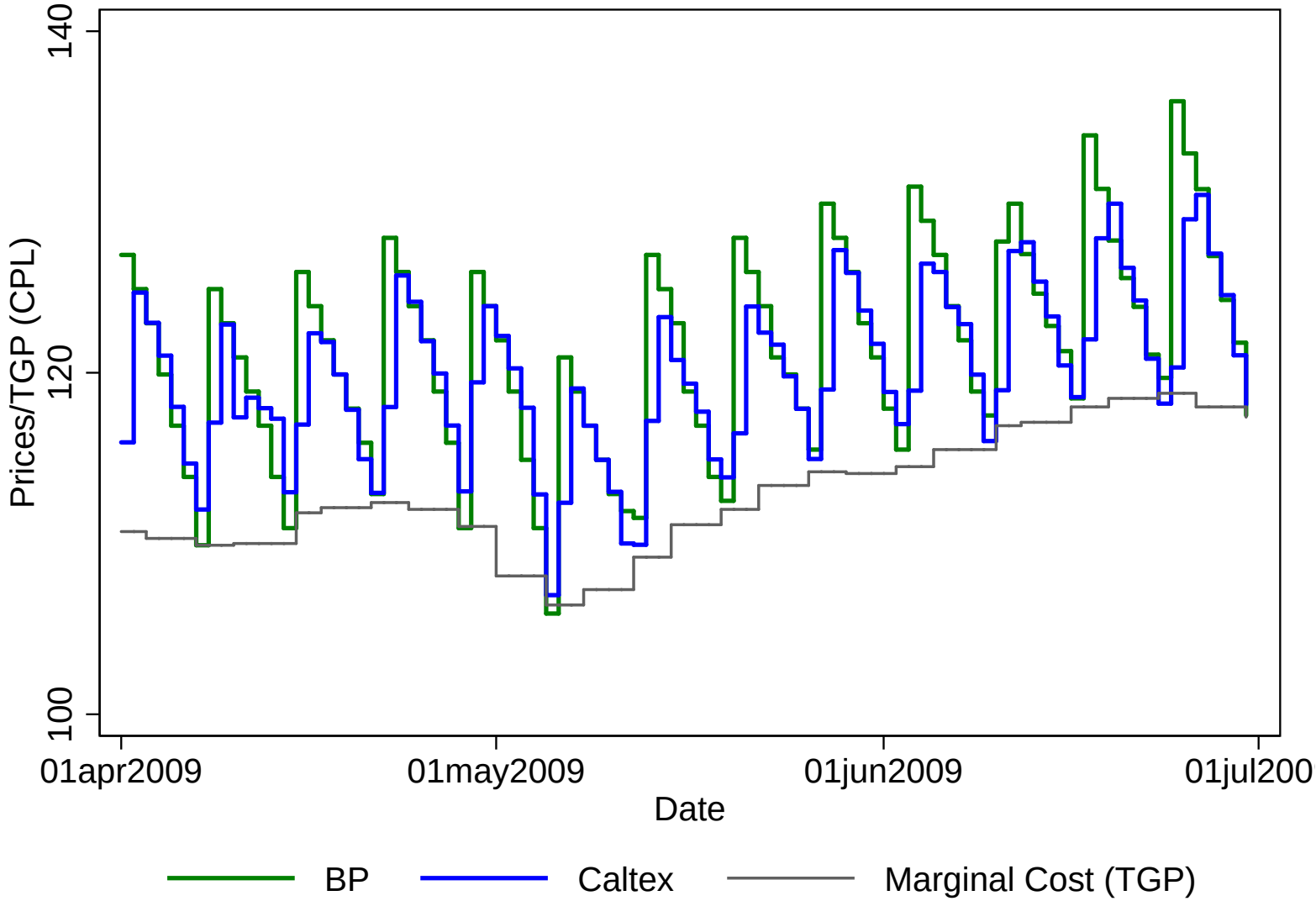
Aggregate Shocks and Price Leadership

Global Crude Oil Price Shock



Price War

Pre-cursor to the new pricing structure



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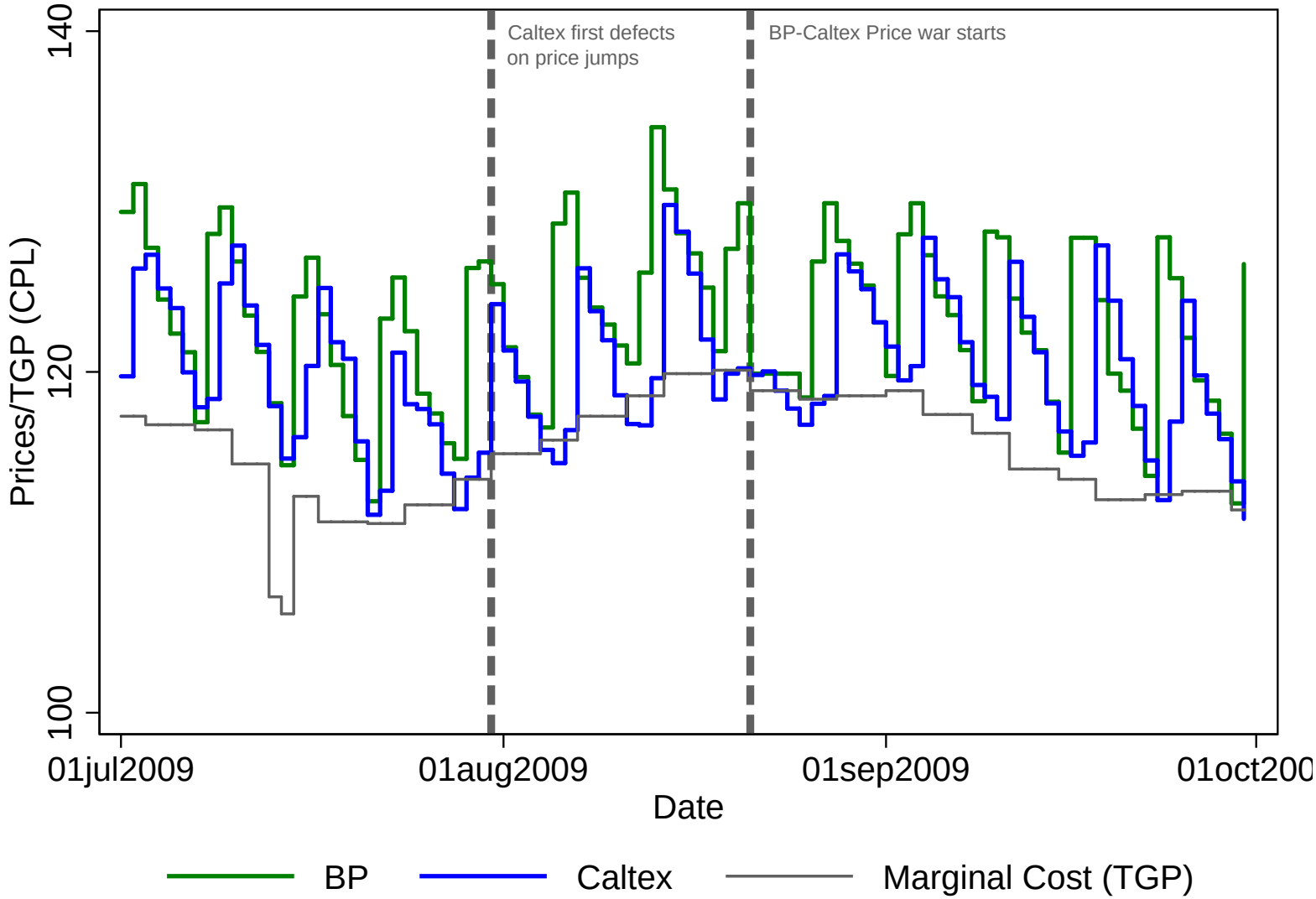

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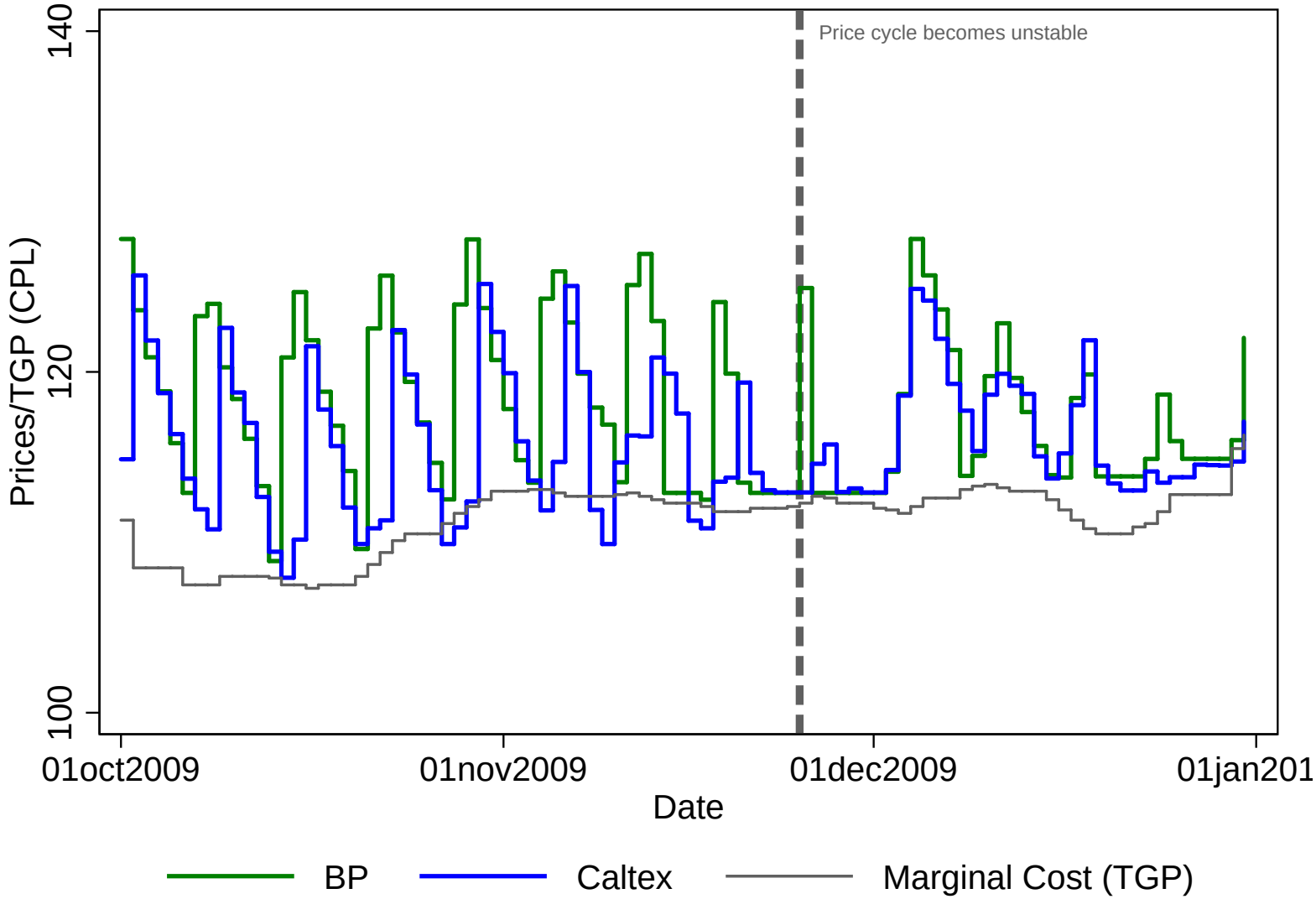

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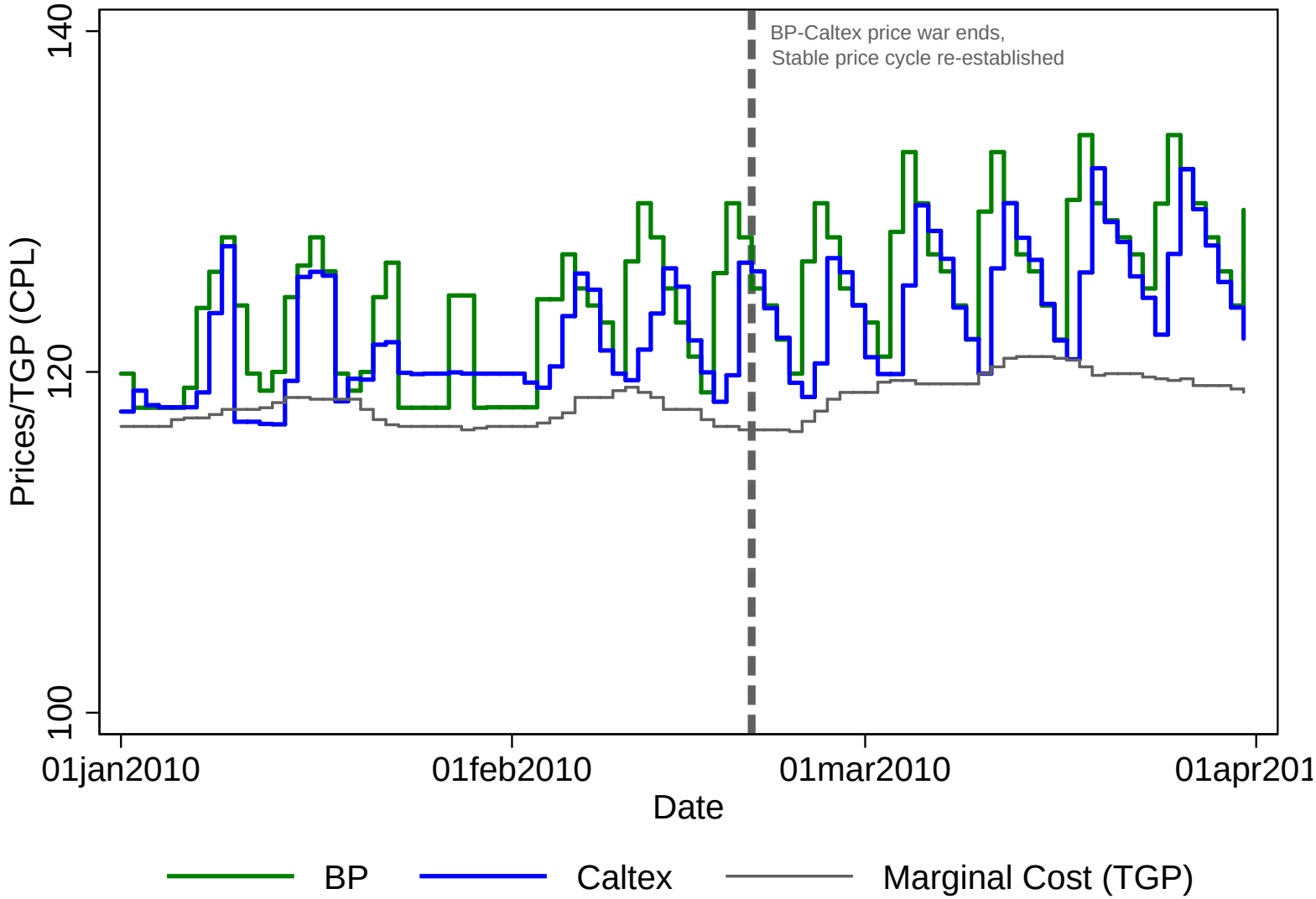
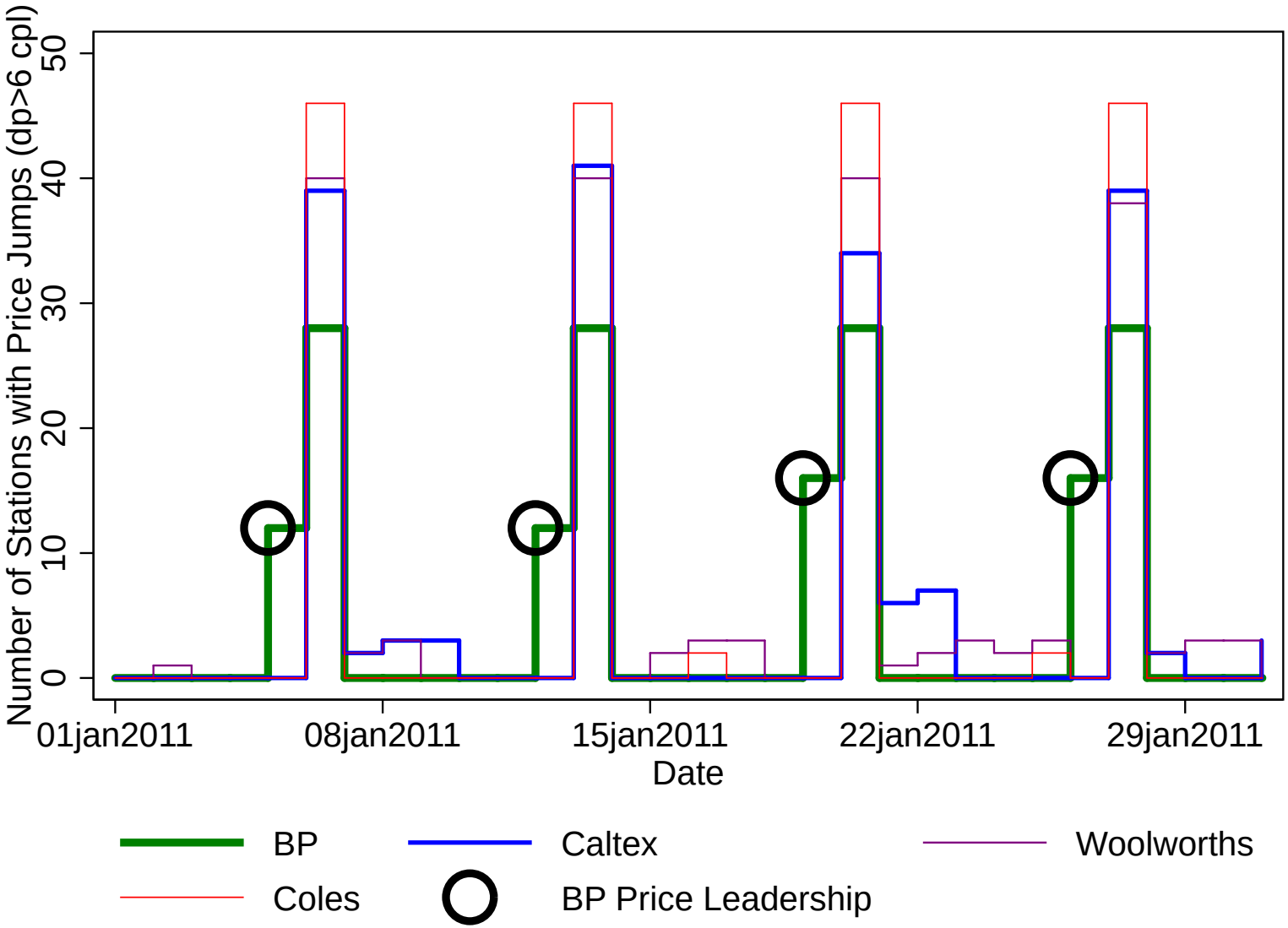


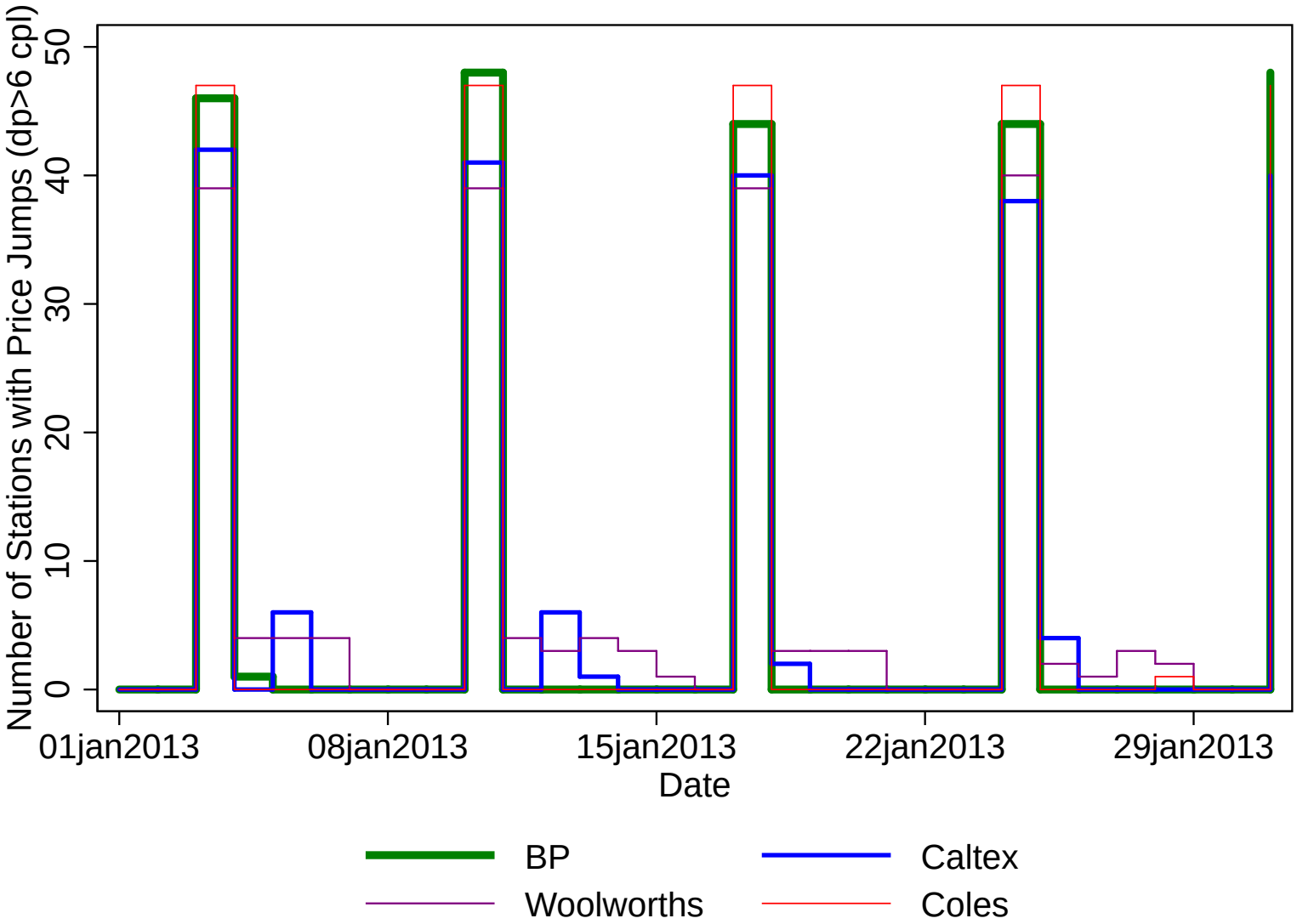
Focal point #1: Thursday price jumps

2011: BP price leadership with price jumps



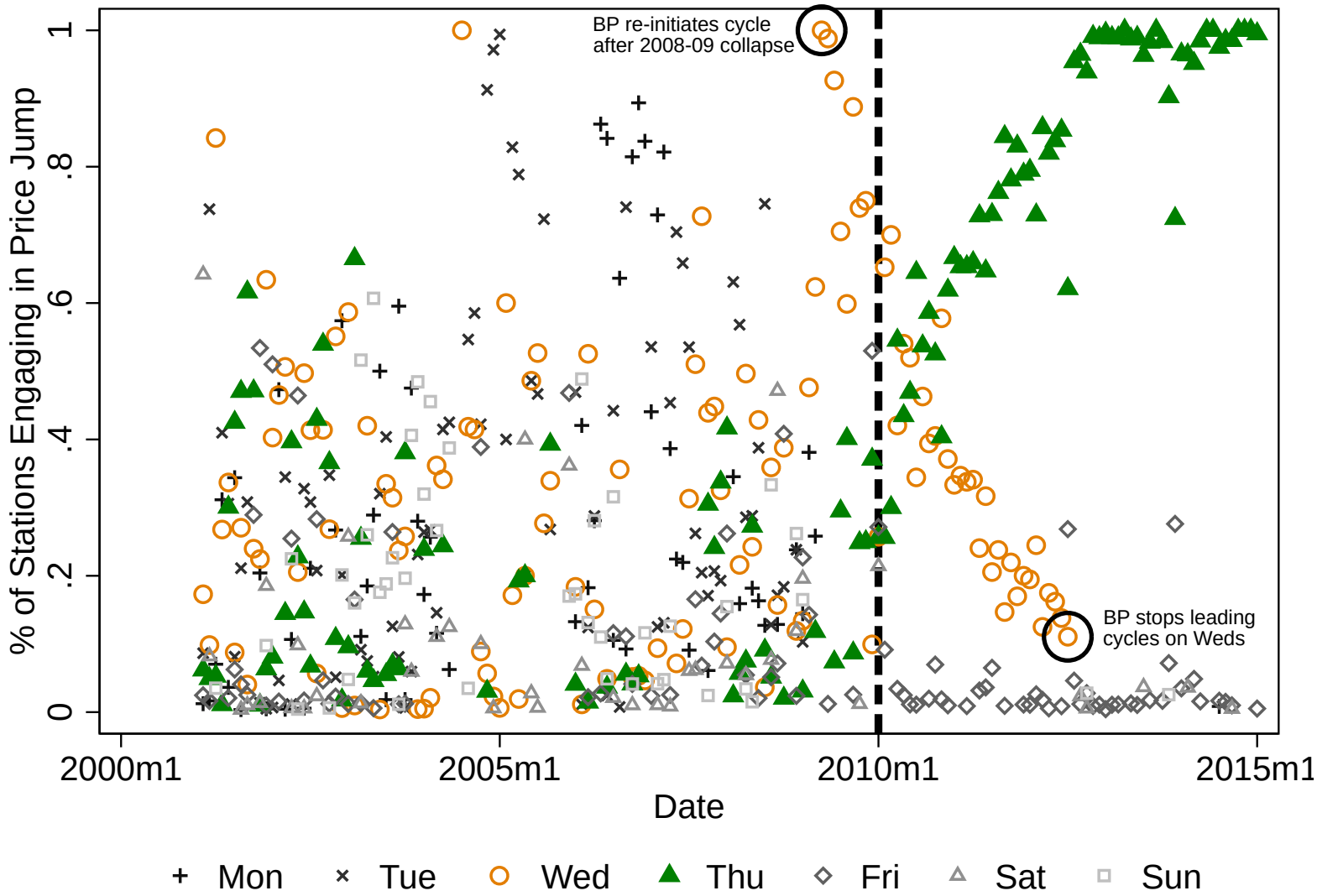
Focal point #1: Thursday price jumps

2013: No price leadership with price jumps



Focal point #1: Thursday price jumps

Stations' propensities to engage in Thursday Price jumps (BP)



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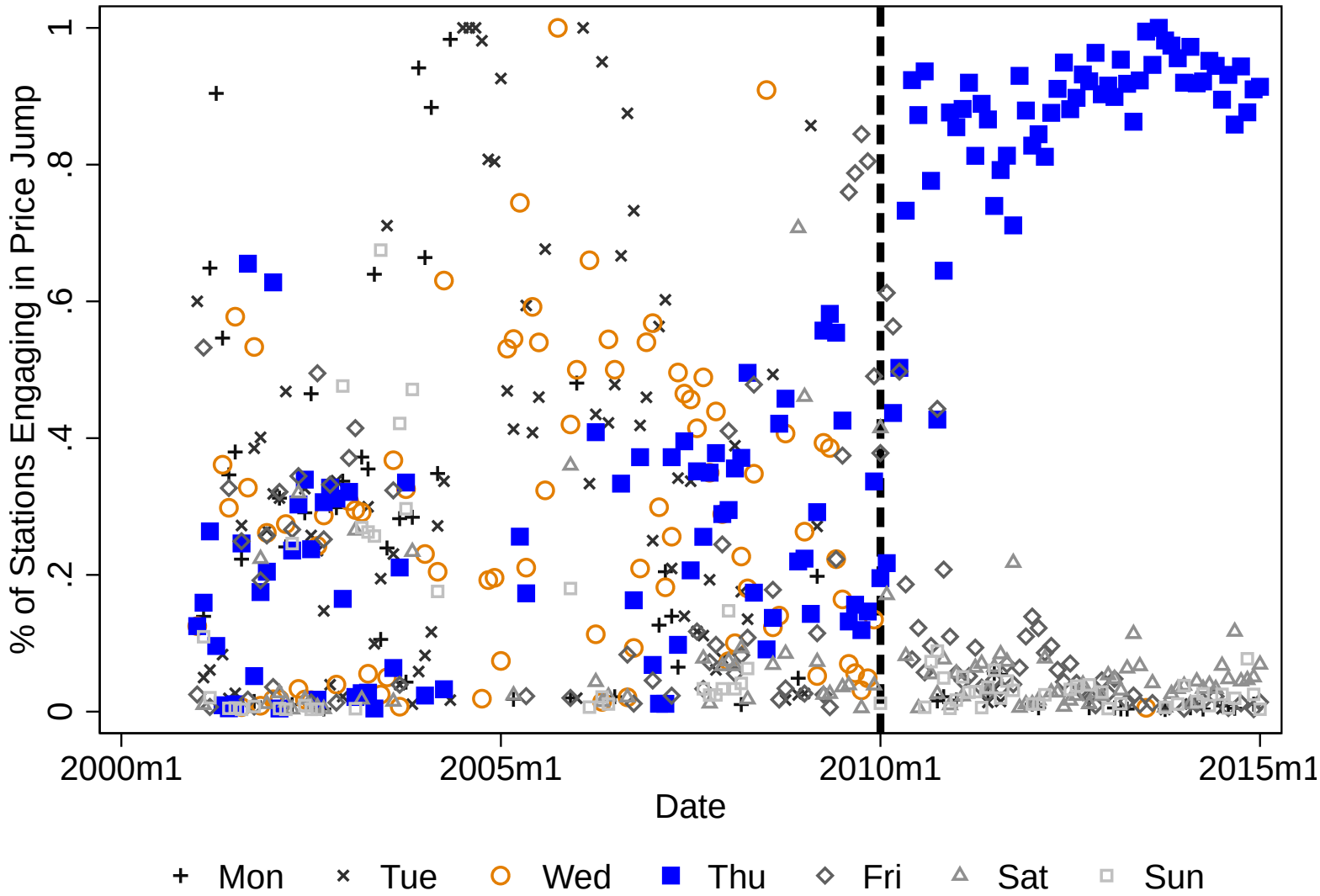
Stations' propensities to engage in Thursday Price jumps (Caltex)



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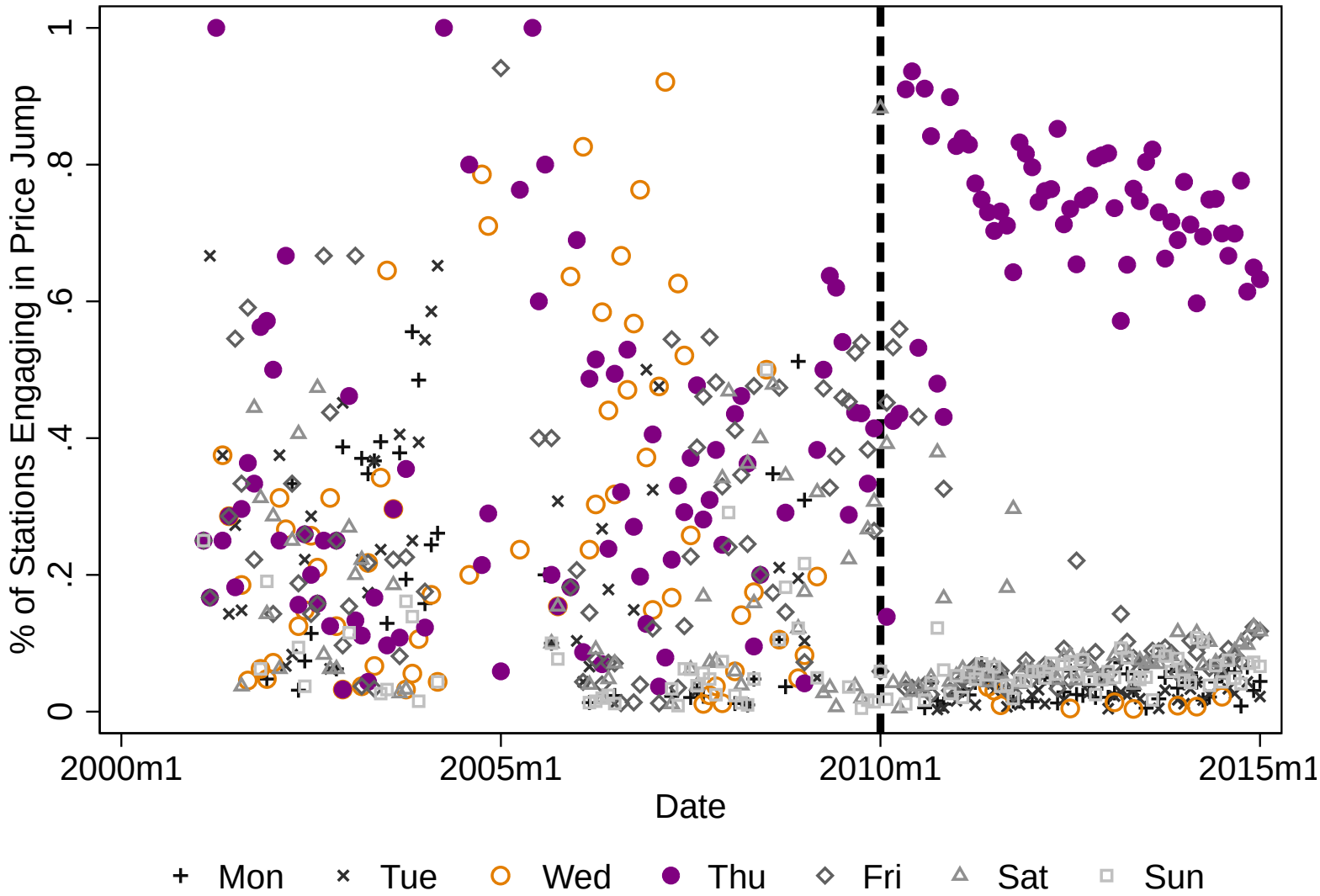
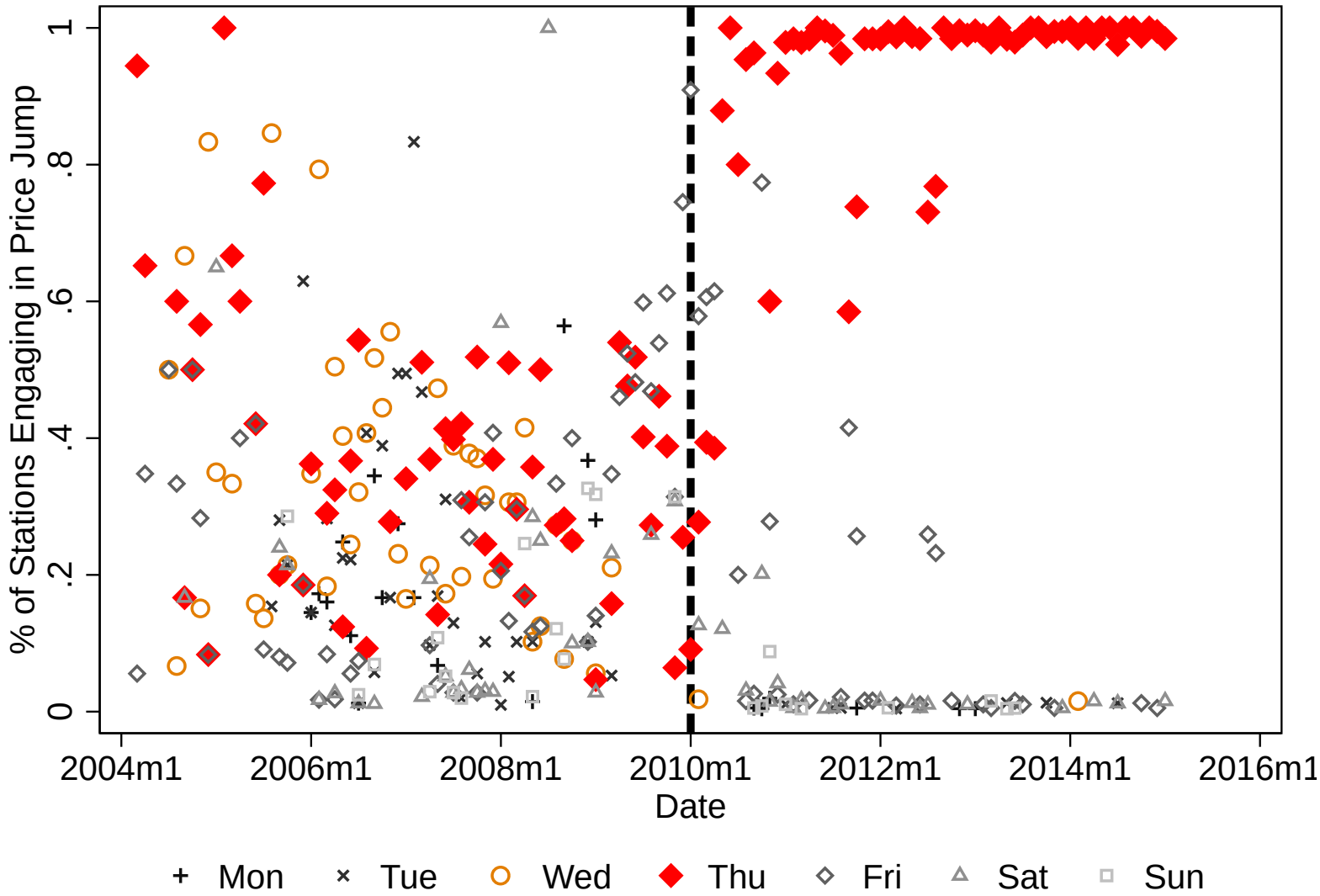
Stations' propensities to engage in Thursday Price jumps (Woolworths)



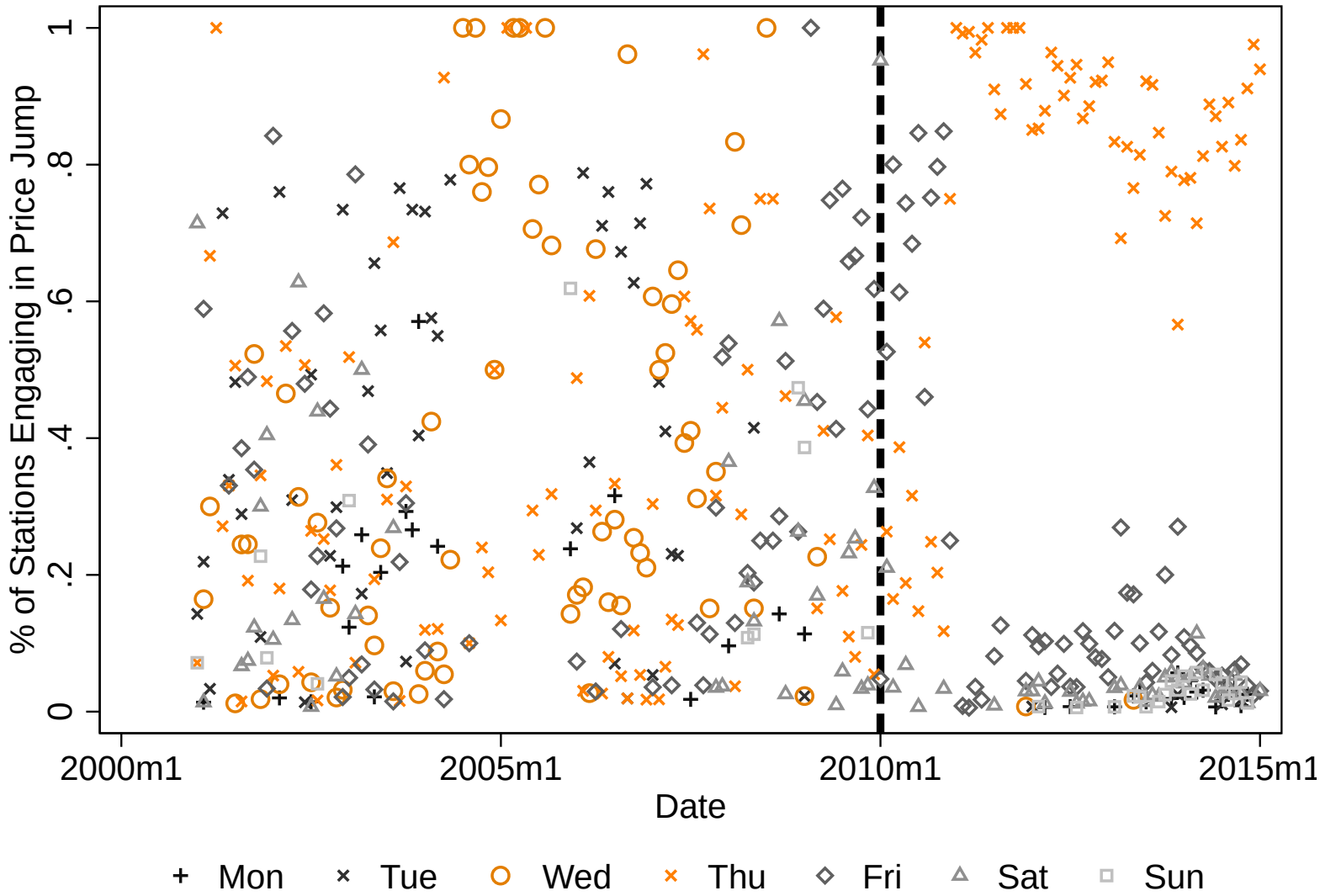
Focal point #1: Thursday price jumps

Stations' propensities to engage in Thursday Price jumps (Coles)



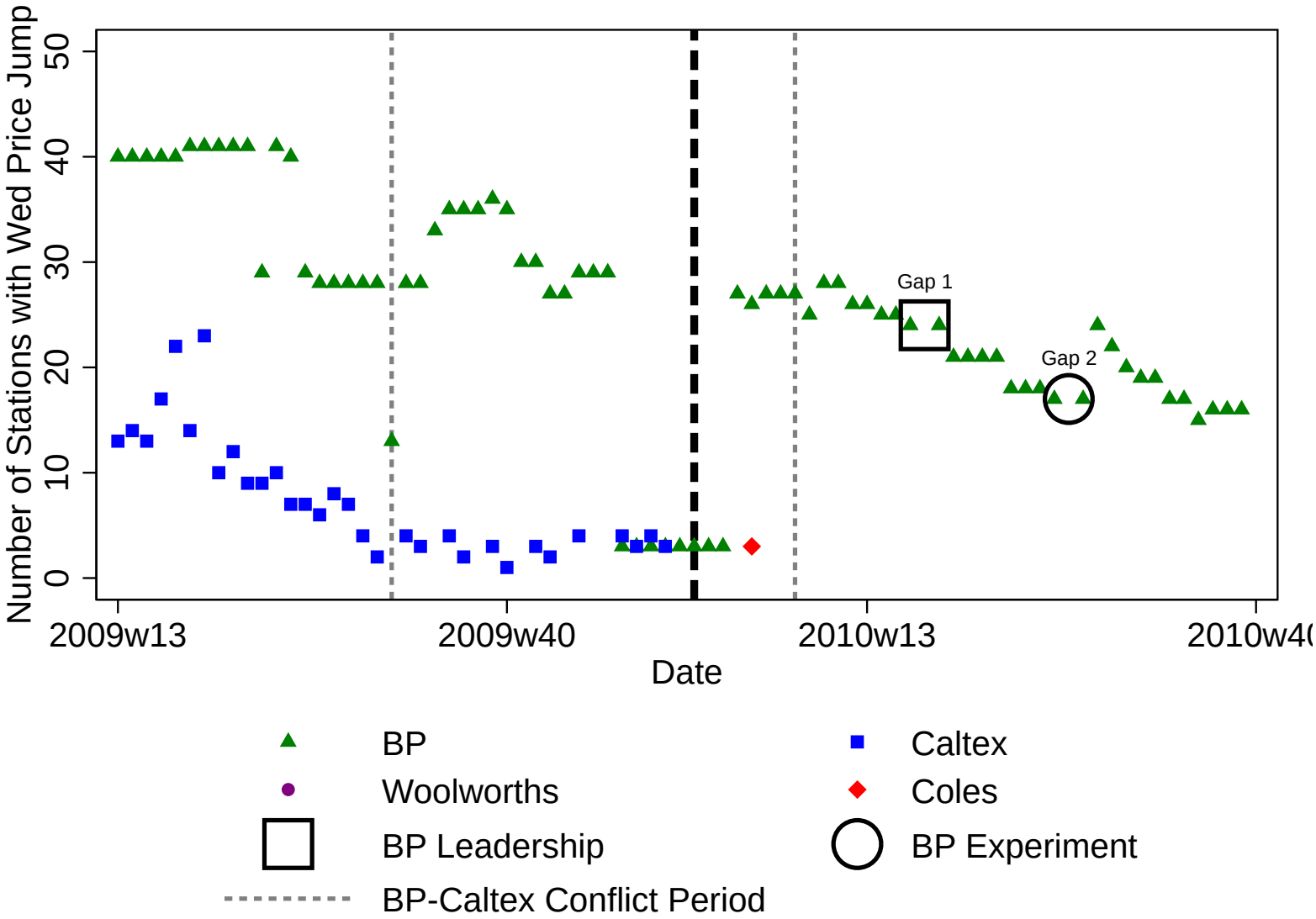
Focal point #1: Thursday price jumps

Stations' propensities to engage in Thursday Price jumps (Gull)



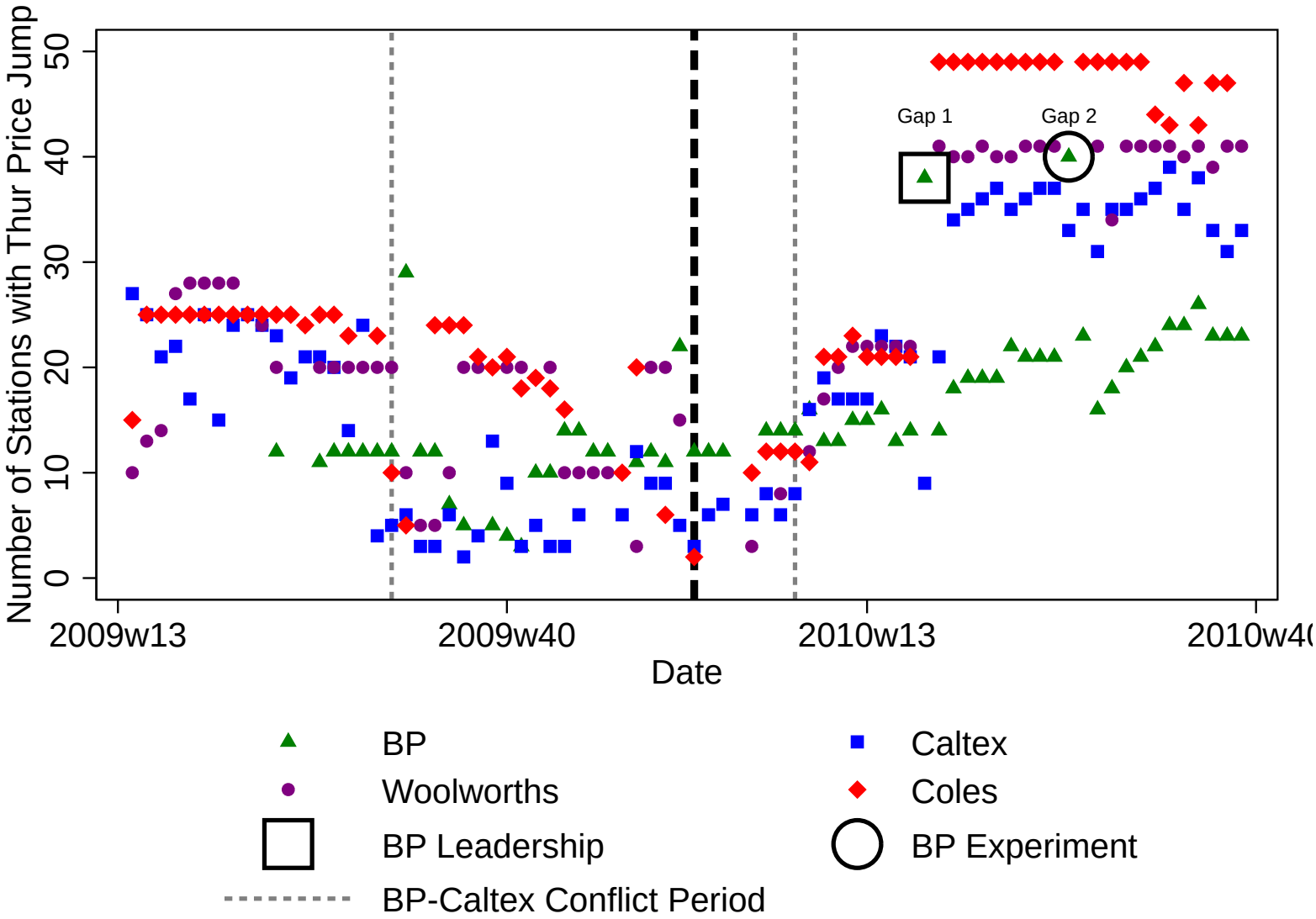
Focal point #1: Thursday price jumps

Zoomed in: **Wednesday** price jumps, all firms, start of 2010



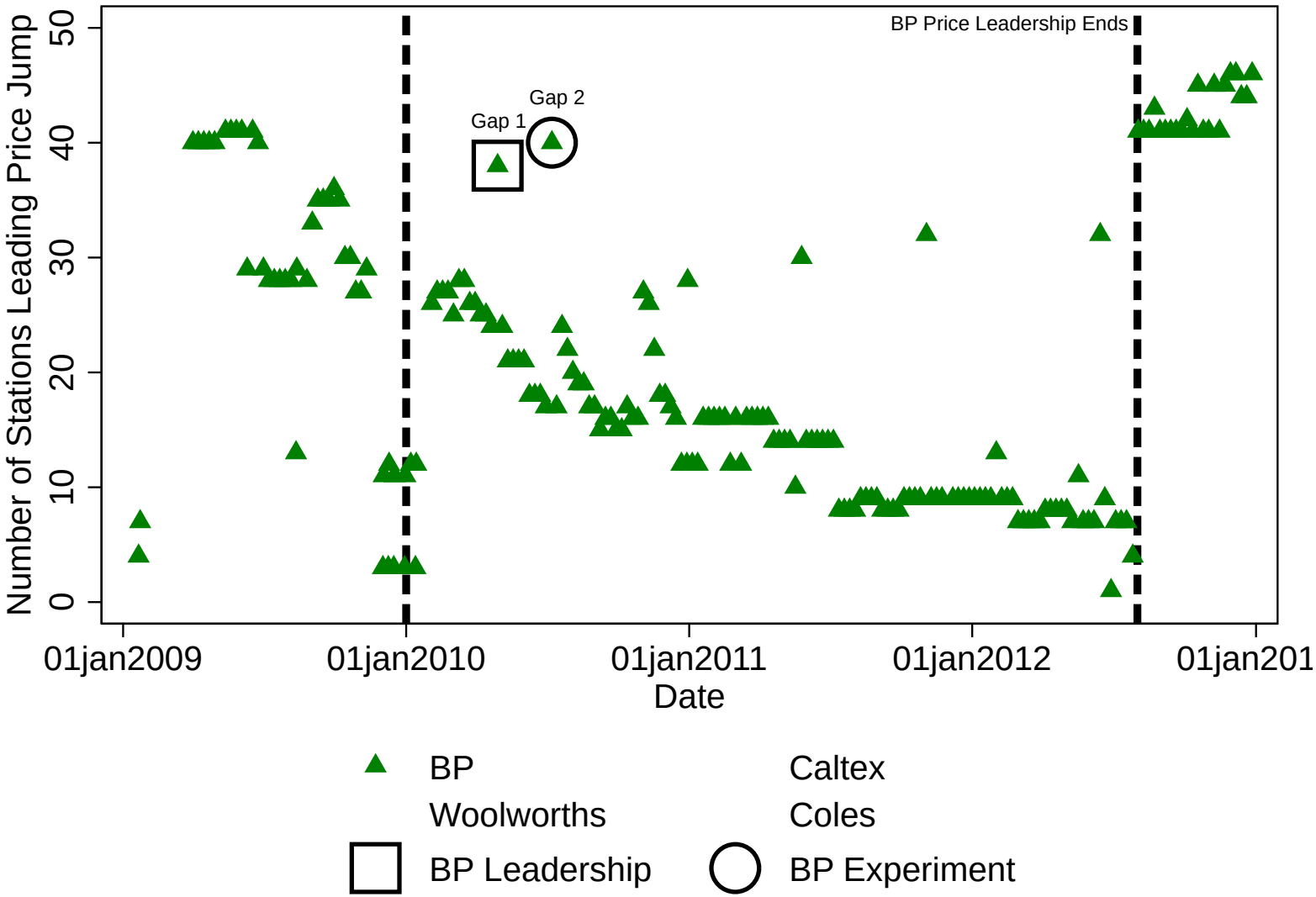
Focal point #1: Thursday price jumps

Zoomed in: **Thursday** price jumps, all firms, start of 2010



Focal point #1: Thursday price jumps

BP price leadership and experiments



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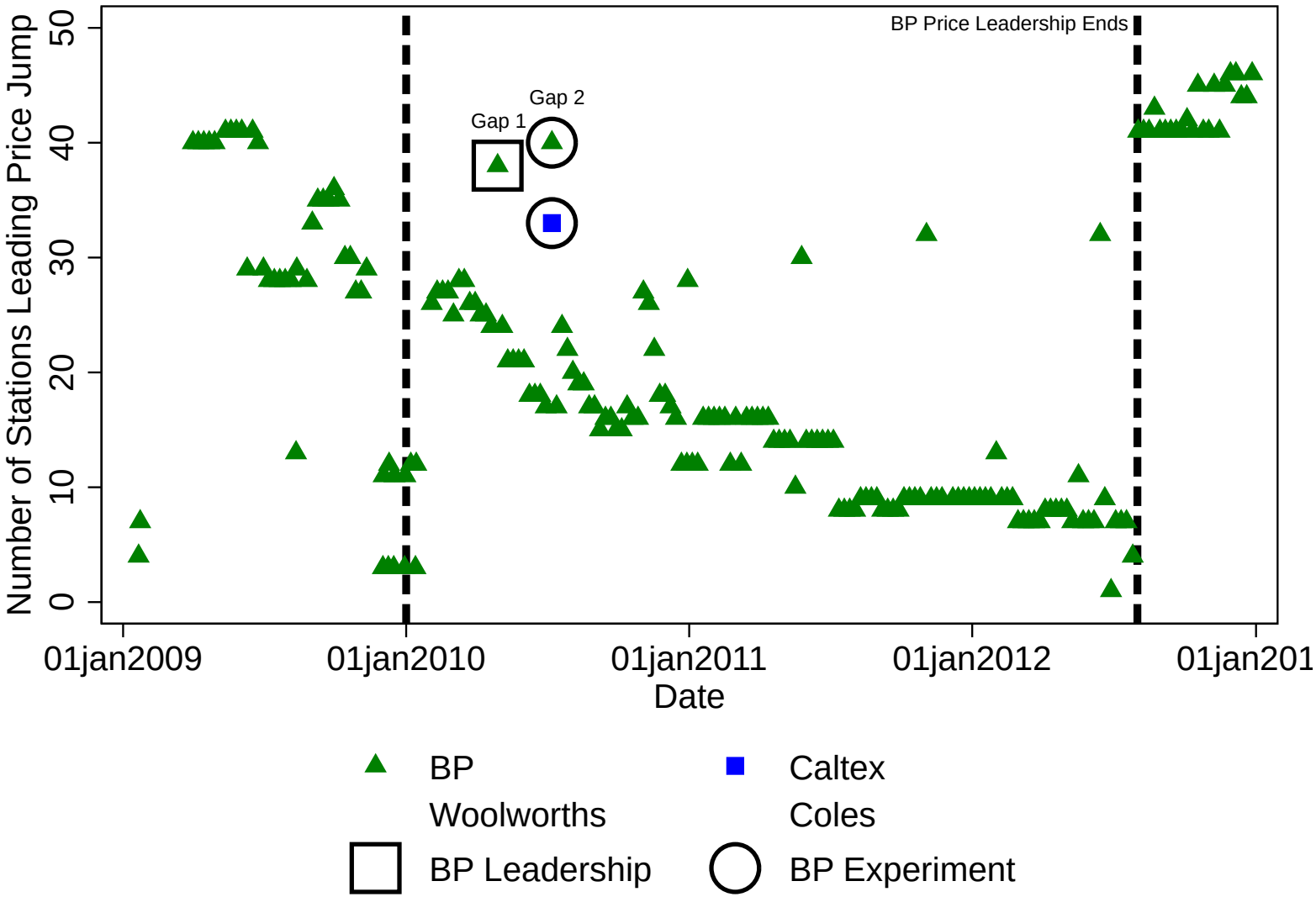

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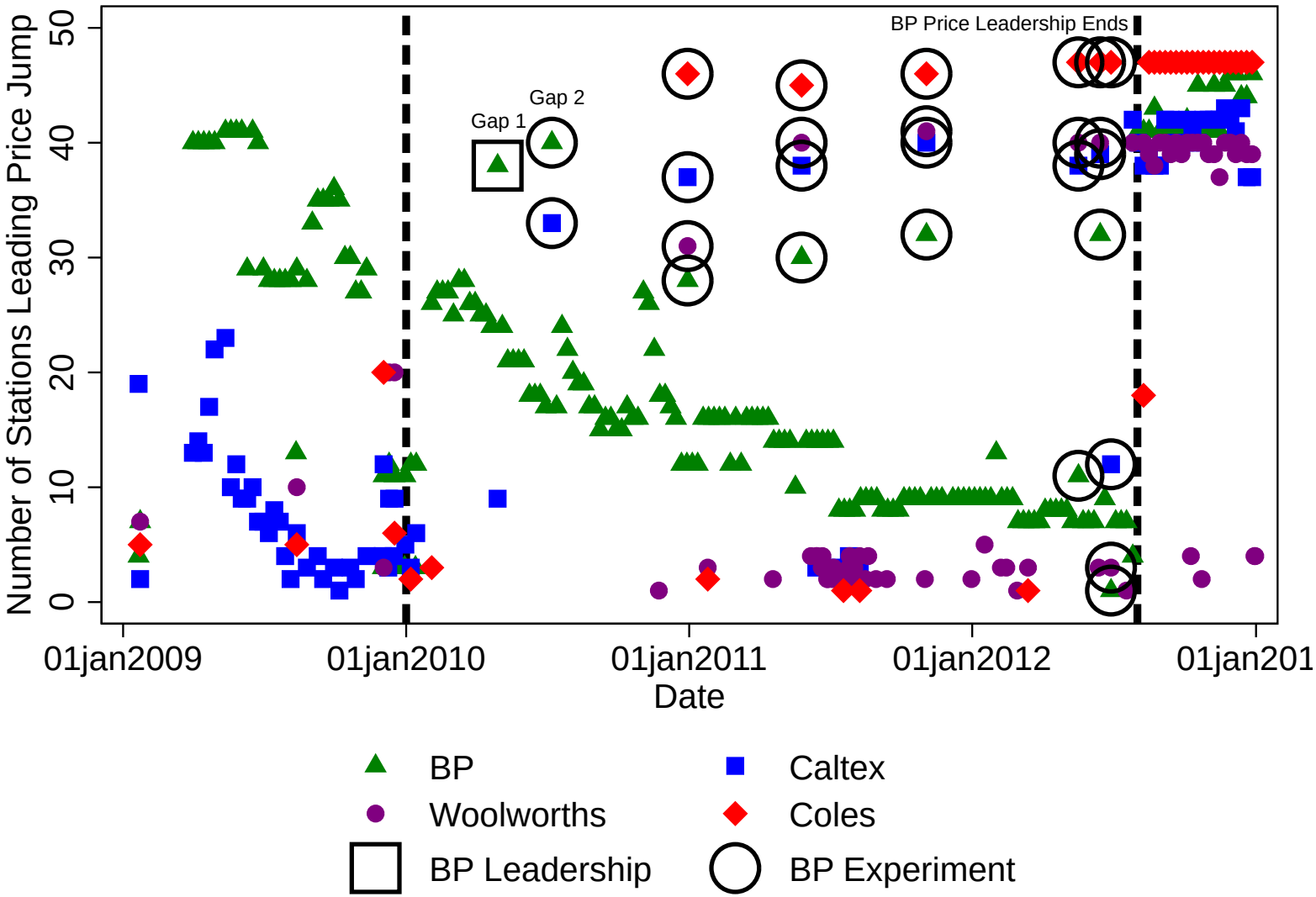
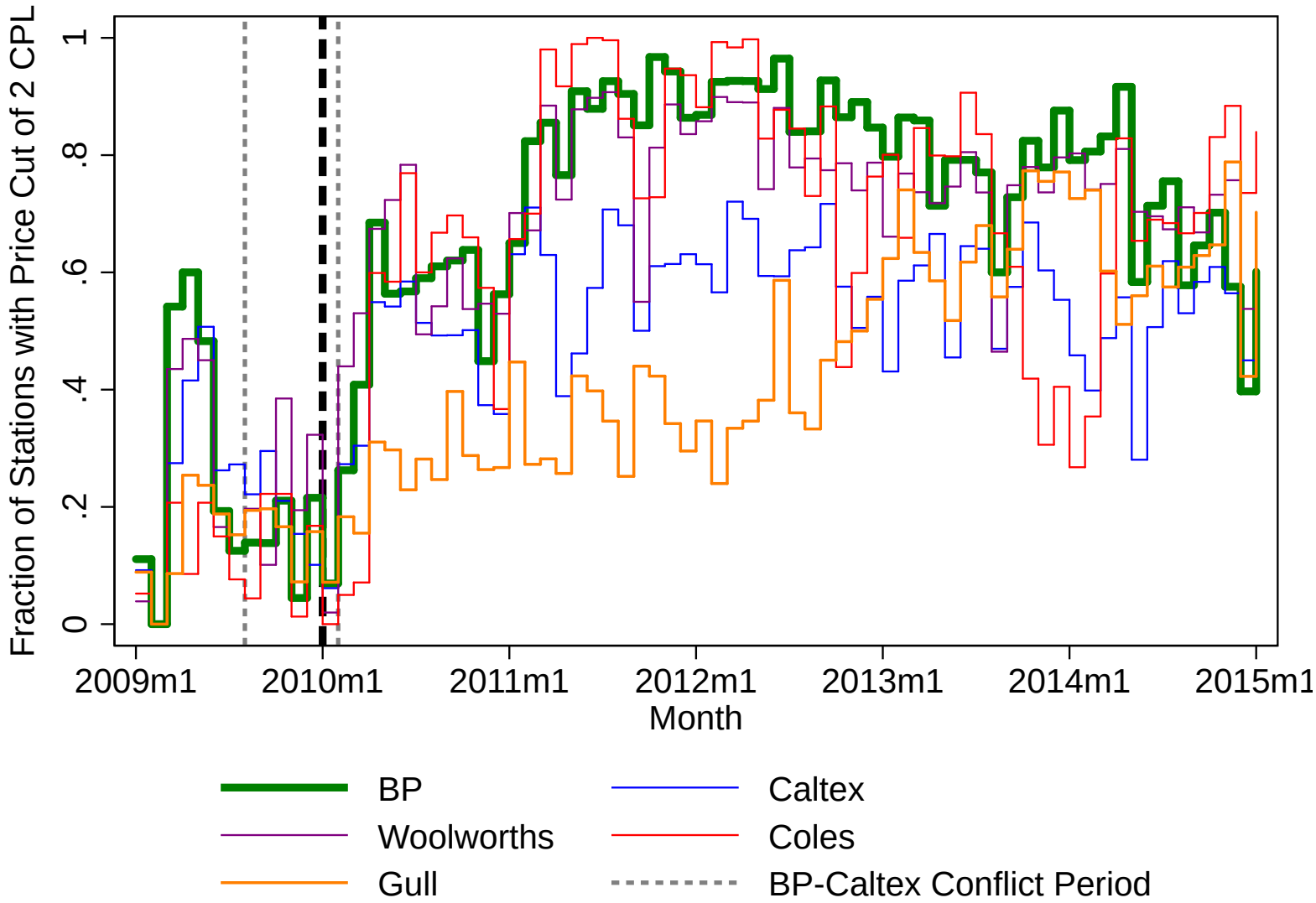


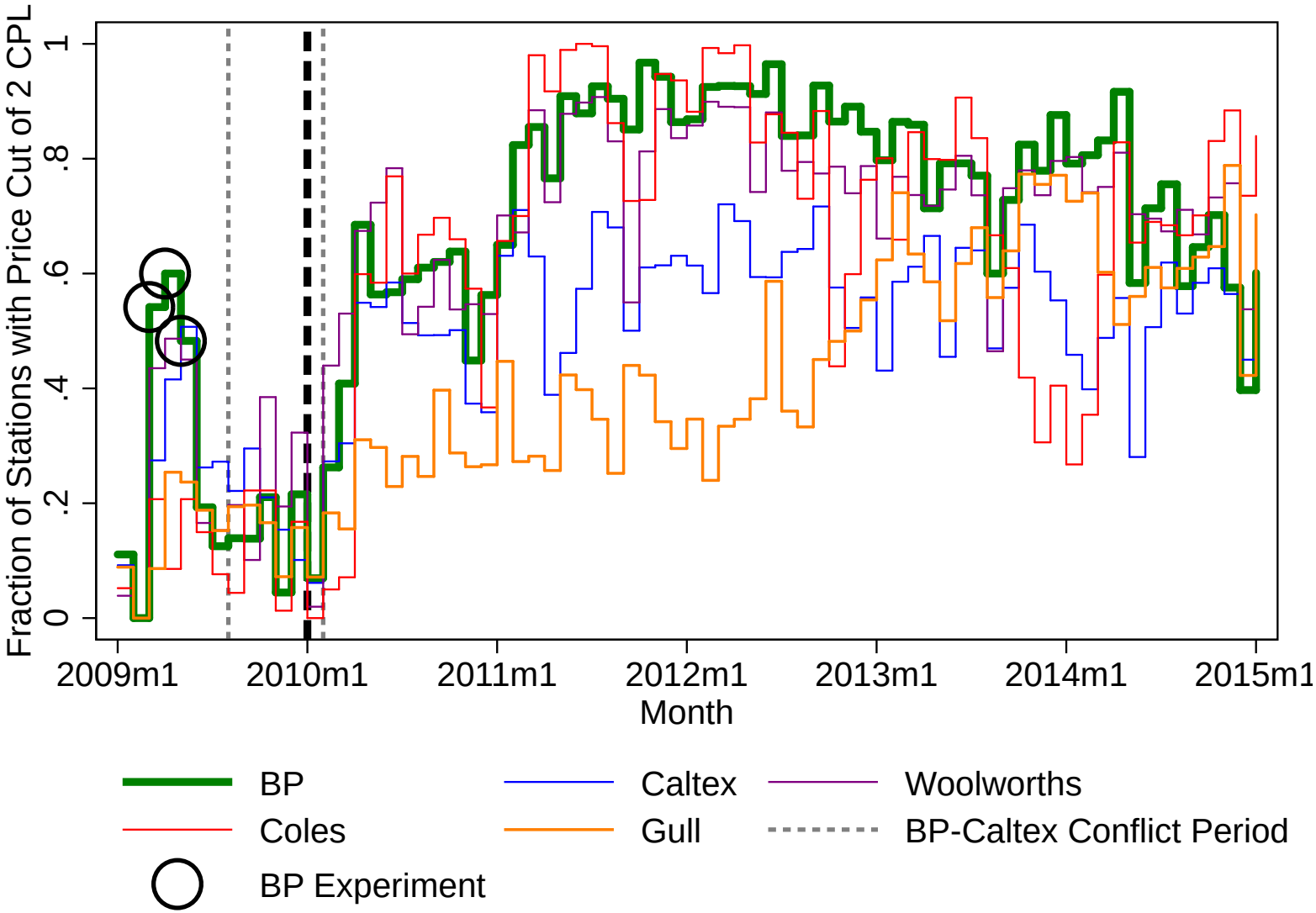
Focal point #2: 2 cpl price cuts

Stations' propensities to set 2 cpl price cuts



Focal point #2: 2 cpl price cuts

Testing the focal point



Summary

How is collusion initiated?

We found price leaders can establish focal points that facilitate tacit price coordination

Evidence points to experimentation is an important mechanism for initiating tacit collusion

- testing firms' willingness to coordinate on focal pricing rules
- communicating intentions to coordinate
- creating common knowledge regarding collusive pricing strategy

Price leadership and experimentation, not punishment, was used to resolved conflict

Collusive outcomes: enhanced margins, price stability, improved conflict resolution

Discussion

Academic relevance

Empirics speak to earlier (e.g., pre-repeated games) theories of tacit collusion

- price leadership: Bain (1968)
- focal points: Schelling (1960), Scherer (1967)

Findings point to recent theories of communication, experimentation, and learning in games as frameworks for collusion initiation (Crawford 2016; Fudenberg and Levine 2016)

Despite perfect monitoring of rivals' behavior...

- a relatively simple tacitly collusive pricing structure was implemented
- and it took 10 years for the pricing structure to emerge

Discussion

Policy implications

Results point to 2 aspects of market structure that can potentially facilitate coordinated effects

- firm size asymmetry
- price transparency policies

Using rich price data (e.g., long panel data at high frequency) to detect collusion at the initiation stage