DATA AND PRICE COMPETITION: THE SPECIAL ROLE OF INFORMATION ABOUT RIVALS' PRICES

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The growing use of automated pricing tools has important implications for consumers. While data-driven pricing can help firms optimize pricing and improve efficiency, the ability to monitor and respond to the prices of rivals can also soften competition and raise overall price levels in a market. Unlike other pieces of information, rival prices are a special input, and their role in pricing algorithms may merit regulatory scrutiny.

I. INTRODUCTION

Automated pricing tools are reshaping competition across a wide range of markets. These tools — already pervasive in online retail, ride-sharing, food delivery, and ticketing — adjust prices rapidly using data on current demand, inventory levels, consumer characteristics, and competitor pricing. As the costs of computing and data collection fall, the adoption of such tools is expanding into additional markets where pricing managers have typically set prices manually.

There is a growing debate over whether algorithmic pricing promotes efficiency or undermines competition. Policy discussions regarding algorithms and data have addressed the potential for price discrimination, enabling firms to charge different prices based on estimated customer willingness to pay. We argue, however, that a special concern arises from algorithmic tools that use *high-frequency data about rivals' prices*. Such tools can alter the nature of price competition itself and cause prices to rise across the board, even in markets with many competing firms. This occurs because algorithms that use rivals' prices as inputs can automatically raise prices in response to a price increase by rivals, softening competition and incentivizing rivals to raise prices. These algorithms can also "punish" rivals for setting low prices by quickly cutting their own prices. This behavior, which may appear to be competitive on the surface, has the opposite effect — it discourages price competition.

This paper focuses on the distinctive role of rival price data in shaping market outcomes and the implications for antitrust enforcement. We review how such data are currently used, present evidence from various industries, and discuss why this information is fundamentally different from other types of pricing inputs.

II. TYPES OF ALGORITHMIC PRICING

There are now a large number of third-party providers that sell pricing tools to online sellers. Many individual firms also invest heavily in proprietary pricing tools.

Pricing algorithms can be classified by the type of data used to set prices. One class of algorithms uses data on demand or supply to adjust prices dynamically. Examples include algorithms used by ride-hailing[2] and food delivery,[3] where there is some evidence that such algorithms can improve efficiency. Other algorithms use customer data to set personalized prices. These types of algorithms typically have mixed effects on consumers: some are harmed, while others benefit. Consumers may benefit on average, and those whom policymakers are most concerned about—such as price-sensitive consumers—may benefit most from personalized pricing.[4]

Another large class of pricing tools emphasizes the importance of monitoring rivals' prices. One tool, for example, states that "competitor price tracking and price monitoring software is a must."[5] Another states that "by monitoring competitor prices in real-time, we equip you with valuable insights to optimize your pricing and stay ahead in the market."[6] Moreover, pricing algorithm providers often emphasize that being able to monitor and adjust prices faster than competitors can give a firm a competitive advantage. For instance, a firm offering an algorithmic pricing tool notes that "businesses can compete more effectively by responding quickly."[7]

Some of the largest online retailers use proprietary tools to engage in surveillance of rival prices and quickly update their prices in response. U.S. antitrust regulators have noted that one major online retailer "can detect any price change virtually anywhere on the internet within hours."[8] Additionally, "if and when the lowest price by a monitored online store or marketplace seller increases," the firm can "automatically" adjust its price in response. This is also consistent with empirical evidence that finds that large online retailers appear to quickly respond to rivals' price changes.[9]

2 Castillo, Juan Camilo. *Who Benefits from Surge Pricing?* Forthcoming, Econometrica (2025).

3 MacKay, Alexander, Dennis Svartbäck & Anders G. Ekholm. *Dynamic Pricing, Intertemporal Spillovers, and Efficiency* (Harvard Business School Strategy Unit Working Paper, 2023).

4 For instance, see Dubé, Jean-Pierre, & Sanjog Misra. *Personalized Pricing and Consumer Welfare*. Journal of Political Economy, 131.1:131-189 (2023).

5 prisync.com, accessed April 29, 2025.

6 webdataguru.com, accessed April 29, 2025.

7 dealhub.io/glossary/dynamic-pricing/, accessed April 29, 2025.

8 See *Federal Trade Commission v. Amazon.com, Inc.* complaint, September 2023.

9 Brown, Zach Y. & Alexander MacKay. *Competition in Pricing Algorithms.* American Economic Journal: Microeconomics 15.2: 109-156 (2023).

Retail gasoline is another setting where firms increasingly use algorithms to facilitate price surveillance of rivals. Historically, retail gasoline managers often observed their competitors' prices once per day on the way to work in the morning and then manually adjusted prices.[10] Similar to online markets, pricing algorithm providers for gas stations advertise methods to "automate your process for tracking competitive fuel prices" in close to real time.[11]

Gasoline retailers are adopting pricing algorithms that increase the speed with which they adjust prices, which can drive up price levels.[12] Recent work has examined what happens when one gasoline retailer could no longer quickly observe and react to rival price changes due to a legal settlement.[13] The gasoline retailers with access to higher-frequency information on rivals' prices gained a competitive advantage. In this case, prices rose on average across all gas retailers.

These trends suggest that high-speed monitoring of rivals' prices is a central feature of pricing algorithms. Empirical evidence shows that faster price responses confer a strategic edge — raising concerns about asymmetric access to rival data.[14]

III. THE STRATEGIC ROLE OF RIVAL PRICE DATA

Why is it valuable for firms to monitor their rivals? When firms are engaged in competitive (i.e. Bertrand) pricing, prices should reflect information about demand and costs, such as the number of interested buyers, input prices, and inventories. Economic theory indicates that firms can determine the competitive price based on these types of information; rival prices matter only insofar as they determine each firm's "residual demand." When a firm knows its own residual demand, it can choose the optimal price directly — without observing rival prices. Algorithms that use better data on market conditions can, in theory, generate more efficient outcomes. When firms do not monitor market conditions, or when they have noisy measures of residual demand, they may consider using rival prices as a proxy for changes in demand or costs. However, the use of such information affects the strategic incentives of market participants directly.

The ability to monitor rivals' prices can facilitate collusion in traditional settings where firms set prices simultaneously, as there is a more immediate threat of punishment for deviations. Consistent with this idea, research from the era before pricing algorithms has found evidence that collusion can result from the publication of price information. A well-known case is that of the Danish concrete market.[15]

In settings where firms use automated pricing algorithms or rules, the use of data on rivals' prices raises additional issues that go beyond standard models of collusion. There are a wide variety of pricing algorithms that use data on rivals' prices, ranging from very simple rules to more complex machine learning approaches. As we discuss, even simple pricing rules can raise prices and can provide insight into the broader effects of more complicated algorithms.

Price matching is one simple approach that makes use of rival price data. Historically, there are instances of brick-and-mortar retailers announcing that they would match competitors' prices. Economists have long been concerned that price-matching guarantees could lead to higher prices since firms take into account the fact that a competitor with a price-matching policy will not undercut a price increase.[16] Under these policies, consumers often had to request that a retailer with a price guarantee match another retailer's price. With near real-time data on competitors' prices, firms can program an automated price-matching rule that does not require effort from consumers. To the extent that firms implement price-matching strategies, automatic monitoring and responses by algorithms provide rivals with a stronger incentive to raise prices.

10 See ``10 Fuel Pricing Best Practices", Price Advantage (2024), https://www.priceadvantage.com/resources/white-papers/10-fuel-pricing-best-practices/.

11 www.taigadata.com/front-office-platform/competitive-fuel-pricing/.

12 Assad, Stephanie, Robert Clark, Daniel Ershov & Lei Xu. *Algorithmic Pricing and Competition: Empirical Evidence from the German Retail Gasoline Market*. Journal of Political Economy 132.3: 723-771 (2024).

13 Byrne, David P., Nicolas de Roos, Matthew S. Lewis, Leslie M. Marx & Xiaosong Wu. *Asymmetric Information Sharing in Oligopoly: A Natural Experiment in Retail Gasoline*. Journal of Political Economy (2025).

14 Descriptive evidence consistent with this is presented in Brown, Zach Y., and Alexander MacKay. *Competition in Pricing Algorithms*. American Economic Journal: Microeconomics 15.2: 109-156 (2023).

15 Albæk, Svend, Peter Møllgaard & Per B. Overgaard. *Government- Assisted Oligopoly Coordination? A Concrete Case*. The Journal of Industrial Economics 45.4: 429-443 (1997).

16 Salop, Steven C, *Practices that (Credibly) Facilitate Oligopoly Coordination*. In New Developments in the Analysis of Market Structure, Edited by J. E. Stiglitz and G. F. Mathewson, 265-294, Cambridge, MIT Press (1986).

Another observed strategy among third-party sellers on Amazon is to undercut rivals by a small amount (e.g. 1 cent) and then reset prices at a high level when demand is low, such as in the middle of the night. By constantly resetting to a high price, these simple rules can increase average prices.[17] The use of reinforcement learning tools to set prices also requires high-frequency data on rivals' prices and can effectively implement a related strategy. These models can converge to a "win-stay, lose-shift" strategy in which a firm sets a high price if its rival also sets a high price, otherwise it sets a low price.[18] If both firms set a low price, the firm resets to a higher price.

Recent work explores the optimal strategies that firms could employ when they have access to higher-frequency information about rival prices than their competitors. Consider a setting in which one firm uses a pricing algorithm that provides a speed advantage over a rival. Economic analysis shows that the firm using this advanced algorithm can effectively "coerce" its slower competitor into setting higher prices by threatening a quick price reduction if the competitor refuses to set a high price.[19]

Under this regime — known as "algorithmic coercion" — prices can rise higher than they would under typical market competition, and the prices for some products may be even higher than they would if both companies explicitly colluded to maximize their joint profits. Because of this, consumers may even be worse off than they would be under standard collusion.

Unlike collusion, algorithmic coercion can occur when only one firm, the adopter of the algorithm, has a long-run view of future profits. It does not require any explicit communication or coordination between the competing firms, nor does it require all firms to employ dynamic punishment strategies. In fact, algorithmic coercion can occur even when the slower competitor does not understand the rival's algorithm and tries to learn how to set prices using simple trial-and-error methods, like A/B testing. Because the algorithm monitors and reacts to prices quickly, it can shift rivals' perceived profit functions (or, to come back to a term from earlier, perceived residual demand) in order to incentivize higher prices. Through this mechanism, algorithmic coercion can generate substantially higher prices even when there are many competitors.

IV. IMPLICATIONS FOR ANTITRUST ENFORCEMENT AND TRANSPARENCY INITIATIVES

The special role of rival price data has important implications for antitrust enforcement. In the United States, concerns about supracompetitive prices, including collusion, are traditionally challenged through Section 1 of the Sherman Act, which outlaws "every contract, combination…, or conspiracy, in restraint of trade." Antitrust regulators have emphasized that algorithms that engage in behavior that would be illegal for a real person, including cooperation to set prices, would still be in violation of the Sherman Act.[20] Yet, due to the mechanisms outlined above, algorithmic pricing tools raise concerns that may be difficult to address under current antitrust law. For example, the decision of a firm to use an algorithm to "coerce" its rivals — who may not even be aware of the algorithm — might not be considered a violation as it might not constitute an agreement.

Instead, with the goal of maintaining competitive prices, policymakers could consider using regulation to mandate transparency of the algorithms that firms use and/or govern the use of data. Many pricing algorithms are a "black box," making it difficult for regulators or researchers to audit the specific features of an algorithm. Pricing algorithms may leverage artificial intelligence or other intensive computations, which can make tracing the logic of the algorithms challenging. However, the complexity of the algorithms may be a moot point. The research highlighted above has shown that even simple pricing rules, such as those that are linear in their rivals' prices, can generate supracompetitive price levels, including full collusion[21] or coercion.[22] What is challenging for policymakers is that even knowing the exact pricing rule may not be enough to determine the impact of algorithms on price levels, as simple rules might also yield prices that are more competitive.

Rather than try to audit the specific features of an algorithm, it is more straightforward for regulators to determine what data are being used as an input into the algorithm. The discussion above highlights that algorithms that rely on real-time, or near real-time, data on competitors' prices may raise more concerns than algorithms that rely on information about demand or cost. This can facilitate rapid punishments by both firms or enable coercion by a single firm. Thus, regulators should be concerned about the overall rate of price changes and asymmetric access

17 Musolff, Leon. *Algorithmic Pricing, Price Wars and Tacit Collusion: Evidence from E-Commerce.* (Working Paper, Wharton School of the University of Pennsylvania, 2024).

18 Werner, Tobias. *Algorithmic and Human Collusion.* (Working Paper, SSRN 3960738, 2024).

19 Brown, Zach Y. & Alexander MacKay. *Algorithmic Coercion with Faster Pricing.* (Working Paper, 2025).

20 "FTC and DOJ File Statement of Interest in Hotel Room Algorithmic Price-Fixing Case," Federal Trade Commission (March 2024). https://www.ftc.gov/news-events/news/press-releases/2024/03/ftc-doj-file-statement-interest-hotel-room-algorithmic-price-fixing-case.

21 Brown, Zach Y. & Alexander MacKay. *Competition in Pricing Algorithms.* American Economic Journal: Microeconomics 15.2: 109-156 (2023).

22 Brown, Zach Y., & Alexander MacKay. *Algorithmic Coercion with Faster Pricing.* (Working Paper, 2025).

to price data that provide an advantage to certain firms. Limits on the granularity or frequency of price surveillance could ensure that no firm can coerce rivals by using faster pricing. Mandated time lags in using rival price data could also facilitate fair competition.

There have been concerns about whether common third-party pricing tools used by many sellers in a market can raise prices.[23] Similarly, upstream firms often facilitate information sharing across firms in a market. To the extent that this allows firms access to price information about their competitors, this may raise similar issues to those discussed above.

A related debate arises around price transparency initiatives. Countries increasingly have price transparency requirements in specific markets, such as in retail gasoline. For instance, Germany mandates that gas stations report price changes in real time. Victoria, Australia recently announced a policy requiring gas stations to publicly report price changes a day before they take effect. While the goal of many price transparency initiatives is to allow consumers to shop for low prices, firms are also utilizing price transparency data as an input for algorithms. While there is some evidence that price transparency tools can make consumers more sensitive to price,[24] increasing competition, policymakers should also be aware of how these tools could facilitate collusion or be embedded in anticompetitive pricing algorithms. If regulators develop price transparency initiatives to inform consumers, regulators should also take care that no firm has prioritized access that could give it a strategic advantage and yield higher market prices.

V. CONCLUSION

Policymakers and antitrust authorities should recognize that not all data used for pricing are created equal. While pricing algorithms can take a wide range of forms, algorithms that rely on high-frequency data about rivals' prices provide unique pathways for firms to increase market prices. Data that give firms a more complete picture of demand can improve efficiency, but access to competitors' prices is a distinct input that can alter competitive outcomes. Evidence from online retail and gasoline markets implies that faster and more detailed monitoring of rivals can lead to higher prices, harming all consumers. Pricing algorithms that use rival prices as an input have important implications for competitive conduct and deserve special attention in both empirical research and regulatory design.

23 See, for instance, Harrington Jr, Joseph E. *The Effect of Outsourcing Pricing Algorithms on Market Competition.* Management Science 68.9: 6889-6906 (2022).

24 Montag, Felix, Alina Sagimuldina & Christoph Winter. *Whom to Inform about Prices? Evidence from the German Fuel Market.* (Working Paper, Econstor No. 415, 2023).

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