Price Discrimination under Minimum Advertised Price Restriction *

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Abstract

A minimum advertised price (MAP) policy is a popular vertical restraint. We study retail pricing under MAP using price data of Seagate hard disk drives on US online retailers. The data suggest that MAP is not a form of minimum resale price maintenance (RPM). First, we find that retail prices are often lower than MAP. Second, retail prices of products subject to MAP have greater dispersions between retailers. Lastly, some retail prices can increase after a MAP decrease. These observations are consistent with the predictions of a search model that interprets MAP as a form of information restraint.

JEL Classification: L41, L81, D83

Keywords: search model; vertical restraint; minimum advertised price; resale price maintenance; online retail

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1 Introduction

In this paper, we provide empirical evidence that a minimum advertised price (MAP) policy is not a form of minimum resale price maintenance (RPM). MAP allows a manufacturer to restrict the minimum price that retailers advertise publicly on a price comparison website or a retailer's product pages. Retailers remain free to charge any price through negotiations or at checkout.

Researchers and legal practitioners have offered a range of interpretations of the MAP policy. A traditional view is that MAP and RPM impose similar vertical controls. Specifically, antitrust authorities and courts often do not distinguish MAP from RPM, and the two policies face similar legal challenges.[1] Economic analysis has shown that MAP would be equivalent to RPM if consumers anticipate being charged the advertised price (Asker and Bar-Isaac, 2018). Kali (1998), for example, treats MAP as a minimum resale price with an advertising subsidy. More recently, a different view has emerged. Asker and Bar-Isaac (2020) (henceforth AB) point out that, like in Diamond (1971), MAP is an information restraint that impedes consumer search, facilitates price discrimination, and increases profit without directly dictating retail prices. The welfare effect of MAP is theoretically ambiguous in this framework.

Given these views' different antitrust implications, it is important to establish empirical evidence on the effects of MAP and distinguish them from RPM. We use online retail prices of two lines of Seagate hard disk drives, Barracuda and Momentus, to study how MAP differs from RPM. We collect Seagate's publicly available MAP policies, which document each product subject to MAP, the specific dates of the policy, and the dollar values of MAP. We match these policies with daily retail prices of the same products on leading US online retailers from November 2011 to April 2013. In the resulting dataset, there are 9 products subject to MAP ("MAP products") and 23 other Barracuda and Momentus products not subject to MAP ("non-MAP products").

[1] We review the historical background on MAP's legality in Section 2. Also see, for example, Hinman and Shah (2008), Romano (2010) and Passo (2015).

Our empirical analysis presents three results that highlight the differences between MAP and RPM. First, we show that retail prices can often be lower than MAP. We observe nine MAP products in our sample. For two of them, retail prices are below MAP in more than half of the retailer-week observations. For the other seven products, retail prices are below MAP in more than 30% of observations. These observations show that MAP, unlike RPM, is not a hard bound on retail prices. We also argue that the violations are not likely due to lax enforcement.

Second, we find that retail prices of MAP products are more dispersed than those of non-MAP products. We argue that the opposite would be true if MAP were equivalent to RPM. Specifically, AB predicts that MAP as a price discrimination device can allow a manufacturer to induce retailers to set different retail prices for the same product. A binding RPM, on the other hand, should homogenize prices across retailers. We define dispersion as a product's weekly maximum-minimum retail price difference across retailers. Compared with non-MAP products, the price dispersion of MAP products is greater, consistent with AB. We also find that the weekly dispersion within a product is almost entirely driven by cross-retailer price differences as opposed to within-retailer, cross-day differences, suggesting a limited role of mixed pricing.

We then further investigate the source of cross-retailer price differences. We show that while most products are available on large retailers (Amazon, BestBuy, and Walmart), MAP products are sold on more niche retailers (such as Newegg). Compared with non-MAP products, the MAP product price difference is larger on niche retailers but smaller on large retailers. We argue that this result may be related to how MAP is enforced.

Finally, we examine how retail prices change after MAP is reduced. We derive a novel prediction from the AB model that, when MAP is reduced to account for declining consumer willingness to pay, retail prices may rise and retail price dispersions become smaller due to changes in retail pricing strategies. We find support for both outcomes in our data. This data pattern is hard to rationalize if MAP acts as binding RPM.

Literature and Contribution

A key novelty of this paper is to document empirical patterns consistent with AB's interpretation of MAP in a search model, where the retailers are offered symmetric contracts.[2] We emphasize MAP's role in shaping consumer search frictions through advertised prices. MAP is thus a concrete example of an obfuscation policy (Ellison and Ellison (2009)). This emphasis differs from some existing theoretical studies on vertical contracts in search markets, where contractual forms (linear vs. non-linear contracts) and asymmetric contracts have a more direct impact on retail prices, and the level of search frictions is not the manufacturer's choice (for example, Mathewson and Winter (1984), Garcia and Janssen (2018), Janssen (2020), Janssen and Reshidi (2023)).[3] Like MAP, recommended retail prices or manufacturer suggested retail prices (Lubensky (2017), De los Santos et al. (2018), Faber and Janssen (2019) and Janssen and Reshidi (2022)) also affect consumer search, but they do so by conveying information about production costs and the equilibrium distribution of retail prices.[4]

This paper is one of the few empirical investigations of MAP's effects despite its widespread use.[5] MAP has even spawned a secondary industry that monitors compliance due to the large volume of products covered under MAP, especially in online markets. Israeli, Anderson, and Coughlan (2016) and Israeli (2018) study the enforcement of MAP. They provide evidence that MAP is not a lower bound on retail prices. We further contribute to understanding

[2]We focus on the implication of the pure-strategy equilibria, and we find that most of the price dispersion is explained by price differences across retailers, as opposed to differences within a retailer and over time. A number of papers (such as Varian (1980), Narasimhan (1988) and Zhou et al. (2015)) characterize the mixed strategy equilibria in search markets. Seim and Sinkinson (2016) and Nishida and Remer (2018) empirically estimate models of consumer search when prices are randomized. Frequent price changes are also documented in Dubois and Perrone (2015), which study unannounced promotions, and Aparicio et al. (2024) which focus on online retailers' use of algorithmic pricing.

[3]See, for example, Baye et al. (2006), for a review of search models. A large body of empirical work tests and estimates models of consumer search (for surveys, see, for example, Chintagunta (2017) and Honka et al. (2019)), where the elimination of search costs has been found to significantly increase consumer welfare in many cases.

[4]More broadly, a large body of theoretical and empirical work explores the implications of vertical contracts. See, for example, Lafontaine and Slade (2007), Rey and Vergé, 2008, and Lee et al. (2021) for surveys.

[5]AB provides examples of MAP policies in over 40 product categories.

the effects of MAP by providing new empirical evidence that MAP is a price discrimination device and has distinct effects from RPM, for which we find data patterns that are best explained through a parsimonious but formally-specified equilibrium model. While this paper does not study how MAP products are chosen or estimate the causal effect of imposing MAP on prices, we find meaningful differences in the retail pricing of products with and without MAP, which are inconsistent with the implications of RPM. These differences suggest that MAP is not RPM, and antitrust regulators should not confuse their competitive effects.[6]

The rest of the paper proceeds as follows. First, we review the historical legality of MAP in Section 2. In Section 3, we briefly summarize the AB model. In Section 4, we discuss our setting and data. We present our empirical analysis in Section 5. Section 6 concludes.

2 An Overview of MAP's Legality

In the US, the legality of MAP has changed over time. Historically, US antitrust law treated any form of vertical price-fixing—including minimum resale price maintenance (RPM)—as *per se* illegal. The Supreme Court's 1911 decision in *Dr. Miles Medical Co. v. John D. Park & Sons Co.* condemned minimum retail price policies, equating them to naked price-fixing cartels (SCOTUS, 1911). Authorities saw MAP policies as similarly influencing retail prices and deemed their use also per se illegal (Federal Trade Commission, 2000). A significant shift occurred with *Leegin Creative Leather Products, Inc. v. PSKS, Inc.* (2007), where the Supreme Court overruled the *per se* ban and held that vertical price restraints like RPM and MAP must be judged under a rule of reason (SCOTUS, 2007). Nowadays, many manufacturers in the US employ MAP to avoid antitrust scrutiny. A MAP policy restricts the advertised price but does not prohibit the retailer from selling at a lower unadvertised price, making it more defensible than explicit RPM agreements (Lindsay and Monts, 2020). In addition, MAP asserts unilateral imposition and avoids being construed as "an agreement between multiple parties" that may violate the Sherman Act (Albert, 2011).

[6] Xia (2024) studies the welfare effects of RPM. For a review of earlier studies on RPM, see MacKay and Smith, 2017.

The legality of MAP varies across other countries. The European Union treats RPM as an antitrust violation and views MAP as similar to RPM. The European Commission and the Court of Justice of the European Union (CJEU) have consistently interpreted minimum resale price agreements as “restrictions by object” due to their inherent potential to restrict competition, particularly in the context of vertical agreements (European Commission, 2022b; Rosas et al., 2023). The European Commission’s Vertical Block Exemption Regulation (VBER) explicitly blacklists RPM, denying it any safe harbor (European Commission, 2022a). Importantly, a supplier-imposed floor on advertised prices is viewed as equivalent to RPM in effect (Ennis and Kuhn, 2021). The United Kingdom’s treatment of RPM and MAP has largely paralleled this approach. The Competition and Markets Authority emphasizes that MAP is an indirect form of RPM, which is illegal in the UK (Competition and Markets Authority, 2016). In Canada, the illegality of MAP requires proof of competitive harm (Competition Bureau Canada, 2022), which is closer to the US approach.

Overall, the legality of MAP is closely related to that of RPM in many countries. Therefore, it is important to understand whether the two policies indeed have similar effects. In the following analysis, we provide theoretical motivation and empirical evidence that MAP and RPM have distinct effects.

3 Theory

In Section 3.1, we describe the premise of the search model in AB and summarize the main results. Specifically, AB shows that under MAP, it is sometimes optimal for a manufacturer to induce a pure strategy price discrimination equilibrium in the retail market. Then in Section 3.2, we discuss the model’s implications that are testable in data.

3.1 AB's Search Model

3.1.1 Setup

A manufacturer sells identical products at zero marginal cost to two retailers, which then sell to a continuum of consumers with unit demand.

There are two types of consumers: a high-type with willingness-to-pay equal to h and a low-type with willingness-to-pay equal to $\ell < h$. The fractions of high and low-types are $(1-\lambda, \lambda), \lambda \in [0,1]$. High-type consumers observe the advertised prices of both retailers and always visit the retailer with the lowest advertised price. These consumers will visit at most one retailer, and they visit either retailer with equal probability if the advertised prices are equal. We also assume that the high-type does not visit the other retailer if the retail price in the visited store is higher than h. The high-type does not observe retail prices until she visits a retailer, and she makes a purchase only if the retail price is no higher than her willingness-to-pay.

Low-type consumers observe the retail prices of both retailers and always visit the retailer with the lowest retail price. If the retail prices are the same, and they are no greater than ℓ, a low-type consumer buys from either retailer with equal probability.

The manufacturer gives the same contract to both retailers. The contract consists of a per-unit wholesale price $w \geq 0$ and a lump-sum fee $T \geq 0$. We will separately discuss whether the contract also imposes a minimum advertised price p^{MAP}. We assume truthful advertising, meaning that retailers do not advertise prices below their retail prices.

3.1.2 Timing and Information Structure

The timing is as follows: (1) the manufacturer sets the same contract for each retailer, (2) retailers accept or reject the contract, (3) retailers set their retail prices and advertised prices, and (4) consumers visit stores and decide whether to purchase a product.

The game assumes complete information among the manufacturer and retailers: they observe the contract terms (w, T) and the minimum advertised price p^{MAP} if the manufacturer chooses to impose it. They understand the distribution of consumer types. They also observe the acceptance decisions in the second stage and pricing decisions in the third stage. Consumers then observe the retail or advertised prices depending on their types.

3.1.3 Pricing Without MAP

In this case, the manufacturer offers the same contract that consists of the wholesale price and the lump sum fee to both retailers. The manufacturer does not impose any restraint on advertised prices.

We first note that, in any pure-strategy subgame perfect Nash equilibrium, the two retailers set the same retail and advertised prices. If retail prices differ, the lower-priced retailer would advertise a lower price and attract more consumers than its rival, causing the rival to reduce its retail price. When retail prices are the same, advertised-price competition drives advertised prices down to the common retail price.

Given these conditions on the strategies, we can compute the manufacturer profits to determine the optimal wholesale contract and retail price. Specifically, when the manufacturer sets the wholesale price at h to sell only to the high valuation consumers, it captures all variable profits $h(1-\lambda)$ of the retail sales. Alternatively, the manufacturer sets the wholesale price at ℓ to sell to all consumers and earns a profit of ℓ. The lump sum fee is 0 in both cases. Therefore, the manufacturer chooses to induce the retail price of h when $(1-\lambda)h > \ell$.

3.1.4 Pricing with MAP

We still focus on the pure-strategy subgame perfect equilibrium with a symmetric wholesale contract and truthful advertising. In addition to the wholesale price and lump sum fee, the manufacturer can additionally set the MAP.

First, if the manufacturer wishes to induce a uniform price equilibrium among retailers with a retail price at ℓ or h that we described in the previous section, there is no need to impose MAP. In this case, MAP can be set at any value below the desired retail price, and retailers advertise at the retail price.

Second, we describe a price-discrimination equilibrium identified in AB. In this equilibrium, the manufacturer sets MAP at h, one retailer sets a price of ℓ and the other sets a price of h. As a result, both retailers advertise at h,[7] and high-type consumers, who decide on which retailer to visit based on the advertised prices, are indifferent between the retailers and randomly visit one of the retailers with equal probability. Therefore, both retailers will be visited by $\frac{1}{2}(1-\lambda)$ number of high-type consumers. The low-type consumers, who decide which retailer to visit based on the retail prices, visit the lower-priced retailer. The manufacturer chooses the wholesale price to ensure that neither retailer has incentives to deviate from the retail prices. This condition yields a unique wholesale price, at which both retailers earn the same variable profit.[8] Then the manufacturer uses the lump sum fee to extract their surplus. The manufacturer profit is thus the total retail revenue by selling to all low-type consumers and half of the high-type at ℓ and to half of the high-type at h, which is $\frac{1}{2}(h(1-\lambda)+\ell(1+\lambda))$.

Because $h > \ell$, we note that this variable profit always exceeds the uniform retail price equilibrium at ℓ. However, when the high-type consumer valuation h is sufficiently high or their fraction $1-\lambda$ is close to 1, the manufacturer profit in the uniform retail price equilibrium at h, $(1-\lambda)h$, can still be higher. Below, we formalize these results, which are based on Proposition 1 and Corollary 1 in AB.

Proposition 1.

1. *If $\frac{1-\lambda}{1+\lambda}h > \ell$, it is optimal for the manufacturer to set a wholesale price of $w = h$, a lump sum payment $T = 0$ and any $MAP \in (0, h)$. Both retailers set a retail price of h.*

2. *If $\frac{1-\lambda}{1+\lambda}h \leq \ell$, it is optimal for the manufacturer to set a wholesale price of $w =$*

[7] We assume that retailers fully comply with the MAP policy. Israeli et al. (2016) show that compliance with MAP among first-party retailers, which are retailers in our data that directly buy from the manufacturer and sell to the consumers, is at 78%-85%.

[8] Specifically, the retailer pricing at h earns a variable profit (before the lump sum payment) $\pi_h = \frac{1-\lambda}{2}(h-w)$, where w is the wholesale price. To ensure that this retailer does not deviate and set a price just below ℓ to undercut its rival, the current profit must be no smaller than the profit after deviation, which is $\pi_\ell = \left(\frac{1-\lambda}{2}+\lambda\right)(\ell - w)$. Similarly, the retailer pricing at ℓ must prefer its current profit, π_ℓ, to the profit when it deviates to a retail price just below h, π_h. Therefore, the equilibrium wholesale price is determined by $\pi_\ell = \pi_h$.

$\frac{\ell(1+\lambda)-h(1-\lambda)}{2\lambda}$, *a lump sum payment* $T = \frac{(h-\ell)(1-\lambda^2)}{4\lambda}$, *and a MAP of* h. *A retailer sets a retail price of* h *and the other sets a price of* ℓ.

Equilibrium Advertised Prices Under MAP. Both retailers advertise at h, regardless of which contract the manufacturer chooses in Proposition 1. To see this, note that if the retailers were to advertise above h, they would lose high-type consumers. Retailers also would not advertise below h under the first contract given that the advertised price must be truthful. Under the second contract, retailers cannot advertise below h, which is the MAP set by the manufacturer.

Optimal Choice of MAP. For the manufacturer, a MAP of h is optimal in this case, because any higher MAP would cause retailers to advertise a price higher than h and lose the high-type consumers. At any MAP lower than h, the retailer selling at h still has to truthfully advertise at h, but the retailer selling at ℓ would advertise at $\max\{\ell, p^{\text{MAP}}\} < h$, attracting all high-type consumers. The retailer selling at h thus could profitably deviate to match the lower advertised price. As a result, the overall variable profits the manufacturer could capture is lower.

3.2 Testable Implications

Using this model, we highlight three implications that would contrast with the effects of RPM.

MAP Is Not A Bound on Retail Prices

First, MAP does not impose a lower bound on retail prices, but a minimum RPM does. If MAP binds retail prices like RPM, we should not frequently observe retail prices lower than MAP.

MAP Products Have Greater Price Dispersions Across Retailers than non-MAP Products

Second, the retail price dispersion of MAP is likely greater than that of non-MAP products. Based on Proposition 1, the manufacturer need not impose MAP (and thus incur any potential enforcement costs) when, for some consumer valuations,[9] it is optimal to induce a retail price of h and sell to just the high-type consumers. In contrast, Section 3.1.3 shows that MAP allows the manufacturer to improve its profit whenever the wholesale contract under MAP induces retail price dispersion. This endogenous MAP choice would imply that retail price dispersion is greater for MAP products when compared with non-MAP products. In comparison, binding RPM homogenizes retail prices. Therefore, under AB's interpretation, MAP products would have greater retail price dispersion than non-MAP products. The opposite would be true if MAP were equivalent to RPM.[10]

Some Retail Price May Rise When MAP is Reduced

Third, we show that some retail price can increase when a manufacturer lowers MAP. To see this, we use Figure 1 to visualize the conditions under which the manufacturer induces different strategies described in Proposition 1. When consumer valuations (h, ℓ) are in the brown region, the manufacturer induces retail price dispersion as in the second strategy of Proposition 1. In the blue region, the manufacturer prefers to induce uniform retail pricing at h. The separation of the two regions is along the line $\frac{1-\lambda}{1+\lambda}h = \ell$.

We then show that a MAP decrease could correspond with a change in retail pricing-strategy. Suppose that the consumer valuations (h, ℓ) are in the brown region. Given the optimal manufacturer contract, the retail prices are h and ℓ. When the valuations decrease,

[9]The manufacturer can profitably impose MAP and earn a higher profit whenever the no-MAP optimal contract induces the uniform-price equilibrium at ℓ. When $\dfrac{1-\lambda}{1+\lambda}h < \ell < (1-\lambda)h$, the optimal no-MAP contract induces the uniform retail price equilibrium at h, but a manufacturer can earn a greater profit if it imposes MAP and induces the price-discrimination equilibrium.

[10]AB also considers an alternative model where all consumers have high search costs and downward sloping demands (as opposed to heterogeneous consumers with unit demand). In this case, binding RPM eliminates price dispersion, while MAP induces dispersions and can earn the manufacturer a higher profit.

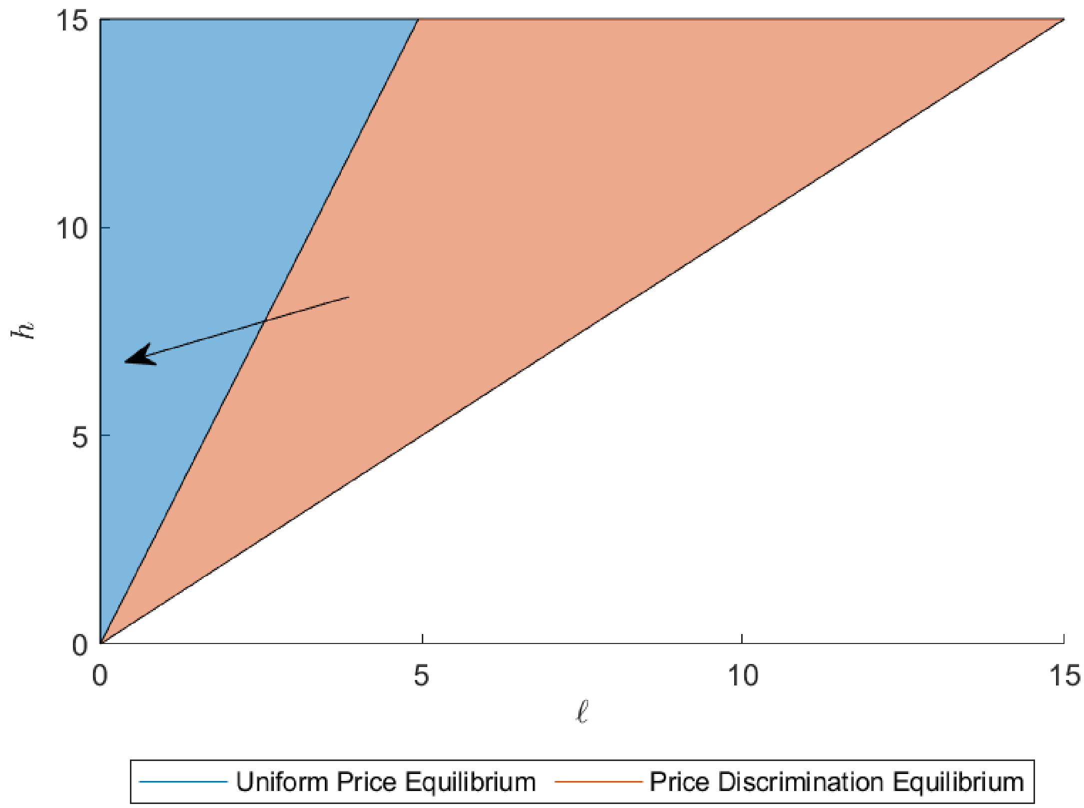
they move in the southwest direction to the lower values (h', ℓ'). If the new valuations are in the blue region, the new optimal contract would induce the uniform-price equilibrium at the retail price of h'. Therefore, the manufacturer would decrease MAP to be no greater than h', and one of the retail prices would change from ℓ to h'.

In this case, the retail price of ℓ, which is the old low-type's valuation, could increase if the new high-type's valuation h' is greater. Specifically, under the following conditions, one of the retail prices increases due to the equilibrium change: $h > h' > \ell > \ell'$, $\frac{1-\lambda}{1+\lambda}h < \ell$ and $\frac{1-\lambda}{1+\lambda}h' > \ell'$. In contrast, when a manufacturer lowers a binding RPM in response to decreasing consumer valuations, the lowest retail price should (weakly) decrease.

Notably, the change in average retail prices is ambiguous. Given (h, ℓ), the average retail price is $\dfrac{h+\ell}{2}$, which may be higher or lower than h', the equilibrium retail price after the MAP decrease.

A few other reasons could also lead to a decrease in MAP and an increase of some retail prices. First, h decreases but ℓ increases, which is a southeast shift in Figure 1 where the valuations stay in the brown region. In this case, the manufacturer's optimal contract still induces price discrimination in the retail market, but the lower retail price increases to match the new valuation of the high-type consumers. Second, consumer valuations stay the same, but the share of low-type consumer λ decreases sufficiently so that valuations in the brown region are now in the blue region because of the rightward shift of the separation line, leading to a change in retail pricing where the low price ℓ increases to h, and the high price h stays the same. In this case, the manufacturer could decrease MAP because MAP is no longer needed to induce the new uniform-price equilibrium. We discuss these alternative explanations in our empirical context in Section 5.3.1.

Figure 1: Consumer Valuations and Retail Price Equilibrium



Notes: The figure shows that when the consumer valuations (h, ℓ) are in the brown region, the manufacturer induces the price-discrimination equilibrium in the retail market. When the valuations are in the blue region, the manufacturer induces a uniform-price equilibrium in the retail market at h. Valuation decreases correspond with a shift to the southwest.

4 Background and Data

4.1 Seagate MAP Policies

Seagate Technology is a leading producer of hard disk drives (HDD), a billion dollar market (Igami and Uetake, 2020). Since at least 2009, Seagate has imposed a minimum advertised pricing policy on its US retailers. Seagate publicizes this information to retailers through its website.[11] In Figure 2, we display the main features of this policy (red emphasis added by the authors).[12] The policy clearly delineates what qualifies as an advertised price and outlines incentives for compliance with its restrictions. In the online setting, Seagate's definition of covered advertising includes price comparison sites like Google Shopping and the front page of retailer websites like Amazon or eBay. It excludes the shopping cart page(s) of these retailer sites. At the shopping cart page,[13] the policy allows the retailer to set whatever price it chooses. Such stipulation means that a consumer will not see the actual price she will pay until just before she enters her payment information. This requirement can potentially impose significant information frictions on average consumers.

As is typical, Seagate defines the terms and holds unilateral enforcement power. There are nine Seagate products subject to MAP from November 2011 to April 2013. These products belong to two Seagate product series: Barracuda for workstations and high performance PCs, and Momentus for mainstream laptops and desktops. Other Seagate products at the time, such as SkyHawk, are for more specialized systems (such as surveillance) and differ substantially from the products we consider here.

In general, MAP is enforced through a variety of measures. These measures range from a warning to product termination.[14] In our data, Seagate's MAP agreements specify cancellations of orders and withdrawal of promotional funds as some of the punitive measures.[15]

[11] These policies also contain manufacturer suggested retail prices (MSRP), but publicly available information does not suggest that these Seagate products are subject to RPM.

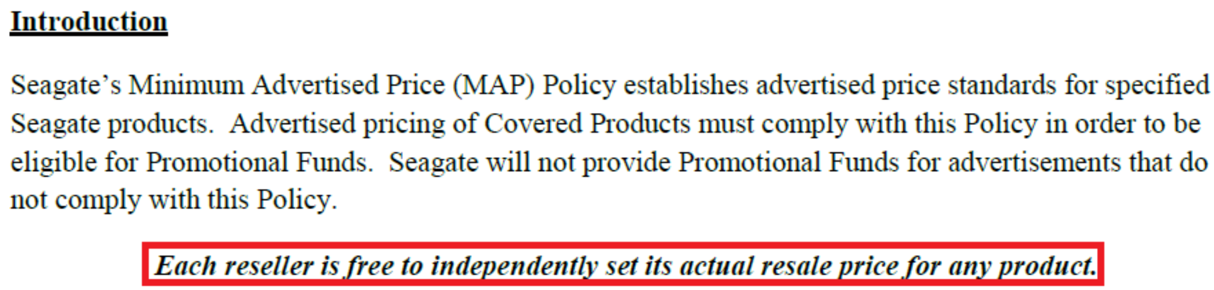
[12] An example contract is available at `https://econ-chenyu-yang.github.io/seagate-map.pdf`.

[13] Seagate defines the digital shopping cart as the price the customer sees by "clicking 'order', 'add to cart', or a similar command."

[14] These measures are commonly used across a variety of retail categories (see, for example, `https://metricscart.com/insights/examples-of-map-violation/`, accessed on Feb 4th, 2026).

[15] Although we do not know the exact magnitude of Seagate's promotional funds, some sources (Schumacher

Figure 2: Seagate MAP Policy



Introduction

Seagate's Minimum Advertised Price (MAP) Policy establishes advertised price standards for specified Seagate products. Advertised pricing of Covered Products must comply with this Policy in order to be eligible for Promotional Funds. Seagate will not provide Promotional Funds for advertisements that do not comply with this Policy.

Each reseller is free to independently set its actual resale price for any product.

Notes: This is an excerpt from Seagate's MAP policy.

4.2 Sales Contract

In addition to promotional funds, volume discounts are common in the manufacturer contracts with retailers.[16] Specific discount thresholds are specified in private retailer contractual agreements.[17] We note that an average wholesale price falling in quantity can be rationalized by a two-part tariff contract used in the theoretical model.

4.3 Data

For retail prices, we use a dataset from Dynamite Data LLC, a provider of global price and other metrics to e-commerce businesses. To find the true retail prices, the firm simulated the purchase decision through the shopping cart stage. Our dataset contains product prices at

(2019)) suggest that the promotional funds average about 3% of wholesale purchases of a retailer for online advertising. This funding is significant when some e-commerce retailers have an average net margin of 10% (`https://www.opensend.com/post/product-margin-statistics`, accessed on Feb 4, 2026).

[16]From Seagate's 10-K report, "[o]ur retail channel consists of our branded storage products sold to retailers either by us directly or by our distributors. Retail sales made by us or our distributors typically require greater marketing support, sales incentives and price protection periods...For the distribution channel, these programs typically involve rebates related to a distributor's level of sales, order size, advertising or point of sale activity and price protection adjustments." Seagate Technology Holdings plc. "Form 10-K (Fiscal Year Ended July 1, 2022)." Filed August 5, 2022. U.S. Securities and Exchange Commission. `https://www.sec.gov/Archives/edgar/data/1137789/000113778922000055/stx-20220701.htm`, accessed January 23, 2026.

[17]In our data, another major HDD manufacturer, Western Digital, has the following language alluding to volume discounts in its MAP agreement with Target in 2016: "Net billings is defined as gross WDT [Western Digital] invoiced revenue less allowances including return merchandise authorizations (RMAs), special pricing authorizations (SPAs), volume incentive and sell-thru rebates (POS), OEM/SI discounts, and any other rebates and discounts as applicable that were credited during the Program Duration."

daily frequencies from across the largest US online retail websites between November 2011 and April 2013.[18]

We focus on products sold by first-party retailers that contract directly with the manufacturer and have high MAP compliance rates (Israeli et al. (2016)). There are 11 retailers in the data. Three are large e-commerce websites: Amazon, BestBuy and Walmart. We also observe more specialized or smaller general outlets, which include CDW, Dell, Frys, Insight, Microcenter, Newegg, Rakuten and TigerDirect. In the analysis below, we call the non-Amazon, BestBuy, and Walmart retailers the "small retailers." We call Amazon, BestBuy, and Walmart the "large retailers."

Table 1: MAP Product Characteristics

	Retail Price*				MAP*	Δ MAP*	# MAP Changes	# Retailers*
	Mean	25^{th} Perc.	50^{th} Perc.	75^{th} Perc.				
Barracuda 500 GB 7200 3.5	47.54	42.87	45.23	48.75	45.98	-3.20	2	8.82
Barracuda 2 TB SATA 3.5	19.55	17.19	17.64	20.31	18.42	-3.47	3	7.35
Barracuda 2 TB SATA	18.36	16.87	18.28	20.28	18.24	-1.87	3	1.86
Barracuda 3 TB SATA	19.62	16.98	18.61	20.00	18.53	-1.71	5	7.54
Momentus 250 GB Plug-In	77.37	63.99	74.23	83.38	63.99	-	0	5.71
Momentus 320 GB Plug-In	79.03	67.82	79.99	89.95	60.98	-5.00	1	1.91
Momentus 320 GB Internal	71.75	59.99	69.99	74.45	60.31	-5.00	2	7.22
Momentus 500 GB Internal	53.45	44.79	51.19	57.59	52.19	-8.00	2	8.46
Momentus 1 TB LP	30.76	29.68	31.25	31.25	31.25	-1.60	2	8.73

Notes: $\star$ denotes statistics across weeks. Prices, MAP, and Δ MAP expressed in dollars per 320 GB. All observations are at the product-retailer-week level. We list commercial product names in our data, which indicate capacity (in gigabytes (GB) or terabytes (TB)). Some product names include spindle speeds measured in rotations-per-minute (RPM). The Barracuda products subject to MAP have a spindle speed of 7,200 RPM, except for the Barracuda 2 TB SATA, which has a speed of 5,900 RPM. Momentus 320 GB 2.5 Plug-in has a speed of 7,200 RPM, and the speed of all other Momentus products is 5,400 RPM. All Barracuda products are 3.5 inches in size, and all Momentus products are 2.5 inches in size.

Table 1 summarizes the characteristics of MAP products. The per-capacity price is

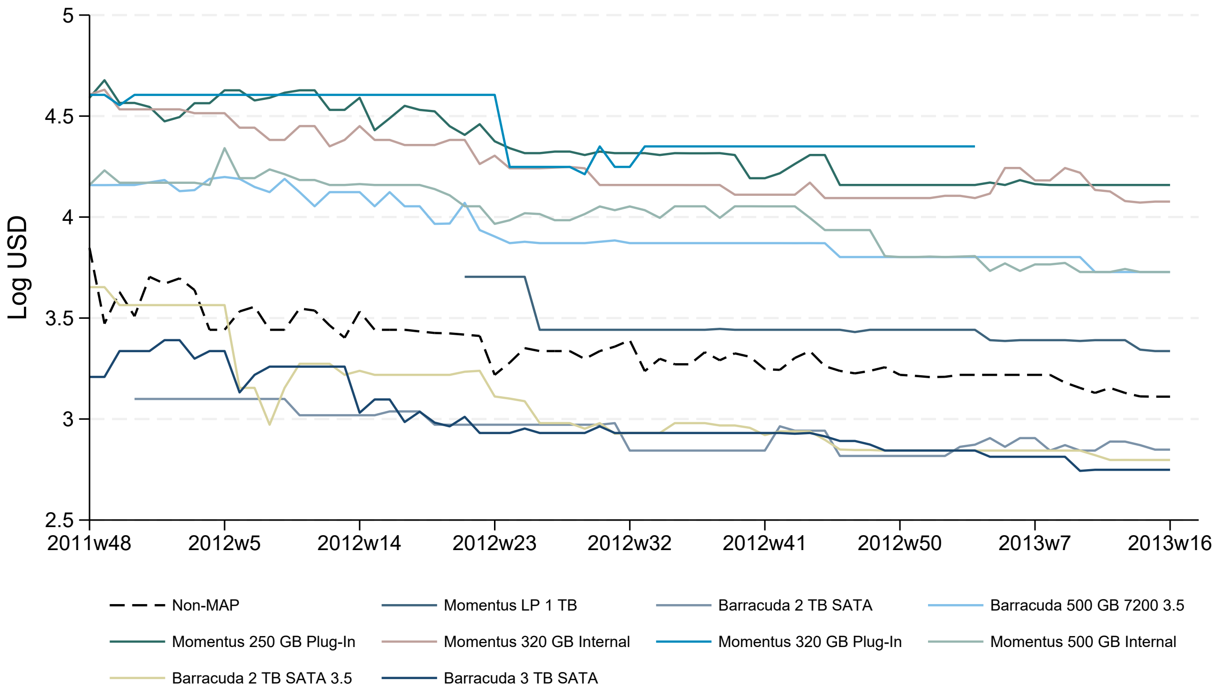
[18] We lack quantity data to directly study substitution across products. In linking MAP decrease to consumer demand, we view one reason for the decrease of consumer valuation over time to be the introduction of new products.

Table 2: Non-MAP Product Characteristics

	Retail Price⋆				# Retailers⋆
	Mean	25^{th} Perc.	Median	75^{th} Perc.	
Barracuda 160 GB 3.5 SATA	120.40	83.98	135.98	149.98	1.81
Barracuda 160 GB SATA 300	173.01	122.02	197.90	197.90	1.02
Barracuda 250 GB 7200	60.87	60.15	61.43	61.43	1.00
Barracuda ES 2 250 GB	125.35	96.00	96.00	127.99	1.29
Barracuda 400 GB SATA	87.85	89.78	89.78	89.78	1.00
Barracuda 500 GB 7200	59.39	50.84	55.65	75.01	1.02
Barracuda ES 2 500 GB	83.19	83.19	83.19	83.19	1.00
Barracuda ES 500 GB	68.23	63.10	68.95	72.23	1.61
Barracuda 1 TB SATA 3	29.03	25.00	28.12	31.25	7.63
Barracuda SAS 1 TB 7200	79.13	53.74	68.73	109.36	1.79
Barracuda 1.5 TB Desktop	22.69	20.52	21.87	23.33	4.95
Barracuda Green 1.5 TB	19.73	16.66	20.42	22.71	3.00
Barracuda 2 TB	18.83	16.22	17.20	18.75	7.33
Barracuda 2 TB SATA 3 5900	17.90	15.62	17.66	18.75	3.28
Barracuda 2 TB SATA 3 7200	9.71	9.37	9.37	10.15	1.00
Barracuda 7 3 TB	17.54	15.62	16.67	18.74	6.73
Barracuda Green 3 TB	62.50	62.50	62.50	62.50	1.00
Barracuda 4 TB SATA 3	15.64	14.84	15.00	16.01	4.40
Momentus Mobile 160 GB 7200	137.61	89.98	110.00	179.98	1.03
Momentus 5400 250 GB	75.26	63.77	63.99	64.49	1.83
Momentus 320 GB Thin SATA	82.34	78.99	79.99	85.99	3.72
Momentus 500 GB 2.5 Internal	52.39	45.04	51.19	57.59	5.82
Momentus 500 GB Thin	42.74	39.67	42.87	44.79	5.73

Notes: ⋆ denotes statistics across weeks. Prices expressed in dollars per 320 GB. All observations are at the product-retailer-week level. We list commercial product names in our data, which indicate capacity (in gigabytes (GB) or terabytes (TB)). Barracuda 2 TB SATA 3 5900 and the "Green" products have a spindle speed of 5,900 rotations-per-minute (RPM), Momentus 500 GB Thin has a speed of 5,400 RPM, and all other products have a speed of 7,200 RPM. All Barracuda products are 3.5 inches in size, and all Momentus products are 2.5 inches in size.

Figure 3: Median Prices Over Time: Non-MAP and MAP Products



Notes: Prices are measured in dollars per 320 GB before logging. Observations are at the product-retailer-week level. Within each week, the median retail price for each MAP product is plotted. The median retail price across all non-MAP products is plotted. The tick label of the x-axis is based on the year and week.

significantly lower for larger drives. The minimum advertised price is similar to the mean retail price, although the distribution of retail prices is relatively dispersed across time and retailers for the same product. Over the approximately two years in our data, one product had five unique MAP changes and seven products had at least two unique MAP changes. In each change, MAP is always decreased, and the average change is about 9% of the retail price.

Table 2 presents the characteristics of non-MAP products. For products with similar capacity and in the same product family as the MAP products, non-MAP product prices are similar. Overall, non-MAP products are distributed over fewer retailers.

Figure 3 shows the price trends of products during our sample period. This pattern is consistent with declining willingness-to-pay for technology products over time (Gordon, 2009; Gowrisankaran and Rysman, 2012). It is also possible that some of the price decrease over time resulted from increased HDD factory capacity, as several major factories were impacted by flooding in Thailand in 2011 (including those of Seagate) (Hydro and Agro Informatics Institute, 2011). Our results in the paper are based on a sample that starts after the flooding had largely subsided, and they are robust to using a shorter sample that starts in June 2012.

4.4 Selection of MAP Products

Whether to impose MAP on a product is a manufacturer's choice. Empirically, the MAP products in Table 1 were Seagate's flagship and mainline offerings at the time. Barracuda 3TB SATA, for example, was Seagate's highest-capacity internal drive at the time, and various review sites regarded it as Seagate's flagship product[19] of the 14th generation of the Barracuda family along with the lower-capacity variants (Seagate Technology LLC (2015)). The Momentus products were also Seagate's new laptop HDDs at the end of 2011.[20] Furthermore, using the page visit history of a subset of comScore panelists who visited Seagate products at the retailers in our sample during November 2018, we find that MAP products receive more visits, suggesting that MAP is more likely to be imposed on flagship products.[21]

In contrast, many of the non-MAP products in Table 2 were legacy products from older generations of the Barracuda (Seagate Technology LLC (2011)) and Momentus families.[22]

[19]This is based on, for example, https://web.archive.org/web/20160905091436/http://www.anandtech.com/show/5042/seagates-new-barracuda-3tb-st3000dm001-review ("Seagate announced its transition to 1TB platters with its new 7200RPM-only Barracuda line. The move marked a significant change for Seagate as it is phasing out the Barracuda Green brand, and shifting the focus of the high-performance Barracuda XT."), as well as https://thessdguy.com/tag/hybrid-hdd/ and https://hardwarecanucks.com/forum/threads/seagate-barracuda-3tb-review-a-1tb-platter-monster-is-unleashed.47668, accessed on Feb 5, 2026.

[20]This is based on Seagate's product manuals and https://www.tomshardware.com/reviews/notebook-hdd-750gb,2832-3.html, accessed on Feb 5th, 2026.

[21]Unfortunately, this product visitation dataset is not available for our sample period.

[22]The older Barracuda products often have lower capacity ($<$ 1 TB), but a few released in 2009 have a 2TB capacity, investors.seagate.com/.../Momentus-XT-Hybrid-Drive/, accessed on Feb 5, 2026. The "thin" drives were introduced in 2009, https://investors.seagate.com/news/news-details/2009/Seagate-unveils-Worlds-Thinnest-25-inch-Hard-Drive-for-Slim-Laptop-Computers/, accessed on Feb 5, 2026. The new Momentus 500 GB 7200 RPM product subject to MAP, which was released in 2011, replaced the older 5400 RPM variant, https://investors.seagate.com/news/news-details/2011/Seag

We further correlate whether a product is selected for the MAP policy with the observed market outcomes in Appendix Table A.1. We find that MAP products are sold on more retailers and available for longer periods of time, consistent with their flagship statuses. The correlation with high spindle speed, which increases speed but is less energy-efficient; disc size, which affects whether the HDD is for desktop or laptop use; capacity; and average price is more ambiguous.[23]

5 Empirical Analysis

5.1 MAP is Not a Retail Price Lower Bound

We start by showing that MAP, unlike a minimum RPM, does not impose a lower bound on retail prices. Table 3 shows the share of retailer-week observations when the weekly average retail prices fall below MAP. The violations occur for all but one MAP product. Overall, the retail prices are lower than MAP in 41% (1,631 of 3,959) of product-retailer-week combinations, and the percentages are greater than 50% for 2 of the 9 products subject to MAP.

We also note that the violations are not likely due to lax enforcement. Firms such as our data provider conduct daily advertised and retail price reports. As we note in Section 4.1, manufacturers can impose a variety of punitive measures to enforce the policy. Some of these measures, such as withholding promotional funds, can be particularly effective against smaller retailers. Had MAP imposed a retail price lower bound, we would have expected smaller retailers to violate the lower bound less frequently. Therefore, in the last column of Table 3, we compute the share of retailer-week observations where retailer prices are below MAP on small retailers. The shares are only slightly lower than the results using all retailers

ate-delivers-One-Million-Solid-State-Hybrid-Drives-Momentus-XT-Hybrid-Drive-Adoption-soars-as-Major-Computer-Makers-offer-Laptops-with-Worlds-Speediest-Hard-Drive/, accessed on Feb 5, 2026.

[23] We note that both MAP and non-MAP lists include products with a spindle speed of 5,900 rotations per minute that were discontinued in 2011, https://www.computerworld.com/article/1536461/seagate-standardizes-barracuda-drive-line-on-7200-rpm.html, accessed on Feb 5th, 2026.

Table 3: Percentage of Time Retail Prices Fall Below MAP

SKU	% Price < MAP (1)	% Small Retailer Price < MAP (2)
Barracuda 500 GB 7200 3.5	33.53	27.07
Barracuda 2 TB SATA 3.5	46.83	35.38
Barracuda 2 TB SATA	46.53	20.00
Barracuda 3 TB SATA	55.75	51.58
Momentus 250 GB Plug-In	35.26	24.38
Momentus 320 GB Plug-In	0.00	0.00
Momentus 320 GB Internal	1.42	1.59
Momentus 500 GB Internal	43.92	41.67
Momentus 1 TB LP	81.86	76.61

Notes: Table displays the percentage of product-retailer-week-level observations where the retail price is below MAP across all product-retailer-week-level observations for each MAP product. Column (1) pools across all retailers, while column (2) restricts to small retailers only.

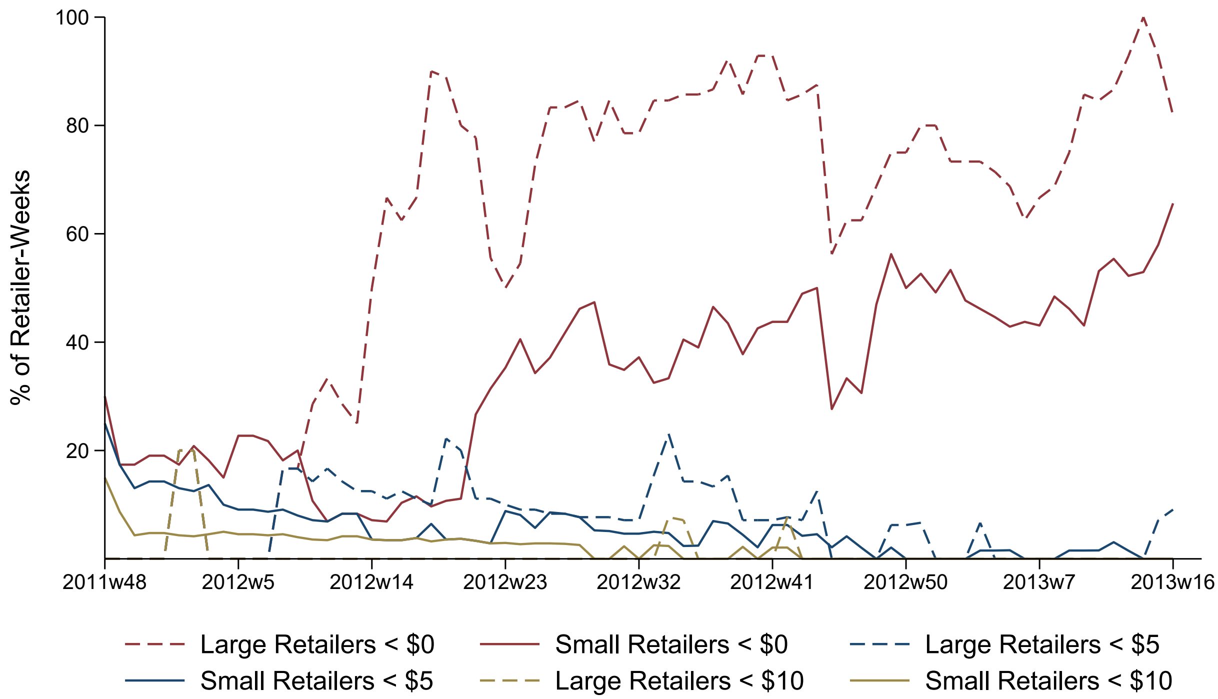
for most MAP products, which suggests that MAP is not likely a retail price lower bound even on small retailers.

We also explore how far the retail prices may fall below MAP. Figure 4 shows the percentage of product-retailer pairs in a given week where the retail prices are below MAP, $5 below MAP, and $10 below MAP. These shares persist over long periods of time and across products, suggesting that setting retail prices below MAP is not a chance event.

5.2 MAP Products have Higher Price Dispersions

We next compare price dispersion for MAP versus non-MAP products. This comparison helps to distinguish MAP from RPM. Under binding RPM, retail prices for a given product should be more uniform across retailers than for products not under RPM. The AB model can generate the opposite pattern, because it is more profitable to impose MAP whenever it allows the manufacturer to induce retail price dispersion. Thus, finding higher dispersion for MAP than for non-MAP products supports the AB interpretation of MAP rather than the view that MAP is effectively RPM.

Figure 4: % of Retailer-Weeks with Retail Prices < \$0, \$5, and \$10 Below MAP by Retailer Type Over Time



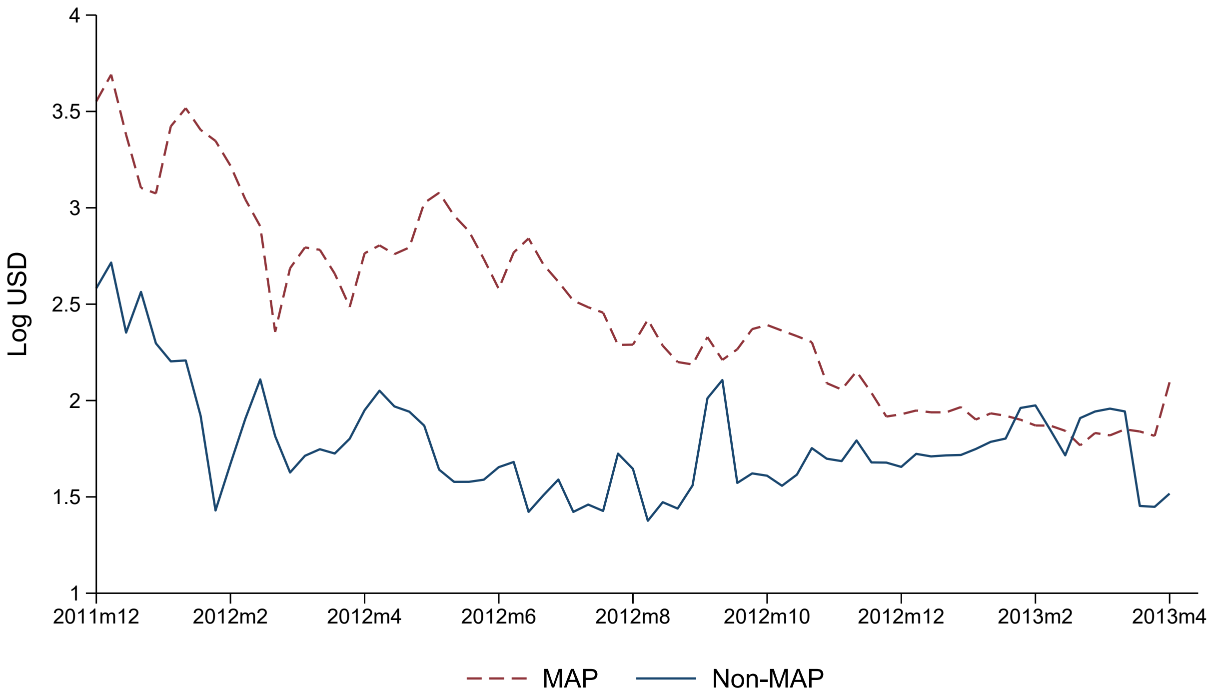
Notes: The figure plots the percentage of product-retailer-week-level observations where each retail price is \$0, \$5, and \$10 below MAP by retailer type (i.e., large vs. small retailers) and week.

Given a product and a week, our primary measure of price dispersion is the difference between the logged highest and lowest retail prices for the same product across days in a week.[24] Figure 5 presents the time series of the average dispersion measure by product type across all product-week combinations, where a product is available on at least two retailers in the same week. The non-MAP products include all Barracuda and Momentus products not subject to MAP. MAP product retail prices, particularly in the earlier part of our sample, are significantly more dispersed than non-MAP product prices.

Furthermore, the dispersion differences are not driven by over-time, within-retailer price differences. Figure 6 attempts to decompose the within-week-retailer price variation from the overall price variation. Specifically, we first compute the variance in daily prices for a

[24]To avoid mechanically understating the price dispersion of the non-MAP products, we exclude the 5 non-MAP products available on only one retailer in this section.

Figure 5: Within Week Average Price Dispersion by Product Type

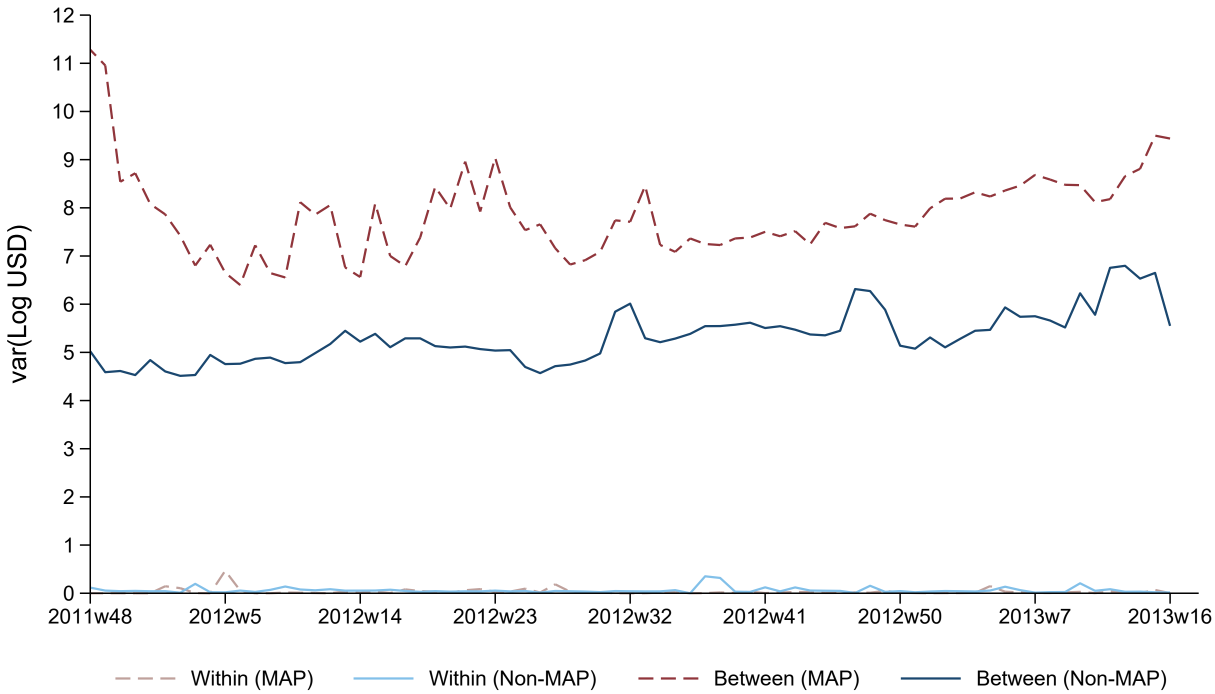


Notes: The figure plots the average in log(maximum price) - log(minimum price) across retailers for each product-week by product type.

product-retailer pair within each week. We then plot the average variance across all such pairs over weeks. This measure represents the decomposed variance for prices within a product-retailer pair (Within). We also compute the variance of daily prices across retailer-day pairs for a product in each week. We then plot the average across all products over weeks. This measure includes the price variation across retailers (Between). We find that the Between variance is orders of magnitude greater than the Within variance, and the Between variance is higher for MAP products. This result suggests that cross-retailer heterogeneity is the main source of price variation for both types of products, and the price variation across retailers is higher for MAP products.

We next more formally quantify the average difference in dispersion and the source of dispersion differences. We divide our sample into small and large retailer sub-samples. In the

Figure 6: Within-Retailer vs. Between-Retailer Variance Decomposition by Product Type and Week



Notes: The figure plots the average variance in prices for a product within a retailer by week and across retailers by week across product types.

first column of Table 4, we regress the price dispersion measure for a product-retailer pair on a MAP indicator, controlling for week, retailer, and product characteristic fixed effects, including indicators for different levels of capacity, speed, and disc size. We find that there are no meaningful differences between MAP and non-MAP products, suggesting the price dispersion difference is not driven by the over-time, within-retailer price variations in a week, consistent with Figure 6.

The second column shows that the dispersion differences between MAP and non-MAP products are driven by retailers setting different prices. We repeat the same regression as in column (1) on the sample of all product-week pairs, but where the outcome variable is defined as the maximum price difference across retailers for a product and a week. We also do not include retailer fixed effects. We find that MAP retail prices are 7.4% more dispersed than non-MAP products on small retailers. In contrast, MAP product prices are less dispersed on large retailers, consistent with the interpretation that MAP may be more effectively enforced on small retailers. In column (3), we find similar dispersion differences without week fixed effects, which suggests that dispersion differences are not driven by over-week price variations either. The price stability over time also suggests a limited role for mixed pricing strategies.

Finally, we repeat the exercises above using alternative measures of price dispersion in Appendix Tables A.2, A.3 and A.4. These measures include the difference between the 80th and 20th quantiles of prices; the value of information, which is defined as the difference between the average and minimum price; and the standard deviation of retailer-day-level prices. These measures yield consistent evidence that retail price dispersion is greater for MAP products across small retailers, but less so on large retailers. At the same time, Table A.5 shows that MAP products' retail prices are 7 to 9.5% higher than non-MAP products on small retailers, but there is no conclusive evidence that the same pattern holds on large retailers.

5.2.1 Retailer Heterogeneity and Selection

There may be two alternative explanations for the findings that the retail price dispersion of MAP products is greater. First, retailers facing different demand may adopt different pricing strategies.[25] To more flexibly account for retailer heterogeneity, we estimate the price differences between MAP and non-MAP products across each pair of retailers in Appendix Table A.6, controlling for retailer-pair fixed effects. We similarly find that dispersion is greater for MAP products on small retailers.

Another potential explanation is that a manufacturer is more likely to impose MAP on a product when its potential consumers do not search intensively for retail prices and rather rely on advertised prices to decide whether to visit a store. If consumers likely to buy MAP

[25] Using a dataset from comScore that tracks website visits of a sample of consumers from 2011 to 2013, we find that Amazon accounts for 71.24% of visits to retailers in our data, and Amazon, Walmart and BestBuy collectively account for 92.89% of all visits.

Table 4: Average Price Dispersion Under MAP

	Intra-Retailer (1)	Inter-Retailer (2)	Inter-Retailer (3)
Panel A: All Retailers			
$\mathbb{1}$(MAP)	-0.001	0.066***	0.063***
	(0.002)	(0.011)	(0.012)
N	7,334	1,210	1,210
R^2	0.052	0.318	0.186
Panel B: Small Retailers			
$\mathbb{1}$(MAP)	0.000	0.074***	0.072***
	(0.002)	(0.011)	(0.012)
N	5,838	1,016	1,016
R^2	0.061	0.361	0.235
Panel C: Amazon, Best Buy, Wal-Mart			
$\mathbb{1}$(MAP)	-0.009	-0.097***	-0.159***
	(0.006)	(0.037)	(0.044)
N	1,496	356	366
R^2	0.111	0.419	0.178
Fixed Effects			
Week	Yes	Yes	No
Retailer	Yes	No	No
GB Capacity	Yes	Yes	Yes
RPM	Yes	Yes	Yes
Disc Size	Yes	Yes	Yes

Notes: Observations in column (1) are at the product × retailer × week level. Observations in columns (2) and (3) are at the product × week level. The dependent variable is the maximum log price less the minimum log price based on prices of a product across days within a retailer in a week (column (1)) and across retailer-day combinations in a week (columns (2) and (3)). Heteroskedasticity-consistent standard errors in parentheses and clustered at product level. Reference group is composed of all non-MAP Barracuda and Momentus products. We include indicators for capacity levels of 250, 320, 500, 1,000, 1,500, 2,000, 3,000, and 4,000 GB, levels of spindle speeds 5,900 and 7,200 RPM, and disc size 3.5 inches. *** indicates significance at the 1% level, ** indicates significance at the 5% level, and * indicates significance at the 10% level.

products have limited price information (for example, they have higher willingness-to-pay but less time to search), and consumers favoring non-MAP products have perfect price information (they are more price-sensitive and search more), we would expect greater price dispersion in the former case (Varian, 1980). There are two reasons that this is not the case. First, as shown in Tables 1 and 2, many of the older, legacy non-MAP products are not necessarily less expensive and thus more attractive to price-sensitive consumers. Second, flagship MAP products receive more marketing support and are more widely promoted across retailers, which should generate greater consumer awareness and more search. A more likely explanation is that MAP is imposed on select (flagship) products to reduce administrative and contractual costs. Therefore, our preferred interpretation is that the data pattern suggests differences in pricing strategy on MAP vs. non-MAP products as opposed to selection.

We want to emphasize that, even if retailer heterogeneity and selection play some roles in our results, the price patterns show a key distinction between MAP and RPM. A binding RPM should increase the price stability of a product across retailers. Should MAP be equivalent to RPM, our regressions would show that the dispersion is smaller for MAP products. Instead, we find the opposite pattern, which we interpret as evidence that MAP is not RPM.

5.3 Some Retail Prices Increase After A MAP Decrease

We now turn to a counter-intuitive implication of the theoretical model where a decrease in MAP may be followed by an increase in low retail prices. This prediction contrasts with the implication of RPM, where a decrease in binding RPM should lead to (weakly) lower retail prices. Therefore data patterns consistent with an increase in retail prices after MAP decrease show that MAP differs from RPM.[26]

We estimate the effects of MAP decrease using the approach of de Chaisemartin and D'Haultfœuille (2020) and de Chaisemartin et al. (2022). We focus on the MAP decrease on

[26] We note that all minimum advertised prices are reduced on Seagate's hard disk drives during our observation period.

March 3rd, 2013, when Seagate reduced MAP on 5 products, because other MAP decreases affect too few products simultaneously to identify their effects. We estimate the following event study specification:

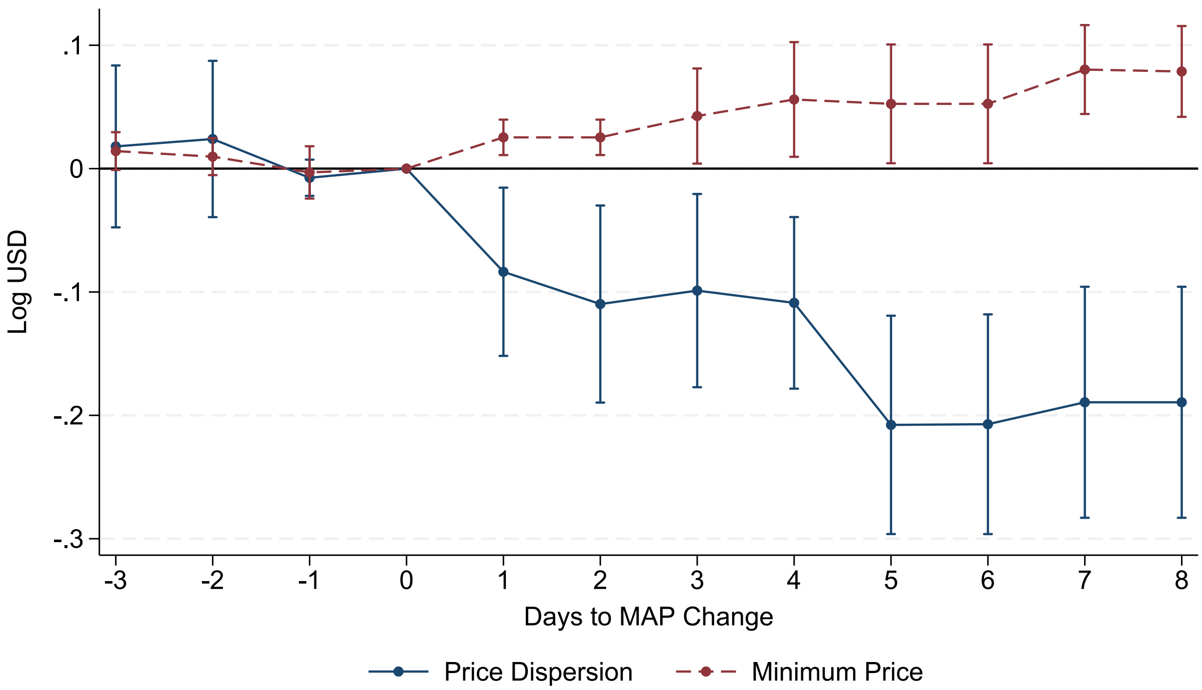
$$y_{it} = \alpha + \sum_{d=-3}^{8} \beta_d \text{Treat}_{it} \times \mathbb{1}[t = d]_t + \sum_{d=-3}^{8} \phi_d^1 \text{MAP}_{i(-3)} \times \mathbb{1}[t = d]_t + \sum_{d=-3}^{8} \phi_d^2 \text{MAP}_{i(-3)}^2 \times \mathbb{1}[t = d]_t + \gamma_i + \tau_t + \epsilon_{it}. \tag{1}$$

We have two outcomes of interest y_{it}. The first measures the price dispersion, which is the max-min difference in logged prices for product i on day t. Our second outcome of interest is the minimum price of product i on day t across all retailers. Our coefficients of interest β_d are on the interactions between whether product i is subject to MAP and a time indicator for each of the three days pre-MAP change and eight days post-MAP change.[27] The treatment variable Treat_{it} is the binary indicator for whether MAP is reduced. Following de Chaisemartin et al. (2022), we include interactions of treatment period fixed effects and a polynomial in the baseline values of MAP as control variables. The coefficients ϕ_d^1 and ϕ_d^2 are on the linear and quadratic terms, respectively. The MAP reductions for the 5 products are \$5, \$3.20, \$1.07, and \$0.80 ($\times$ 2 products) per 320 GB, respectively. These correspond to MAP reductions of 8.3%, 7.1%, 6.3%, and 4.5% ($\times$ 2 products), respectively. We include product γ_i and day τ_t fixed effects as well. We restrict our sample to all Barracuda and Momentus MAP products available within the week of the MAP decrease.

Average effects are presented in Table 5. Following a reduction in MAP, average intra-day price dispersion among MAP products declines by 14.9%, while the average increase in minimum prices is 11.4%. Figure 7 plots the estimates of the MAP decrease for both of our outcomes of interest that show the consistent changes. These results align with the interpretation that a MAP decrease is associated with a decrease in consumer valuations, leading to a change in the retail price equilibrium, where a retailer that previously set a low price raises its price.

[27]The pattern is similar under other time windows.

Figure 7: Effect of MAP Change on Price Dispersion and Lowest Retail Price



Notes: The figure plots the de Chaisemartin and D'Haultfœuille (2020) event study coefficients. The minimum prices are defined for the same product across retailers in a day. Price dispersion is defined as the difference in the natural logs of the maximum and minimum prices.

Table 5: MAP Decrease, Intra-Day Price Dispersion and Minimum Price

	Price Dispersion (1)	Minimum Price (2)
$\bar{\beta}_d$	-0.149***	0.114***
	(0.032)	(0.023)
Fixed Effects		
Day	Yes	Yes
Product	Yes	Yes
N	112	112

Notes: Observations are at the product × day level. The y variables are the maximum difference in logged per 320GB prices and minimum logged price of a product across retailers. Heteroskedasticity-consistent standard errors in parentheses and clustered at the product level. Average $\bar{\beta}_d$s post MAP decrease in eq. (1) are displayed. *** indicates significance at the 1% level, ** 5%, and * 10%.

Table 6: Heterogeneous Effects of MAP Decrease: Dispersion and Minimum Price

	< 7% MAP Decrease		> 7% MAP Decrease	
	Price (1)	Dispersion (2)	Minimum (3)	Price (4)
$\bar{\beta}_d$	-0.142*** (0.037)	0.101*** (0.024)	-0.161*** (0.053)	0.132*** (0.049)
Fixed Effects				
Day	Yes	Yes	Yes	Yes
Product	Yes	Yes	Yes	Yes
N	96	96	88	88

Notes: Observations are at the product × day level. Subsamples are split based on the magnitude of the MAP decrease. The y variables are the differences in the natural log of the 80th and 20th price quantiles and the natural log of the 20th percentile price across retailers within a day. Standard errors in parentheses and clustered at the product level. *** indicates significance at the 1% level, ** 5%, and * 10%.

For robustness, we next separate the products with MAP into two groups, where one group's MAP change is greater than 7% of the MAP and the other is below. The subsample results (with the same control group as the baseline) shown in Table 6 are similar to those in Table 5. For products with MAP reductions less than 7% of the original MAP, intra-day price dispersion declines by 14.2% on average and minimum price increases by 10.1% on average. Similarly, for products with MAP reductions greater than 7% of the original MAP, intra-day price dispersion declines by 16.1% on average and minimum prices increased by 13.2% on average. A two-way fixed effect specification also shows a similar result.

In addition to the minimum price increase, we also find that the 20th price quantile increases after the MAP decrease (Appendix Table A.7 and Figure A.1). The result holds on the split samples by the sizes of the MAP change (Appendix Table A.8).[28]

Overall, we see this data pattern as additional evidence that MAP is not RPM. A decrease of a binding RPM should lead to a decrease, as opposed to an increase in retail prices.

[28]The MAP decrease is also associated with a decrease in alternative measures of price dispersions as discussed in Section 5.2, but has a small and statistically insignificant effect on the average price (Appendix Table A.9).

5.3.1 Discussions: Why does MAP Decrease?

The theoretical discussion in Section 3.2 assumes that a manufacturer decreases MAP in response to reduced consumer valuations for products, and the new valuations can result in a new uniform price equilibrium. We find support for this prediction.

An alternative explanation for our finding is that MAP decreases because high-type consumers' valuation declines, but low-type consumers' valuation increases. We first note that this possibility does not contradict the interpretation of MAP in the AB model and still generates price increases that would not occur under a binding, decreasing RPM. Although it is possible that low-type consumers' valuations can occasionally increase, this would be inconsistent with the broad trend that all MAP products' minimum prices and the 20th price quantiles, based on the daily prices of each product across retailers in a week, generally fall over time. Furthermore, in the broader economy, the sentiment of lower-income consumers was relatively unchanged from 2011 to 2013, while the sentiment of higher-income consumers increased.[29]

Another theoretical explanation for our finding is that the share of low-type consumers, as opposed to valuations, changed. A decrease in this share would make the manufacturer more likely to induce uniform retail prices and sell only to the high-valuation consumers. We cannot rule out this possibility, but we find evidence that the highest retail price and the 80th price quantile both decrease after the MAP decrease (Appendix Figure A.2), consistent with a decrease in valuation.[30]

[29]Survey Research Center, Institute for Social Research, University of Michigan (2025).

[30]Retailers may raise prices less than reduce them, out of fairness or consumer loss aversion concerns (Kahneman et al. (1986) and Kalyanaram and Winer (1995)). In the consumer electronics category, we generally observe large declines of prices for different reasons, such as the frequent introduction of new products. In light of this empirical pattern, our results are particularly unexpected without interpreting MAP in a search model. In Appendix Table A.10, we also find that price increases and decreases are of similar magnitudes, conditional on product, retailer and day fixed effects. The price decreases are larger if MAP is decreased in the prior week.

5.4 Welfare Implication

Proposition 1 from AB implies that MAP can improve welfare through price discrimination. Specifically, high valuation buyers could potentially benefit from visiting a low-price retailer. When $\frac{1-\lambda}{1+\lambda}h \leq \ell \leq (1-\lambda)h$, a manufacturer that does not impose MAP would set a wholesale price equal to h, which would result in the high retail price h. Using MAP, the manufacturer would instead set a lower wholesale price that induces two retailers to set different prices, decreasing the average retail price and increasing the total surplus. This result is intuitive, because quantity expands under MAP-enabled price discrimination.[31] The results in our study are consistent with MAP policies enabling price discrimination, but the lack of quantity data does not permit us to estimate consumer preferences or directly evaluate MAP's welfare effects.

6 Conclusion

We use online retail prices of Seagate hard disk drives to document empirical facts about the minimum advertised price policy. We present three findings suggesting that MAP is not equivalent to RPM. First, MAP does not impose a lower bound on retail prices. Second, MAP product prices are more dispersed than products not subject to MAP. Third, some retail prices can increase after a MAP decrease. In a search model, we find natural explanations for these facts when we interpret the MAP policy as an information restraint that enables price discrimination.

References

Julie Beth Albert. Adding uncertainty to the virtual shopping cart: Antitrust regulation of internet minimum advertised price policies. *Fordham L. Rev.*, 80:1679, 2011.

[31] In the AB model, the additional equilibrium quantity reflects sales to low-type consumers, but their surplus remains zero; the entire welfare gain accrues to the increase in the high-type consumer's surplus and the manufacturer's profit.

Diego Aparicio, Zachary Metzman, and Roberto Rigobon. The pricing strategies of online grocery retailers. *Quantitative Marketing and Economics*, 22(1):1–21, 2024.

John Asker and Heski Bar-Isaac. Advertising and related restraints. *CPI Antitrust Chronicle*, 2018.

John Asker and Heski Bar-Isaac. Vertical information restraints: Pro-and anticompetitive impacts of minimum-advertised-price restrictions. *The Journal of Law and Economics*, 63 (1):111–148, 2020.

Michael R Baye, John Morgan, Patrick Scholten, et al. Information, search, and price dispersion. *Handbook on economics and information systems*, 1:323–375, 2006.

Pradeep Chintagunta. Structural models in marketing: Consumer demand and search. *Handbook of Marketing Decision Models*, pages 167–198, 2017.

Competition and Markets Authority. Resale price maintenance: Advice for retailers, August 2016. URL `https://www.gov.uk/government/publications/resale-price-maintenance-advice-for-retailers/resale-price-maintenance-advice-for-retailers`. Official UK government guidance.

Competition Bureau Canada. Price maintenance—section 76 of the competition act, October 2022. URL `https://competition-bureau.canada.ca/en/how-we-foster-competition/education-and-outreach/price-maintenance-section-76-competition-act#section2_1_3`. Government of Canada guidance on the legal treatment of resale and advertised price maintenance, including MAP policies.

Clément de Chaisemartin and Xavier D'Haultfœuille. Difference-in-differences estimators of intertemporal treatment effects. Working Paper, 2020.

Clément de Chaisemartin, Xavier D'Haultfœuille, Felix Pasquier, and Gonzalo Vazquez-Bare. Difference-in-differences for continuous treatments and instruments with stayers. Working Paper, 2022.

Babur De los Santos, In Kyung Kim, and Dmitry Lubensky. Do msrps decrease prices? *International Journal of Industrial Organization*, 59:429–457, 2018. doi: 10.1016/j.ijindorg.2018.02.008.

Peter A Diamond. A model of price adjustment. *Journal of economic theory*, 3(2):156–168, 1971.

Pierre Dubois and Helena Perrone. Price dispersion and informational frictions: Evidence from supermarket purchases. 2015.

Glenn Ellison and Sara Fisher Ellison. Search, obfuscation, and price elasticities on the internet. *Econometrica*, 77(2):427–452, 2009.

Sean Ennis and Kai-Uwe Kuhn. Minimum advertised prices: How they differ from rpm, 2021. URL `https://competitionpolicy.ac.uk/publications/minimum-advertised-prices-how-they-differ-from-rpm/`.

European Commission. Commission regulation (eu) 2022/720 of 10 may 2022 on the application of article 101(3) of the treaty on the functioning of the european union to categories of vertical agreements and concerted practices, 2022a. URL `https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R0720`.

European Commission. Guidelines on vertical restraints accompanying commission regulation (eu) 2022/720, 2022b. URL `https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022XC0701%2801%29`.

Riemer P Faber and Maarten CW Janssen. On the effects of suggested prices in gasoline markets. *The Scandinavian Journal of Economics*, 121(2):676–705, 2019.

Federal Trade Commission. Analysis of proposed consent order to aid public comment: Minimum advertised price provisions, May 2000. URL `https://www.ftc.gov/system/files?file=documents%2Fcases%2F000510minimumadprice-analysis.htm`. FTC analysis regarding legality of MAP provisions under antitrust law prior to Leegin.

Daniel Garcia and Maarten C. W. Janssen. Retail channel management in consumer search markets. *International Journal of Industrial Organization*, 58:162–182, 2018. doi: 10.1016/j.ijindorg.2017.05.004.

Brett R Gordon. A dynamic model of consumer replacement cycles in the pc processor industry. *Marketing Science*, 28(5):846–867, 2009.

Gautam Gowrisankaran and Marc Rysman. Dynamics of consumer demand for new durable goods. *Journal of political Economy*, 120(6):1173–1219, 2012.

Frank M Hinman and Sujal J Shah. Counseling clients on vertical price restraints. *Antitrust*, 23:60, 2008.

Elisabeth Honka, Ali Hortaçsu, and Matthijs Wildenbeest. Empirical search and consideration sets. In *Handbook of the Economics of Marketing*, volume 1, pages 193–257. Elsevier, 2019.

Hydro and Agro Informatics Institute. Flood2011 summary of the situation and key facts from the 2011 great flood, 2011. URL `https://tiwrmdev.hii.or.th/current/2011/flood54Eng.html`. Accessed: 2025-07-11.

Mitsuru Igami and Kosuke Uetake. Mergers, innovation, and entry-exit dynamics: Consolidation of the hard disk drive industry, 1996–2016. *The Review of Economic Studies*, 87(6):2672–2702, 2020.

Ayelet Israeli. Online map enforcement: evidence from a quasi-experiment. *Marketing Science*, 37(5):710–732, 2018.

Ayelet Israeli, Eric T Anderson, and Anne T Coughlan. Minimum advertised pricing: Patterns of violation in competitive retail markets. *Marketing Science*, 35(4):539–564, 2016.

Maarten Janssen and Edona Reshidi. Regulating recommended retail prices. *International Journal of Industrial Organization*, 85:102872, 2022. doi: 10.1016/j.ijindorg.2022.102872.

Maarten Janssen and Edona Reshidi. Discriminatory trade promotions in consumer search markets. *Marketing Science*, 42(2):401–422, 2023. doi: 10.1287/mksc.2022.1380.

Maarten C. W. Janssen. Vertical contracts in search markets. *International Journal of Industrial Organization*, 70:102527, 2020. doi: 10.1016/j.ijindorg.2019.102527.

Daniel Kahneman, Jack L. Knetsch, and Richard H. Thaler. Fairness as a constraint on profit seeking: Entitlements in the market. *American Economic Review*, 76(4):728–741, 1986.

Raja Kali. Minimum advertised price. *Journal of Economics & Management Strategy*, 7(4): 647–668, 1998.

Gurumurthy Kalyanaram and Russell S. Winer. Empirical generalizations from reference price research. *Marketing Science*, 14(3):G161–G169, 1995. Part 2 of 2, Special Issue on Empirical Generalizations in Marketing.

Francine Lafontaine and Margaret Slade. Vertical integration and firm boundaries: The evidence. *Journal of Economic literature*, 45(3):629–685, 2007.

Robin S Lee, Michael D Whinston, and Ali Yurukoglu. Structural empirical analysis of contracting in vertical markets. In *Handbook of Industrial Organization*, volume 4, pages 673–742. Elsevier, 2021.

Michael Lindsay and William L. Monts. Resale price maintenance and minimum advertised pricing: Structuring to minimize antitrust scrutiny, 2020. URL `https://www.straffordpub.com/products/resale-price-maintenance-and-minimum-advertised-pricing-structuring-to-minimize-antitrust-scrutiny-2020-09-10`.

Dmitry Lubensky. A model of recommended retail prices. *The RAND Journal of Economics*, 48(2):358–386, 2017. doi: 10.1111/1756-2171.12179.

Alexander MacKay and David A Smith. Challenges for empirical research on rpm. *Review of Industrial Organization*, 50:209–220, 2017.

G. Frank Mathewson and Ralph A. Winter. An economic theory of vertical restraints. *The RAND Journal of Economics*, 15(1):27–38, 1984. URL https://www.jstor.org/stable/3003667.

Chakravarthi Narasimhan. Competitive promotional strategies. *Journal of business*, pages 427–449, 1988.

Mitsukuni Nishida and Marc Remer. The determinants and consequences of search cost heterogeneity: Evidence from local gasoline markets. *Journal of Marketing Research*, 55 (3):305–320, 2018.

Alexander I Passo. Internet minimum advertising price policies: Why manufacturers should be wary when implementing. *Suffolk UL Rev.*, 48:795, 2015.

Patrick Rey and Thibaud Vergé. Economics of vertical restraints. *Handbook of antitrust economics*, 353:390, 2008.

Salvatore A Romano. Resale price maintenance for beginners: Beware of the pitfalls. *The Antitrust Bulletin*, 55(2):513–538, 2010.

Gonçalo Rosas, Inês F. Neves, and Joana Fraga Nunes. Unravelling the ecj's verdict in case c-211/22 - super bock: The golden rules to assess vertical price-fixing agreements in eu competition law. *Kluwer Competition Law Blog*, 2023. URL https://competitionlawblog.kluwercompetitionlaw.com/2023/07/17/unravelling-the-ecjs-verdict-in-case-c-211-22-super-bock-the-golden-rules-to-assess-vertical-price-fixing-agreements-in-eu-competition-law/.

Leslye Schumacher. Understanding digital Co-Op advertising and terms. Vici Media (blog post), February 2019. URL https://www.vicimediainc.com/post/understanding-digital-co-op-advertising-and-terms. Published February 10, 2019. Accessed 2026-02-04.

SCOTUS. Dr. miles medical co. v. john d. park & sons co., 1911. URL https://supreme.justia.com/cases/federal/us/220/373/. SCOTUS.

SCOTUS. Leegin Creative Leather Products, Inc. v. PSKS, Inc. 551 U.S. 877, 2007. SCOTUS.

Seagate Technology LLC. *Barracuda® 7200.12: Performance and reliability for everyone*. Seagate Technology LLC, January 2011. Data sheet number DS1668.6-1101US (January 2011). © 2011 Seagate Technology LLC.

Seagate Technology LLC. *Product Manual: Seagate® Desktop HDD (Gen 14)*. Seagate Technology LLC, January 2015. URL `https://www.seagate.com/www-content/product-content/barracuda-fam/desktop-hdd/barracuda-7200-14/en-us/docs/100686584l.pdf`. Publication number 100686584, Revision L (January 2015).

Katja Seim and Michael Sinkinson. Mixed pricing in online marketplaces. *Quantitative Marketing and Economics*, 14:129–155, 2016.

Survey Research Center, Institute for Social Research, University of Michigan. Chart 2: Index of consumer sentiment within income terciles. PDF chart generated from the Surveys of Consumers (Survey of Consumer Attitudes and Behavior), December 2025. URL `https://data.sca.isr.umich.edu/get-chart.php?y=2025&m=12&n=2h&d=ylch&f=pdf&k=8723d424c1b5116318519e017a9e8a93ce5918b77d30b4aa704ad75bb9a296cc`. Accessed 2026-02-05.

Hal R Varian. A model of sales. *The American economic review*, 70(4):651–659, 1980.

Tianli Xia. Welfare effects of resale price maintenance: Evidence from the chinese pharmaceutical industry. *Available at SSRN 5118723*, 2024.

Bo Zhou, Carl F Mela, and Wilfred Amaldoss. Do firms endowed with greater strategic capability earn higher profits? *Journal of Marketing Research*, 52(3):325–336, 2015.

A Additional Figures and Tables

Table A.1: Correlation Between MAP and Product Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
RPM = 7200	-0.382*					
	(0.190)					
ln(GB Capacity)		0.020				
		(0.079)				
Disc Size = 3.5			-0.318*			
			(0.184)			
# of Days on Market				0.001***		
				(0.000)		
Avg. # of Retailers					0.082***	
					(0.026)	
ln(Avg Price)						-0.031
						(0.100)
N	32	32	32	32	32	32
R^2	0.146	0.002	0.108	0.118	0.256	0.002

Notes: The observations are at the product level. Robust standard errors in parentheses. We regress the indicator of whether a product is subject to MAP on whether the HDD has the highest spindle speed (the common choices are 5400, 5900 and 7200 RPM), which affects speed and energy efficiency, natural log of capacity, disc size, where 3.5 inches are more common for desktops and 2.5 are for laptops, number of days on the market, the average number of retailers, and the natural log of average price. Because the number of retailers selling a product changes over time, we calculate the variable as the average across all days. The price is averaged across retailer-day combinations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.2: MAP and Alternative Dispersion Measure 1: Logged 80th - Logged 20th Percentile Prices

	(1) Intra-Retailer	(2) Inter-Retailer	(3) Inter-Retailer
Panel A: All Retailers			
$\mathbb{1}$(MAP)	-0.001	0.026***	0.019*
	(0.002)	(0.010)	(0.011)
N	7,334	1,210	1,210
R^2	0.044	0.299	0.120
Panel B: Small Retailers			
$\mathbb{1}$(MAP)	0.001	0.050***	0.047***
	(0.001)	(0.009)	(0.010)
N	5,838	1,016	1,017
R^2	0.053	0.395	0.146
Panel C: Large Retailers			
$\mathbb{1}$(MAP)	-0.006	-0.097***	-0.159***
	(0.005)	(0.037)	(0.044)
N	1,496	356	366
R^2	0.092	0.419	0.178
Fixed Effects			
Week	Yes	Yes	No
Retailer	Yes	No	No
GB Capacity	Yes	Yes	Yes
RPM	Yes	Yes	Yes
Disc Size	Yes	Yes	Yes

Notes: Observations are at the product-retailer-week level in column (1) and at the product-week level in columns (2) and (3). Heteroskedasticity-consistent standard errors in parentheses and clustered at product level. Reference group is composed of all non-MAP Barracuda and Momentus products. We include indicators for capacity levels of 250, 320, 500, 1,000, 1,500, 2,000, 3,000, and 4,000 GB, levels of spindle speeds 5,900 and 7,200 RPM, and disc size 3.5 inches. *** indicates significance at the 1% level, ** at 5%, * at 10%.

Table A.3: MAP and Alternative Dispersion Measure 2: Logged Avg. Price - Logged Min. Price

	(1) Intra-Retailer	(2) Inter-Retailer	(3) Inter-Retailer
Panel A: All Retailers			
$\mathbb{1}$(MAP)	-0.000	0.032***	0.028***
	(0.001)	(0.006)	(0.007)
N	7,334	1,210	1,210
R^2	0.048	0.339	0.128
Panel B: Small Retailers			
$\mathbb{1}$(MAP)	0.001	0.040***	0.038***
	(0.001)	(0.007)	(0.007)
N	5,838	1,016	1,017
R^2	0.060	0.392	0.201
Panel C: Large Retailers			
$\mathbb{1}$(MAP)	-0.007**	-0.058***	-0.093***
	(0.004)	(0.021)	(0.026)
N	1,496	356	366
R^2	0.108	0.419	0.183
Fixed Effects			
Week	Yes	Yes	No
Retailer	Yes	No	No
GB Capacity	Yes	Yes	Yes
RPM	Yes	Yes	Yes
Disc Size	Yes	Yes	Yes

Notes: Observations are at the product-retailer-week level in column (1) and at the product-week level in columns (2) and (3). The outcome is the difference in the natural logs of the average price and the minimum price based on prices of a product across days within a retailer in a week (column (1)) and across retailer-day combinations in a week (columns (2) and (3)). Heteroskedasticity-consistent standard errors in parentheses and clustered at product level. Reference group is composed of all non-MAP Barracuda and Momentus products. We include indicators for capacity levels of 250, 320, 500, 1,000, 1,500, 2,000, 3,000, and 4,000 GB, levels of spindle speeds 5,900 and 7,200 RPM, and disc size 3.5 inches. *** indicates significance at the 1% level, ** at 5%, * at 10%.

Table A.4: MAP and Alternative Dispersion Measure 3: Standard Deviation of Prices

	(1) Intra-Retailer	(2) Inter-Retailer	(3) Inter-Retailer
Panel A: All Retailers			
𝟙(MAP)	0.063*	-1.857***	-2.090***
	(0.032)	(0.447)	(0.437)
N	7,226	1,210	1,210
R^2	0.057	0.402	0.367
Panel B: Small Retailers			
𝟙(MAP)	0.072**	1.041**	0.981**
	(0.032)	(0.425)	(0.453)
N	5,752	1,016	1,017
R^2	0.067	0.491	0.350
Panel C: Large Retailers			
𝟙(MAP)	0.013	-1.285*	-2.990***
	(0.110)	(0.678)	(0.870)
N	1,474	356	366
R^2	0.110	0.464	0.202
Fixed Effects			
Week	Yes	Yes	No
Retailer	Yes	No	No
GB Capacity	Yes	Yes	Yes
RPM	Yes	Yes	Yes
Disc Size	Yes	Yes	Yes

Notes: Observations are at the product-retailer-week level in column (1) and at the product-week level in columns (2) and (3). The outcome is the standard deviation of a product's prices across days within a retailer (column (1)) or retailer-day combinations in a week (columns (2) and (3)). Heteroskedasticity-consistent standard errors in parentheses and clustered at product level. Reference group is composed of all non-MAP Barracuda and Momentus products. We include indicators for capacity levels of 250, 320, 500, 1,000, 1,500, 2,000, 3,000, and 4,000 GB, levels of spindle speeds 5,900 and 7,200 RPM, and disc size 3.5 inches. *** indicates significance at the 1% level, ** at 5%, * at 10%.

Table A.5: Average Prices of MAP Products

	(1) Intra-Retailer	(2) Inter-Retailer	(3) Inter-Retailer
Panel A: All Retailers			
$\mathbb{1}$(MAP)	0.044***	-0.019*	-0.030**
	(0.005)	(0.011)	(0.014)
N	7,334	1,210	1,210
R^2	0.918	0.907	0.876
Panel B: Small Retailers			
$\mathbb{1}$(MAP)	0.069***	0.094***	0.088***
	(0.005)	(0.008)	(0.013)
N	5,838	1,016	1,017
R^2	0.936	0.985	0.935
Panel C: Large Retailers			
$\mathbb{1}$(MAP)	-0.064***	0.060**	-0.046
	(0.015)	(0.030)	(0.042)
N	1,496	356	366
R^2	0.878	0.974	0.934
Fixed Effects			
Week	Yes	Yes	No
Retailer	Yes	No	No
GB Capacity	Yes	Yes	Yes
RPM	Yes	Yes	Yes
Disc Size	Yes	Yes	Yes

Notes: Observations are at the product-retailer-week level in column (1) and at the product-week level in columns (2) and (3). The outcome is the average price based on prices of a product across days within a retailer in a week (column (1)) and across retailer-day combinations in a week (columns (2) and (3)). Heteroskedasticity-consistent standard errors in parentheses and clustered at product level. Reference group is composed of all non-MAP Barracuda and Momentus products. We include indicators for capacity levels of 250, 320, 500, 1,000, 1,500, 2,000, 3,000, and 4,000 GB, levels of spindle speeds 5,900 and 7,200 RPM, and disc size 3.5 inches. *** indicates significance at the 1% level, ** at 5%, * at 10%.

Table A.6: MAP and Average Pairwise Inter-Retailer Price Dispersion

	(1)	(2)	(3)
$\mathbb{1}$(MAP)	0.003*	-0.011***	-0.007**
	(0.002)	(0.003)	(0.003)
Both Retailers ∈ {Amazon, Best Buy, Wal-Mart}		0.044**	
		(0.019)	
Both Small Retailers		-0.024***	
		(0.003)	
$\mathbb{1}$(MAP) ×			
Both Retailers ∈ {Amazon, Best Buy, Wal-Mart}		-0.072***	-0.053***
		(0.019)	(0.018)
Both Small Retailers		0.028***	0.016***
		(0.003)	(0.004)
RPM =			
5,900	-0.052***	-0.089***	-0.056***
	(0.006)	(0.006)	(0.006)
7,200	-0.011***	-0.015***	-0.011***
	(0.003)	(0.003)	(0.003)
Disc Size =			
3.5	-0.008**	0.000	-0.009**
	(0.003)	(0.003)	(0.003)
GB Capacity =			
250	0.070**	0.110***	0.075**
	(0.029)	(0.029)	(0.029)
320	0.058**	0.100***	0.063**
	(0.029)	(0.029)	(0.029)
500	0.067**	0.102***	0.073**
	(0.029)	(0.029)	(0.029)
1,000	0.046	0.074**	0.052*
	(0.029)	(0.029)	(0.029)
1,500	0.095***	0.125***	0.097***
	(0.029)	(0.029)	(0.029)
2,000	0.097***	0.128***	0.102***
	(0.029)	(0.029)	(0.029)
3,000	0.088***	0.118***	0.092***
	(0.029)	(0.028)	(0.029)
4,000	0.091***	0.116***	0.097***
	(0.029)	(0.030)	(0.029)
Fixed Effects			
Week	Yes	Yes	Yes
Retailer Pair	Yes	No	Yes
N	24,300	24,309	24,300
R^2	0.246	0.169	0.248

Notes: Observations are at the product × retailer pair × week level. Heteroskedasticity-consistent standard errors in parentheses and clustered at product level. Reference group is composed of all non-MAP Barracuda and Momentus products. Reference category in column (2) are retailer pairs where one retailer is in the set {Amazon, Best Buy, Wal-Mart} and the other retailer is a small retailer. *** indicates significance at the 1% level, ** indicates significance at the 5% level, and * indicates significance at the 10% level.

Table A.7: Effects of MAP Decrease: Price Quantiles and 20th Quantile

	P80-P20 (1)	P20 (2)
$\bar{\beta}_d$	-0.089*** (0.018)	0.052*** (0.015)
Fixed Effects		
Day	Yes	Yes
Product	Yes	Yes
N	112	112

Notes: Observations are at the product × day level. The y variables are the differences in the natural log of the 80th and 20th price quantiles and the natural log of the 20th percentile price across retailers within a day. Heteroskedasticity-consistent standard errors in parentheses and clustered at the product level. Average $\bar{\beta}_d$s post MAP decrease in eq. (1) are displayed. *** indicates significance at the 1% level, ** 5%, and * 10%.

Table A.8: Heterogeneous Effects of MAP Decrease: Quantile Price Difference and 20th Quantile

	< 7% MAP Decrease		> 7% MAP Decrease	
	P80-P20 (1)	P20 (2)	P80-P20 (3)	P20 (4)
$\bar{\beta}_d$	-0.079*** (0.023)	0.050** (0.023)	-0.104*** (0.024)	0.054** (0.026)
Fixed Effects				
Day	Yes	Yes	Yes	Yes
Product	Yes	Yes	Yes	Yes
N	96	96	88	88

Notes: Observations are at the product × day level. Subsamples are split based on the magnitude of the MAP decrease. The y variables are the differences in the natural log of the 80th and 20th price quantiles and the natural log of the 20th percentile price across retailers within a day. Standard errors in parentheses and clustered at the product level. *** indicates significance at the 1% level, ** 5%, and * 10%.

Table A.9: MAP Decrease, Alternative Price Dispersion Measures and Average Price

	Avg - Min (1)	Std Dev (2)	Avg Price (3)
$\bar{\beta}_d$	-0.103***	-0.005***	0.011
	(0.020)	(0.001)	(0.008)
Fixed Effects			
Day	Yes	Yes	Yes
Product	Yes	Yes	Yes
N	112	112	112

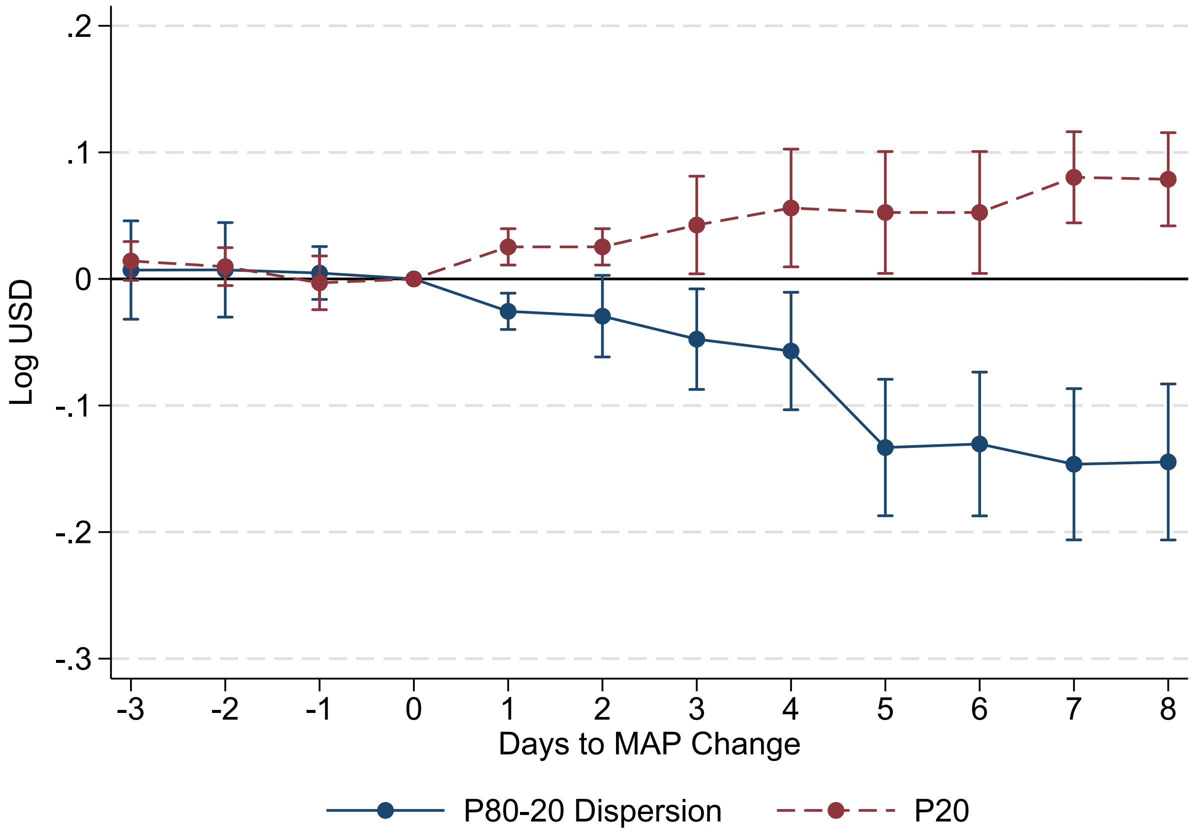
Notes: Observations are at the product × day level. The y variables are the average price minus the minimum price, the standard deviation of prices, and the average logged price across retailers. Heteroskedasticity-consistent standard errors in parentheses and clustered at the product level. Average $\bar{\beta}_d$s post MAP decrease in eq. (1) are displayed. *** indicates significance at the 1% level, ** 5%, and * 10%.

Table A.10: Loss Aversion Regression Results

	(1) Log Price Change	(2) Log Price Change + MAP-change Interactions
	(1)	(2)
Increase	0.077***	0.076***
	(0.003)	(0.003)
Decrease	-0.072***	-0.071***
	(0.002)	(0.002)
Increase × MAP Change		0.029
		(0.022)
Decrease × MAP Change		-0.022**
		(0.011)
Fixed Effects		
Product	Yes	Yes
Retailer	Yes	Yes
Day	Yes	Yes
N	50,594	50,594
R^2	0.420	0.422

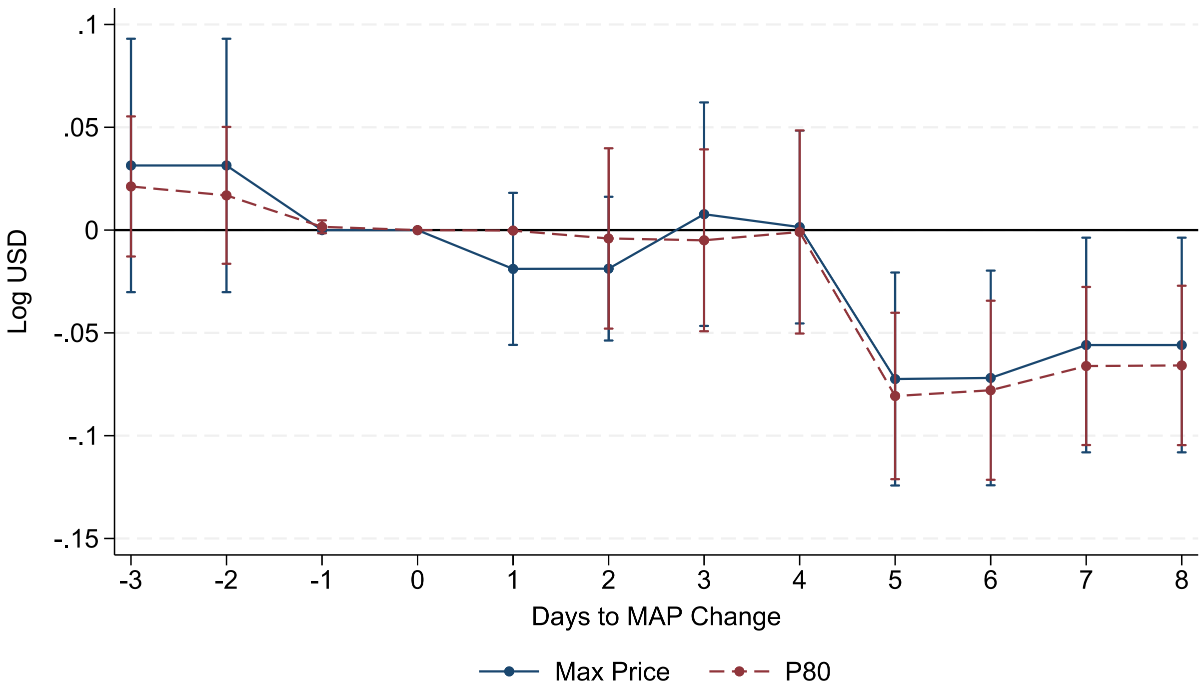
Notes: The observations are at the product-retailer-day level. We regress the natural log of the day-over-day price differences over indicators of whether these changes are price increases or decreases in columns (1) and (2). Column (2) additionally includes the indicators' interactions with whether the MAP is decreased in the past seven days. *** indicates significance at the 1% level, ** 5%, and * 10%.

Figure A.1: MAP Decrease, Price Quantile Difference and the 20th Quantile



Notes: The figure plots the de Chaisemartin and D'Haultfœuille (2020) event study coefficients. P20 is the 20th price quantile of a product across retailers on a given day. The dispersion is measured as the difference in the natural logs of the 80th and 20th price quantiles.

Figure A.2: MAP Decrease, the Highest Retail Price and 80th Price Quantile



Notes: The figure plots the de Chaisemartin and D'Haultfœuille (2020) event study coefficients. Max Price and P80 are the natural logs of the highest price and the 80th price quantile of a product across retailers on a given day.