FAIR PLAY.

With competition,
everybody wins.

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An enforcer's view on competition and algorithms in the digital economy

TSE Workshop

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The views expressed are personal views of the author and cannot be regarded as stating an official position of the AdC

Outline

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I. Introduction

II. Algorithms in practice

III. Algorithms and collusion

IV. Pricing algorithms and Competition Law

AdC's Digital Issues Paper

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- Published in July 2019 (in PT and EN).
- Addresses key issues in digital markets that may impact competition:
  - Network effects and multi-sided markets;
  - Digital ecosystems;
  - Data access and data portability
  - Implications for merger evaluation
  - Monitoring and pricing algorithms, and their possible role as facilitators of collusion

Aims

- **Added focus on Algorithms**
- **Advocacy for the PT competition community** as to how AdC views challenges regarding the digital developments for competition policy and enforcement

- **Other reports on the digital economy** to check: CMA (2018), ACCC (2019), CERRE (2019), Crémer et al. (2019), Furman Report (2019), Stigler Center Report (2019), BkA and AdIC (2019), CMA (2020), CMA (2021)

Algorithms in the digital economy

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- The ability to collect **large volumes of information** and the **speed of communication** have allowed the development of **tools that aid firms' decisions** and **facilitate product discovery**.
- **Chen et al. (2016)** detect a significant number of algorithmic pricing strategies on Amazon.
- **Algorithms may change the way competition takes place** in the market:
  - Firms can do what they already did **faster and/or with more information** (e.g., monitoring prices)
  - **The way firms interact may change** (e.g., easier to detect deviations from collusive equilibria) (E.g., Mehra, 2015; Ezrachi & Stucke, 2017)
  - Firms may adopt **new strategies** (e.g., personalised pricing

Algorithms:

Monitoring algorithms

Software that tracks prices (and other strategic and non strategic variables)

Pricing algorithms

Change prices without direct human intervention

Ranking, recommendation, search algorithms

Determine what is shown and the salience of what is shown

Algorithms in the digital economy

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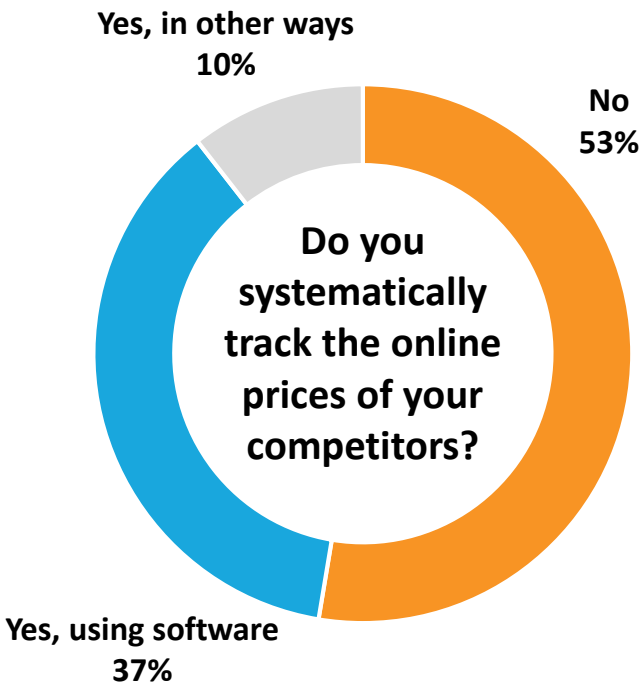
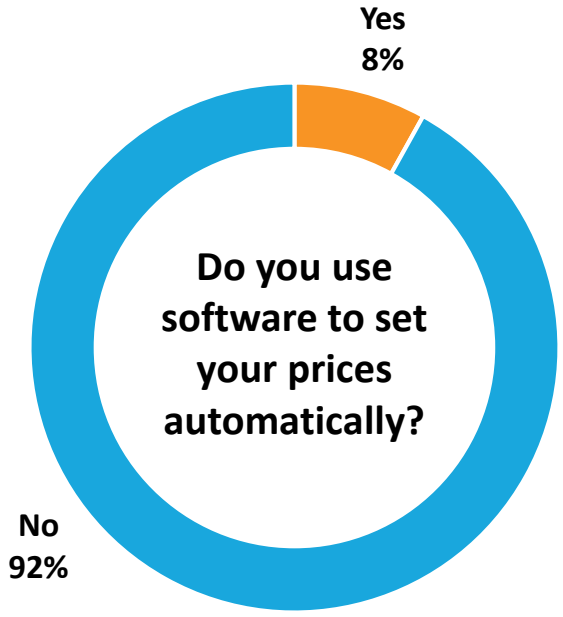
- Ranking, recommendation and search algorithms may determine **what is shown** but also **the salience of what is shown**.
- The **ability to divert consumers** from some products to others and to **exploit consumer behavioural biases** may imply that "**exclusion is a click away**", instead of competition being a click away:
  - Adding extra steps to access a product
  - Deranking results in search results pages
  - Default options

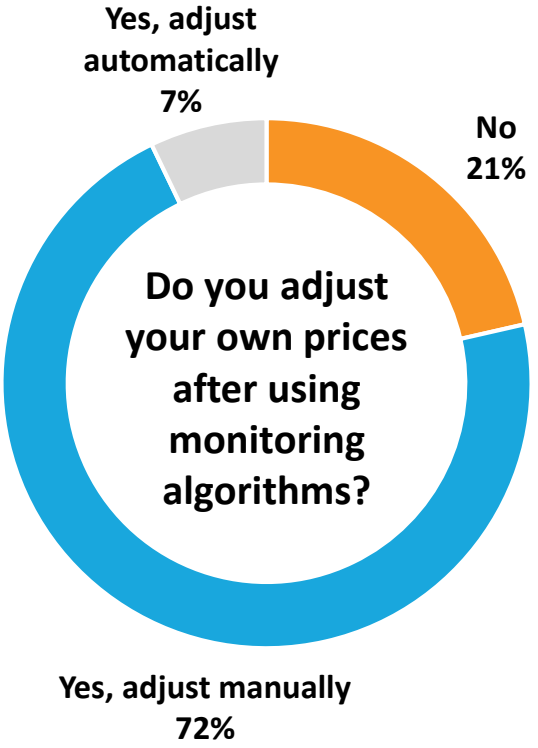
Heatmap of where people look in search results pages "F pattern"

Source: https://www.nngroup.com/articles/f-shaped-pattern-reading-web-content/

Monitoring and pricing algorithms in Portugal







Source: AdC. (2019). Digital Ecosystems, Big Data and Algorithms (RFI to 38 firms with active online presence in Portugal)

Monitoring algorithms

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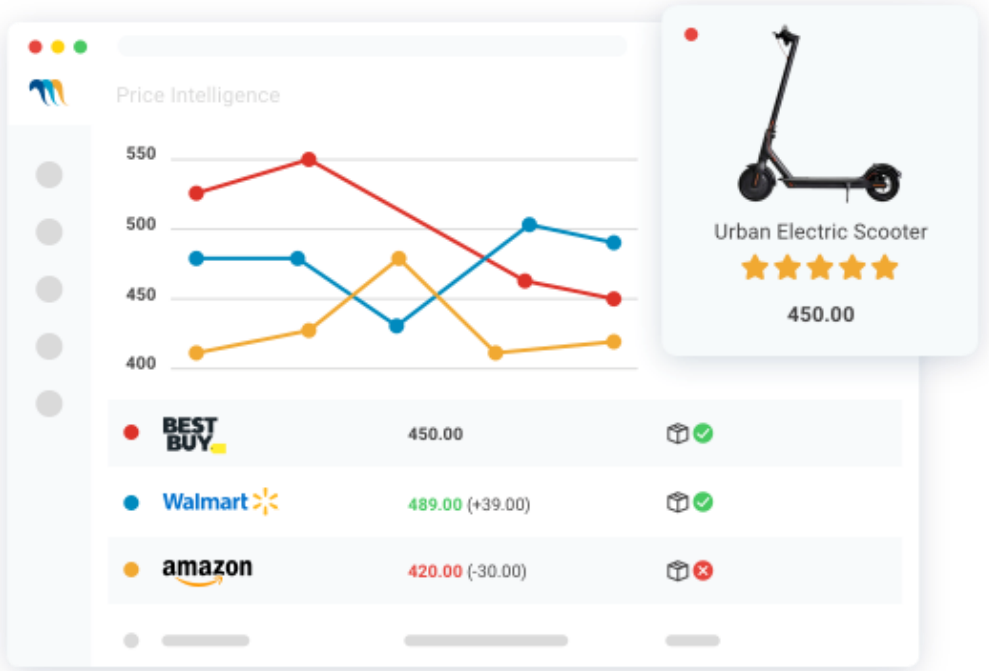
- Using monitoring algorithms, firms have access to **on-demand information about prices** (and other strategic variables), including both **current and historical information** (e.g., up to 1 year).
- Data is obtained through **APIs**, **web scraping** and/or **data feeds** with retailers.
- Information updates can take a few minutes (e.g., Amazon) or be done up to 3-4 times a day (e.g., retailers).
- Information often presented through dashboards, like price comparison services for consumers.



Source: www.minderest.com

Source: www.pricebench.pt

Simple vs. self-learning pricing algorithms

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Simple pricing algorithms

- Highly customisable
- Very simple pricing rules and strategies, i.e. explicit “do Y if X”
- Often bundled with monitoring algorithms
- May be used to facilitate explicit collusion (e.g., Trod and Topkins cases)
- May be predictable and foster tacit collusion

Self-learning pricing algorithms

- Black-box
- Optimize for target variables (e.g., profit)
- No evidence of widespread use
- May reach collusion on their own
- May raise liability questions

Simple pricing algorithms

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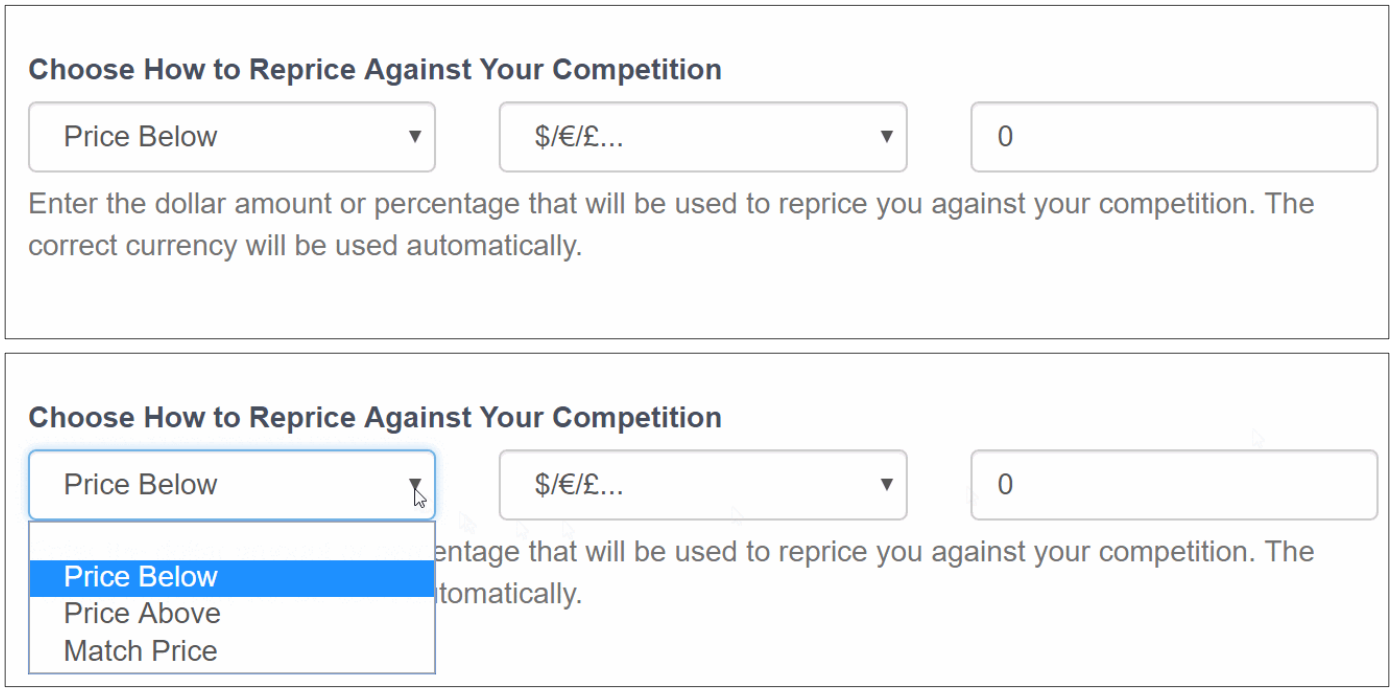
- **Setting prices according to competitors' prices (e.g., undercut; match)** is one of the most common pricing rules. This requires active monitoring of the competition.
- **Price updates can be very fast** (1-30 minutes), following changes in competitors' prices.



Source: https://help.informed.co/strategies/strategy-types/compete-with-lowest-price

Minimum and maximum prices

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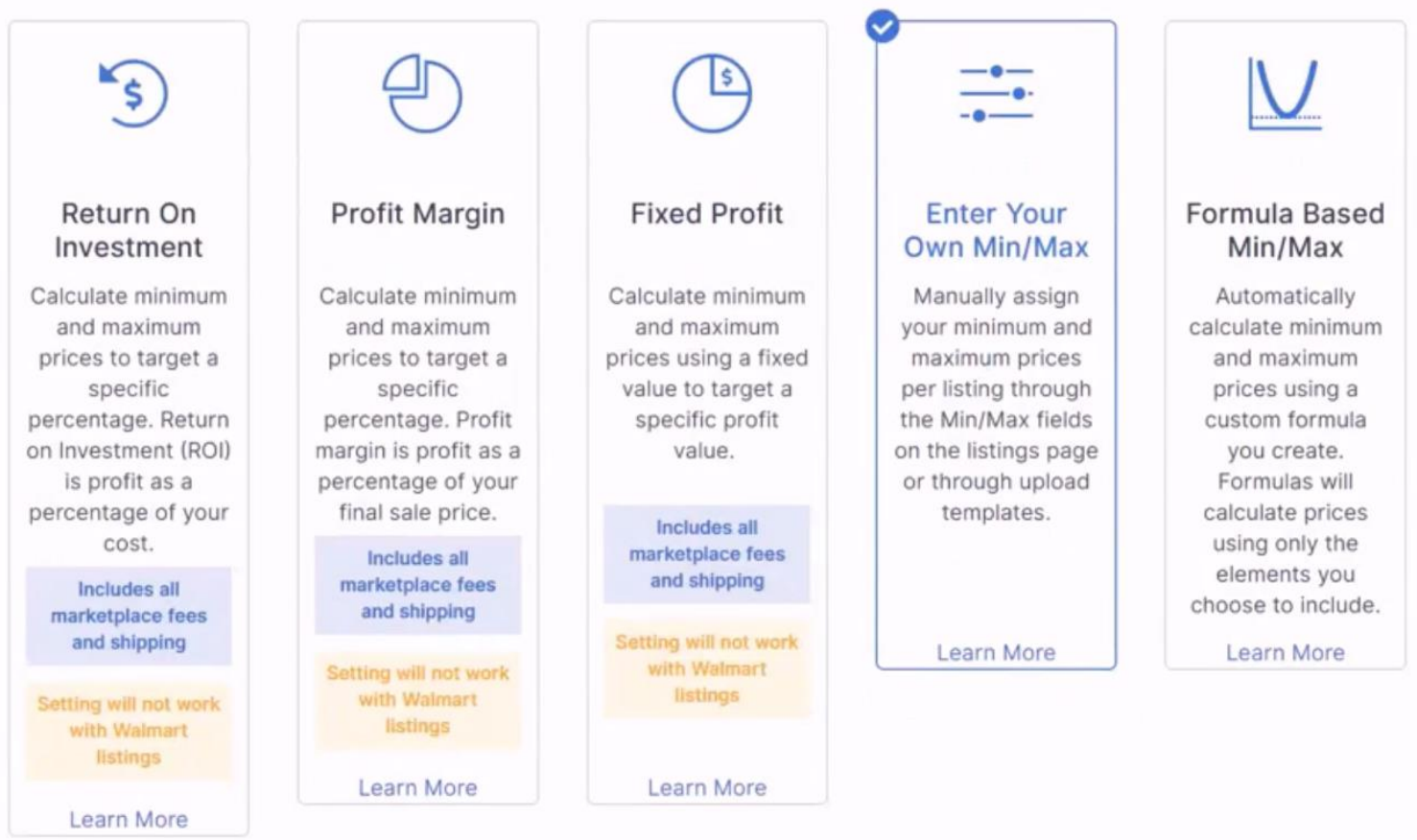
- Third-party vendors can set **minimum prices** and **maximum prices** automatically or manually.



Source: https://help.informed.co/strategies/strategy-types/build-your-own

Additional options for pricing algorithms

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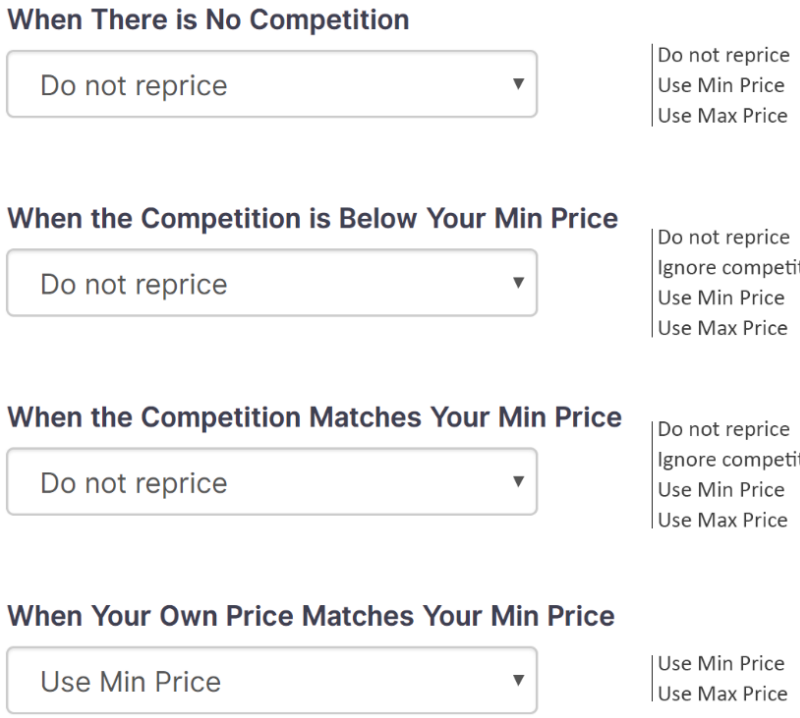
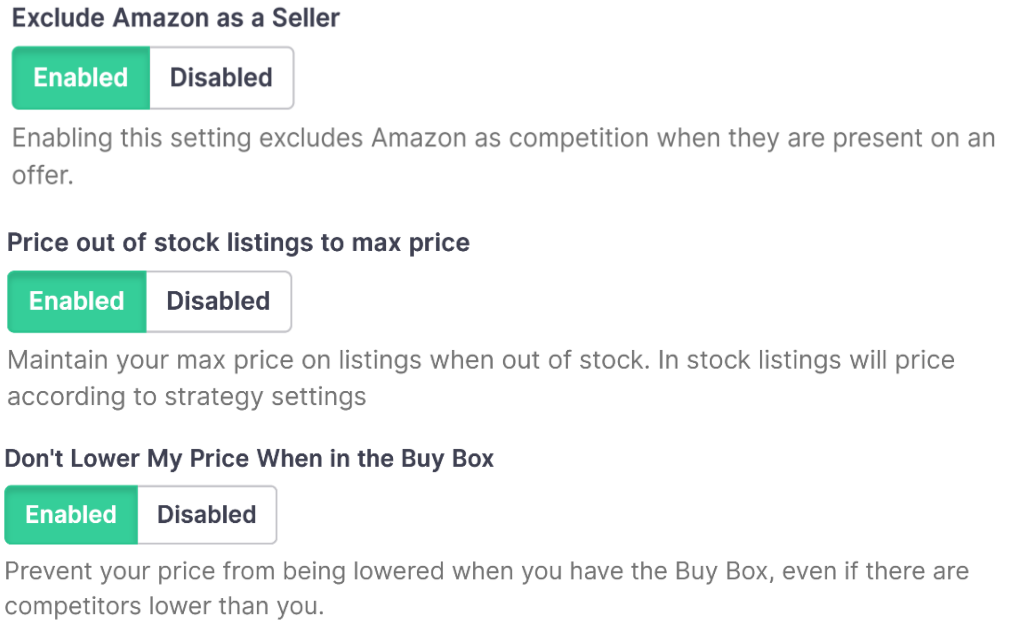
- Vendors can stop the pricing algorithm if there are **no competitors selling the same product**.
- They can price differently when **out of stock**, if their **products are in the Amazon Buy Box** or **relative to specific competitors**.



Source: https://help.informed.co/strategies/strategy-types/build-your-own



On Amazon, "having the Buy Box" means one is the default vendor in the product page. More than 80% of sales go through the "Buy Box" (consumer inertia).

Triggers to change pricing rules

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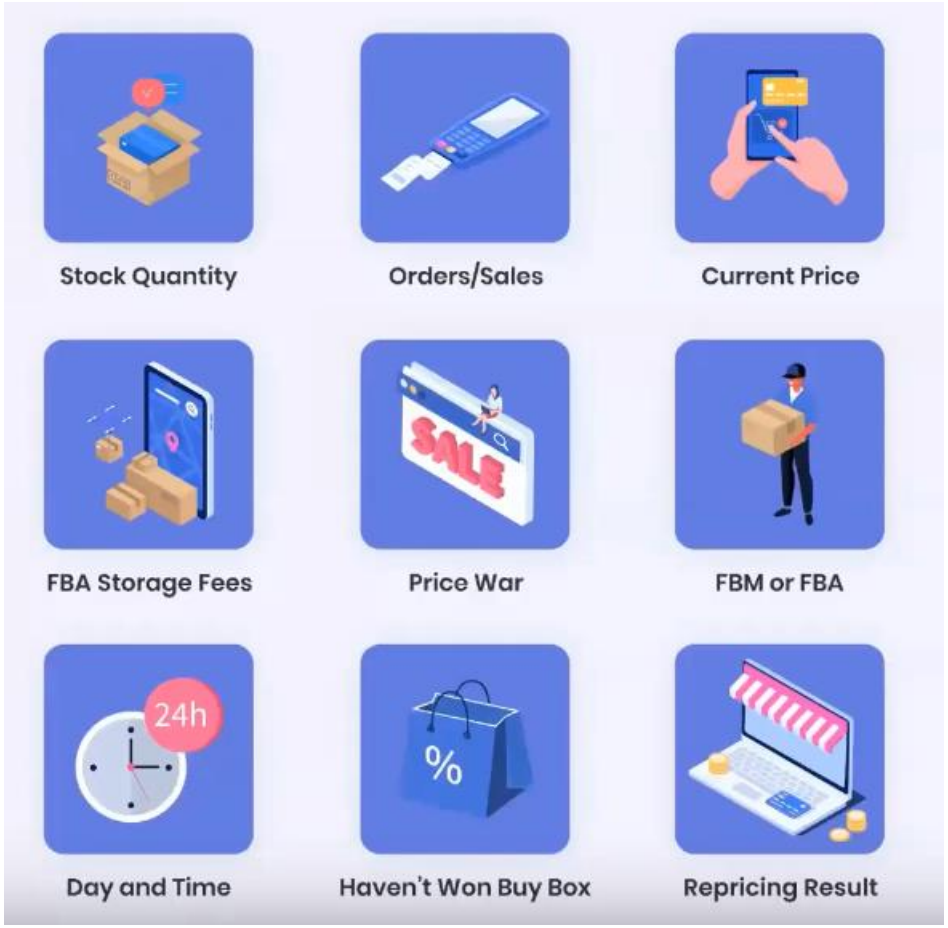
- Vendors can **set up various triggers to shift the pricing algorithm between pricing rules**.
- Ultimately, pricing rules, despite being simple, can generate **arbitrarily complex behaviour**.

Possible triggers



Source: https://www.youtube.com/watch?v=M0vkYQg6m3w

E.g. detecting and avoiding price wars

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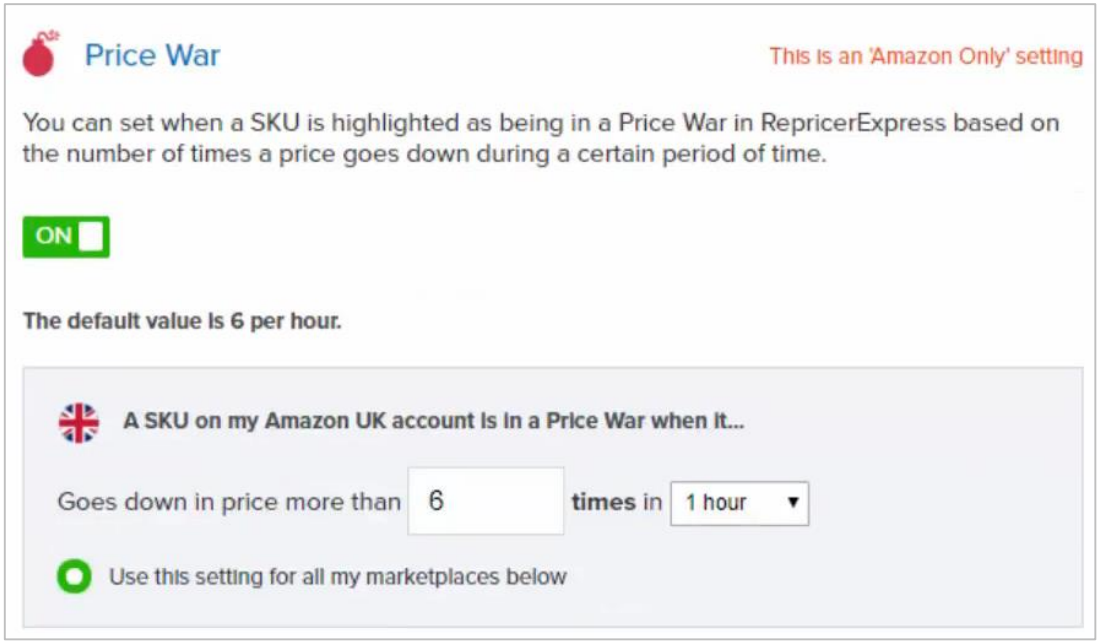
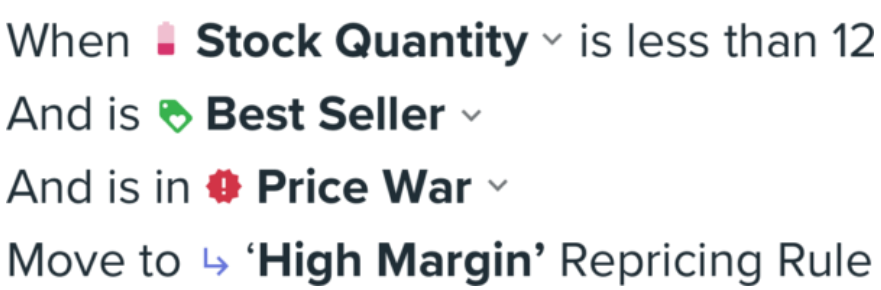


Source: https://www.youtube.com/watch?v=DkmuUZ2Lvds



Source: https://www.youtube.com/watch?v=M0vkYQg6m3w

- One notable example is **the ability to detect and avoid price wars**, depending on the frequency or magnitude of price changes.
- Vendors can configure the pricing algorithm to change pricing rules whenever a price war is detected.

“Putting the algorithm to sleep”

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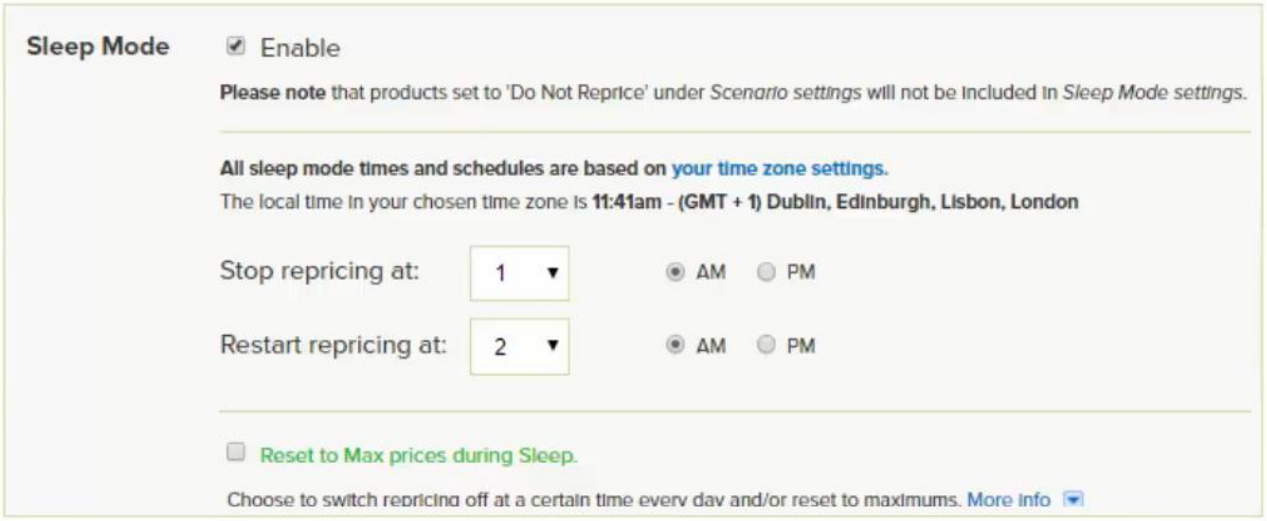
- Pricing algorithms can be **put in sleep mode** during certain periods, and even be reset to max price, to **prevent unexpected price fluctuations (e.g., price wars):**



Source: https://www.youtube.com/watch?v=DkmuUZ2Lvds

- The developers claim this feature may be used “***if you want to force your competitors’ prices to increase by increasing your own price overnight***”.

Algorithms and collusion

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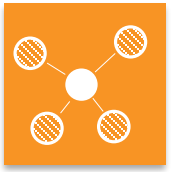
- There are several ways in which algorithms may foster collusion

Making **horizontal and vertical agreements easier to initiate and enforce**

Making the **market more predictable**



Creating **“hub-and-spoke”-** like scenarios

Reaching **collusive equilibria on their own**

“Traditional” cases involving algorithms

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Enno Vatti 100 Movies Scratch Off Poster - Top Films of All Time Bucket List (16.5" x 23.4")

525

$19.97 $29.97

More Buying Choices
$18.36 (3 used & new offers)

Poster Michael Jordan Chicago Bulls Last Shot 1998 (Basketball) Sports Print (24in x 36in)

110

“Amazon posters” cases
Topkins (DOJ, 2015) and
Trod (DOJ, 2016 and CMA, 2016)

- Pricing (and monitoring) algorithms may **facilitate both the initiation and maintenance of explicit collusive agreements**.

- Topkins (DOJ, 2015) and Trod (DOJ, 2016 and CMA, 2016) are seminal cases. Some e-mail exchanges from Trod (CMA, 2016):
  - *“Trod (Buy 4 Less) have **agreed not to undercut** us on Amazon and I have agreed to reciprocate. We will therefore be aiming to be the same price wherever possible, put prices up and share the sales (…)”*
  - *“Logistically it is going to be difficult to follow the pricing effectively on a daily basis so **I am looking into re-pricing [so]ftware**…”*

(emphasis added)

“Traditional” cases involving algorithms

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- Pricing (and monitoring) algorithms may also be used to **implement vertical agreements, namely RPM agreements**.
- In recent RPM cases involving algorithms by the EC, **monitoring algorithms and software were used by manufacturers to track retailers’ prices** and intervene in case of price decreases.
- Because retailers **use pricing algorithms**, **RPM restrictions** on low pricing online retailers **may have an overall impact on market prices.**

RPM cases involving algorithms by the EC

Asus (EC, 2018),
Philips (EC, 2018),
Denon & Marantz (EC, 2018) and
Pioneer (EC, 2018)

Algorithms and predictable markets

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- Simple pricing algorithms may be a **short-term commitment** to a specific price strategy

- Given the **simplicity of price strategies** (e.g., price matching), and the high **frequency of price updates**, market players easily **learn how competitors will respond**, thus **softening competition**.
  - E.g. with price matching, every time I change my price to X, my competitor matches my price at X within 30 minutes and I have no business stealing effect.

- **Salcedo (2016)** and **Brown & MacKay (2020)** highlight how pricing algorithms may lead to price increases if they are used as commitment devices for pricing strategies.

- Information and tips on the outcomes of price strategies seem to be widely available online, in forums, pages geared towards e-commerce, video-sharing platforms and social networks.

Communication in public fora

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The race to the bottom - EVERYONE LOSES. Please read

Selling on Amazon · General Selling Questions

noober0x mar '15

I am here to teach you all some things.

Something that has ticked me off for quite some time. Something that should be second nature to everyone. Something that everyone here should have known the second they started, but has failed to learn.*

The race to the bottom is a race that EVERYONE loses. *STOP REPRICING YOUR STUFF INTO OBLIVION.*

What do I mean? I mean when you reprice your product to a penny below the next person. Then that person reprices his price to a penny below you. Then the next 5 guys all do the same thing, then you log in one day and see that you're 10 cents above everyone else, so you drop your price 11 cents and the cycle begins all over again…

So please people, remember these two points when you do competitive repricing. Consider these following alternatives to penny wars:

MATCH the lowest person's price rather than attempting to undercut them. Undercutting is a win for no one other than the buyer, who will save a few pennies on your price, but you'll lose hundreds because you have 800 of them in stock.

Source: https://sellercentral.amazon.com/forums/t/the-race-to-the-bottom-everyone-loses-please-read/32676 (emphasis added)

Communication in public fora

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Repricers and their perils

Selling on Amazon · General Selling Questions

sellsome mar '16

This is just a rant.

So there is a new seller on some of my best selling listings and he is FBA and has the repricer set to undercut. Other's have set to match. So this guys undercuts and others match. Result: very fast march to bottom! I know very well their price points and am shocked to see sellers being so irresponsible. This seller is new, I get it but the other more experienced sellers also seem to have no bottom price. On listings where there are good number of FBA sellers, now it is going to take months for it all to clear out. I can set 10% lower and they will come down fast, but I do not want to keep doing it as I do not want to risk any policy violation! I have heard of how repricers are dangerous and can set ur price to a penny, but I feel the most dangerous aspect of repricers is their use by people who do not know their margins!

I know that talking pricing is illegal and will not do so. But can I contact this crazy seller and just tell him this:

"Hello,
I see u have a repricer on that undercuts the lowest FBA offer. When u undercut, the others match, and then u again undercut and so on. The result is loss of profitability for everyone. Now your price is your choice and this message is in no way an attempt to fix pricing. You set your price to whatever you like but I just wanted to send you a message on what I observed on the listings you are on and share my thoughts with you."

Source: https://sellercentral.amazon.com/forums/t/repricers-and-their-perils/158542 (emphasis added)

Common Algorithms/Hub-and-spoke

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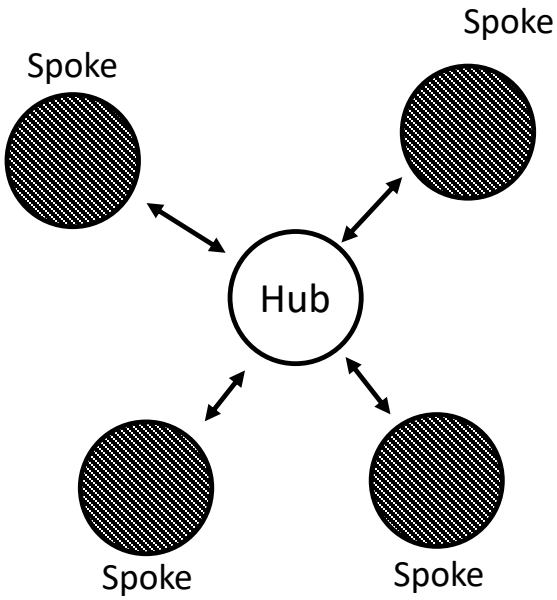
- **Commons algorithms may increase market transparency; may foster parallel behaviour as each firm may know the decision-making process of their competitors.**
- In a "hub-and-spoke", **the "spokes" collude without direct communication, through a "hub"**. "Hubs" may be **common suppliers or retailers**.
- With regards to pricing algorithms, the "hub" may be a **common provider of algorithms.**
- The algorithm developer **may access sensitive data from other rivals** that would not otherwise be available and use the information to calibrate the pricing algorithm.
- **There may for example be a full outsource of pricing decisions, with the provider engaging** in **joint profit maximisation**.



Pitching from algorithm developers

- Third-party providers of pricing algorithms may promote collusion namely by:
  - **Disclosing their list of clients** on their promotional material, **particularly if the market is concentrated**;
  - Claiming the pricing algorithm **increases profit margins**;
  - Claiming the pricing algorithm **prevents price wars**, and presenting it as a plus.

- E.g. pricing algorithms used by airline companies.

Source: https://resources.pros.com/home/the-critical-dos-and-donts-of-pricing-optimize-for-frictionless-selling-experiences

Pitching from algorithm developers

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"In a promotional war, everyone loses"

"If we are in a price war with two competitors who are out of stock, why continue selling the product with such a tight margin?"

"The only way to win a price war is to avoid it"

"Well-behaved AI will be able to proactively change its prices to "tie in" competitors that follow it to its own price and become the "price maker" in the market. This way it may directly and strongly influence the prices of competitors."

Source: https://competera.net/resources/articles/price-wars
https://www.netrivals.com/retailers/repricer/
https://www.pricebench.pt/blog/promocao-vs-margem/ (AdC translation)
https://fr.paarly.com/2020/10/12/marketplace-strategies-prix/ (AdC translation)

repricerexpress

Repricing on Amazon: How to Avoid a Price War

We all know price has a lot to do with winning a share of Amazon's Buy Box, but perhaps merchants place a little *too* much importance on price. Instead of worrying so much about having the lowest costs among your competitors, RepricerExpress recommends avoiding a price war as a technique for coming out on top. It rarely works out for the best, and we'll take a look at why that is.

Source: https://www.repricerexpress.com/avoiding-price-war-on-amazon/

Self-learning pricing algorithms

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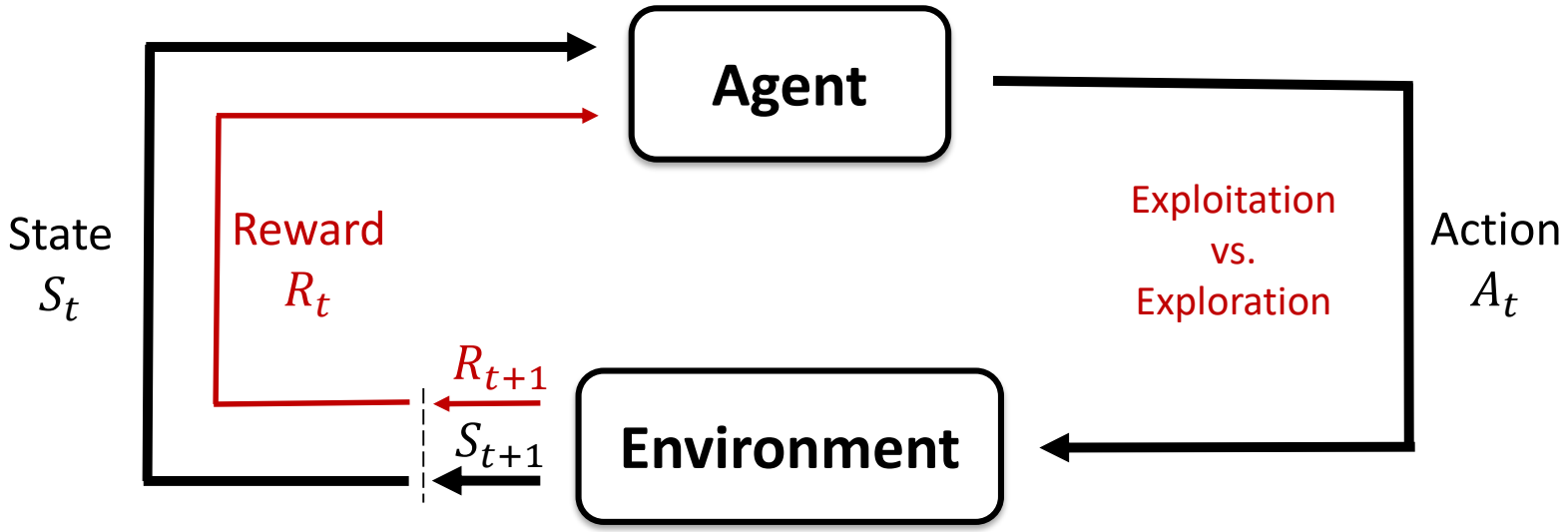
- Algorithms based on Machine Learning (e.g., **Reinforcement Learning**).
- **Klein (2020)** and **Calvano et al. (2020)** simulate the interaction between RL pricing algorithms (Q-learning) in a price competition setting. They find that **RL algorithms may learn to collude and converge to collusive equilibria**.
- **Assad et al. (2021)**, in an offline setting, find that the introduction of pricing algorithms in the road fuels market in Germany increases profit margins.



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