

Emerging Technologies – risks and opportunities

1.1 Introduction

Digital services and online platforms play an increasingly important role in the economy, enabling businesses to find and connect with a large number of consumers. In doing so, they have improved cross-border trade, increased competition and created new business opportunities for app developers, retailers and advertisers, among others.

However, digital markets feature several characteristics that can facilitate market concentration, create barriers to entry and enable the entrenchment of market power into other nearby markets. Such characteristics include:

- **Network effects and tipping points:** the result of a good or service becoming more attractive as it is owned or used by more consumers resulting in the market tipping towards a single dominant provider.
- **Big Data:** large incumbent tech companies collect vast amounts of user data, which can give them an advantage over smaller firms who lack the same data resource.
- **User lock-in:** consumers become dependent on a service or provider due to high switching costs or barriers, making it hard to transition to an alternative.



Emerging technologies such as **Generative AI**, **neurotechnologies** and **machine learning** are creating new ways for consumers to interact,

gather data and are changing traditional business models. The development of AI technologies presents significant opportunities for innovation and economic growth.

However, despite the presence of opportunities, governments and regulators are facing new challenges regarding AI's implications on fair competition, consumer welfare and market dominance. The European Union (EU) and the UK have introduced several initiatives to address the intersection of AI and competition law:

- **The Digital, Markets, Competition and Consumers Act (DMCC)** implemented in May 2024 granted new powers to the Competition and Markets Authority (CMA) in respect of digital markets, competition and consumer protection.
- **The Digital Markets Act (DMA)** complements EU competition rules to regulate the gatekeeper power of large digital technology firms.



A challenge for regulators **is finding the right balance** between promoting the growth of these technologies and keeping markets open for innovation, while also ensuring consumer protection and fair competition as the landscape shifts.

1.2 The beginning - algorithmic pricing

Broadly speaking, an algorithm is a 'process or set of rules to be followed in calculations or other problem-solving operation'.¹ This mechanism of **using software to set prices** is called 'algorithmic pricing'. A pricing algorithm is a unique formula based on a set of computer rules and processes designed to optimise pricing in online markets. These algorithms can analyse various factors such

¹ Oxford Dictionary (2019)

as market conditions (e.g. demand), competitor’s prices and personal characteristics (geo-location).

Algorithmic pricing is most likely to occur in markets that have the following three characteristics:

- The **cost to serve consumers** is different from consumer to consumer (e.g. insurance markets).
- There are a **large number of products to price** (e.g. consumer retail)
- **Demand fluctuates** more rapidly than supply (e.g. airline travel).²

Firms are increasingly using algorithms to set prices (algorithmic pricing), which does not only change the frequency and sophistication of pricing movements, but also the ways firms compete. A growing concern is that learning or self-reinforcing algorithms could unintentionally create anticompetitive pricing patterns, such as price cycles, without any direct human involvement. This outcome would be difficult to regulate, as firms may be unaware of the complex strategy the algorithm has developed.

This becomes further complicated since a range of algorithms of various firms might be interacting in run time, **dynamically reacting to the market** and consumers’ characteristics through bidding optimisation, dynamic pricing, and personalisation algorithms.

On one hand, algorithms have clear advantages for firms that use them, such as **cost-reducing or revenue enhancing** (through faster and more efficient price adjustments). On the other hand, there is a risk that pricing algorithms may (inadvertently) **create collusive outcomes**, whether by design or not. This can be attributed to the learning feature of algorithms, as shown in **Figure 1**:

Figure 1:

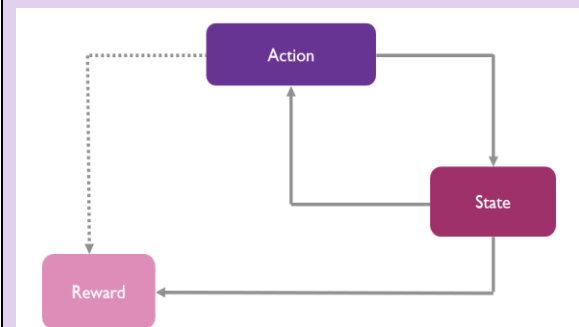
Figure 1: Reinforcement learning process

This diagram below illustrates the **reinforcement learning** process, where an algorithm interacts with an environment.

Reinforcement learning serves as an overarching framework for pricing algorithms, where the algorithm can learn from outcomes and decide which action to take next. It formalises how agents (companies) can learn to adjust their pricing strategies (actions) overtime to maximise profits (rewards).

For instance, if demand for a product rises and competitors raise their prices, the algorithm (using an advanced reinforcement learning approach) might increase its price slightly to increase profit. If sales drop as a result, the algorithm learns to avoid such actions in similar situations. Over time, it fine-tunes its pricing strategy to maximise long-term revenue and customer satisfaction.

Diagram 1: Reinforcement learning process



Source: Oxera (2017)

As with many digital technologies, AI can bring many wide-reaching benefits for consumers, but it can also give rise to durable market power, giving rise to new competition concerns.

The concerns with algorithmic pricing are twofold:

- Pricing algorithms can **learn to spontaneously collude** through rapid price monitoring, and quick retaliation to any deviation from a price strategy.
- Tacit algorithmic collusion is currently **beyond the scope** of antitrust laws.

Within tacit collusion (e.g. where algorithms engage in tacitly collusive strategies in the absence of human intervention), there are three key cases

² Oxera (2017) “When algorithms set prices: winners and losers” [\[link\]](#)

which have gained attention amongst competition authorities and regulators:³

- **Predictable agent:** firms can design algorithms to react to certain external factors in a predictable way. These types of algorithms are a concern if they lead to predictable and transparent behaviour i.e., lowest price matching or price cycles.
- **Hub-and-spoke:** this can arise if several firms in the same industry use the same type of algorithm which therefore compromises sellers' ability to set prices independently.
- **Autonomous algorithms:** competitors can unilaterally design an algorithm that strives to reach a pre-set target (e.g. maximising profit).

Therefore, one of the key challenges in finding the delicate balance of promoting fair competition, while also realising the benefits that innovation in technology can bring.

While the risks associated with pricing algorithms has received the attention of many, its many positive features have the potential to improve outcomes for consumers:

- Algorithms can **swiftly make price adjustments** based on a large amount of market information. This should enable a better match between demand and supply, as well as meeting consumers needs better and lowering prices.
- Additionally, algorithms can **significantly reduce the costs of setting (and changing) prices**. This should facilitate improved market entry as suppliers can understand quickly how a market works.

1.3 Other emerging technologies

AI markets have also shown to have characteristics that are different to other digital markets. For instance, digital markets have limited access points (e.g. laptops and phones), whereas AI markets have a constantly increasing number of players in the market, as well as expanding access points across the value chain which could appear in the

physical environment (e.g. wearables). This may raise issues with regards to market entrenchment, and which regulatory tools to apply in these emerging AI markets.⁴

The rise in the use of Generative AI uses content created by others to generate new material, but does not always direct users back to original content creators. This can potentially have an impact on the **journalism and media sectors** who may lose website traffic. There is also a possibility that it may further entrench the position of platforms that become content mediators (e.g. Google search).

Like pricing algorithms, self-driving cars could change the **transport industry**. The software needed to control vehicles requires significant data and investment, and only a limited number of companies may be able to develop it. As these companies gain control over how self-driving cars operate, they could dominate the market, deciding prices and access to the technology. This could lead to shifts in the transport market if the control of pricing becomes concentrated among a few large firms.⁵



Disruptive technological progress also changes traditional business models, meaning that products and services can **shift from one regulatory category to another** as they evolve. New and emerging AI business models and similar commercial arrangements have attracted regulatory scrutiny, in particular with regards to the issue of **“killer acquisitions”**. In such instances, large incumbent firms acquire smaller, promising firms with the objective of eliminating future competition (i.e. Apple's acquisition of Shazam in 2018).⁶

³ Competition and Markets Authority (2018): Pricing algorithms [\[link\]](#)

⁴ Weil, Gotshal and Manges (2024) “Antitrust and Generative AI: Navigating the Interplay – Five key takeaways from our W@Competition event” [\[link\]](#)

⁵ Lyyra et.al. (2023) “Tethered Architecture in Cyber-Physical System Development: The Case of Tesla's Autopilot System” [\[link\]](#)

⁶ Competition Policy International (2019) “Preserving Innovation Competition in the Digital Era: “Killer Acquisitions” [\[link\]](#)

1.4 Key regulatory challenges

Digital markets are not only rapidly changing and complex, but are full of trade-offs and have an array of platforms with different characteristics. However, while there are clear regulatory concerns due to **the fast-paced nature** of emerging technology markets, a slower and more considered approach may be preferred to avoid the effects of ‘over enforcement’.

A key issue in regulatory matters is how emerging technologies redefine market boundaries, potentially leading to changes in the definition of relevant markets and reshaping the structure of industries (at both national and regional levels). Such changes of the definition of relevant markets and competitive structure may fall below the financial thresholds set out in regulatory frameworks (e.g. the DMA). There are still cases that do not meet the financial thresholds of regulatory frameworks, but still have the potential to affect competition (e.g. the Illumina/GRAIL case).⁷



These issues are also reflected by the findings from the Furman Review, which noted that regulatory frameworks need to be flexible and forward-looking to anticipate how digital markets will evolve under the influence of emerging technologies. Similar to the DMA, the DMCC aims to ensure that gatekeepers do not abuse their dominant positions, but also underscores the necessity of continuous monitoring and updating of regulatory frameworks as new technologies emerge. The review also emphasised that AI-driven acquisitions by large incumbents ("killer acquisitions") may further entrench market power by eliminating potential competitors.⁸

1.5 Looking ahead

Emerging technologies such as algorithmic pricing can bring many benefits such as reducing search costs, pricing monitoring and making forecasts on supply and demand. We can benefit from this market transparency which creates better for consumers and producers. However, new technologies introduce a new problem for policymakers and competition authorities, especially as AI-driven market interactions call traditional economic models into question. One could argue that a new type of market structure has emerged in the era of AI and algorithmic pricing. At the frontline of the literature is the issue of tacit collusion which is testing the scope of current antitrust laws.

Overall, the benefits that emerging technologies can provide to firms and consumers are very desirable. Technology will continue to advance in unpredictable ways, emphasising the need for increased collaboration from scholars, economists and legal bodies as the landscape shifts.

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⁷ Dentons (2024) “Illumina/Grail: European Court of Justice strikes down the European Commission’s

policy of accepting referrals of non-notifiable deals” [\[link\]](#)

⁸ OGL “Unlocking digital competition” (2019) [\[link\]](#)