DIGITAL CARTELS & ALGORITHMS

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OECD
BETTER POLICIES FOR BETTER LIVES

Technology is neither good nor bad; nor is it neutral.

Melvin Kranzberg

DEFINITION OF ALGORITHM
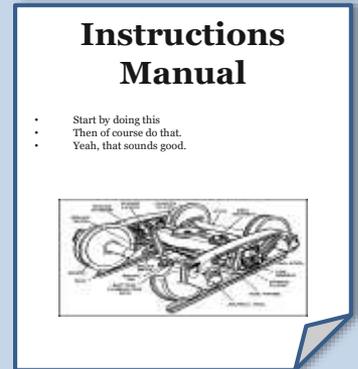
"An algorithm is an unambiguous, precise, list of simple operations applied mechanically and systematically to a set of tokens or objects. (...) The initial state of the tokens is the input; the final state is the output."
Wilson and Keil (1999)

PROGRAMMING PRINCIPLES

- **Artificial intelligence**
  - Detailed algorithms that mimic human intelligence, "*the science and engineering of making intelligent machines*" (John McCarthy, 1956)

- **Machine learning**
  - Algorithms that iteratively learn from data, "*the ability to learn without being explicitly programmed*" (Samuel, 1959)
  - Learning patterns: supervised, unsupervised, reinforcement

- **Deep learning**
  - Artificial neural networks that replicate the activity of human neurons…

Artificial Intelligence

Machine Learning
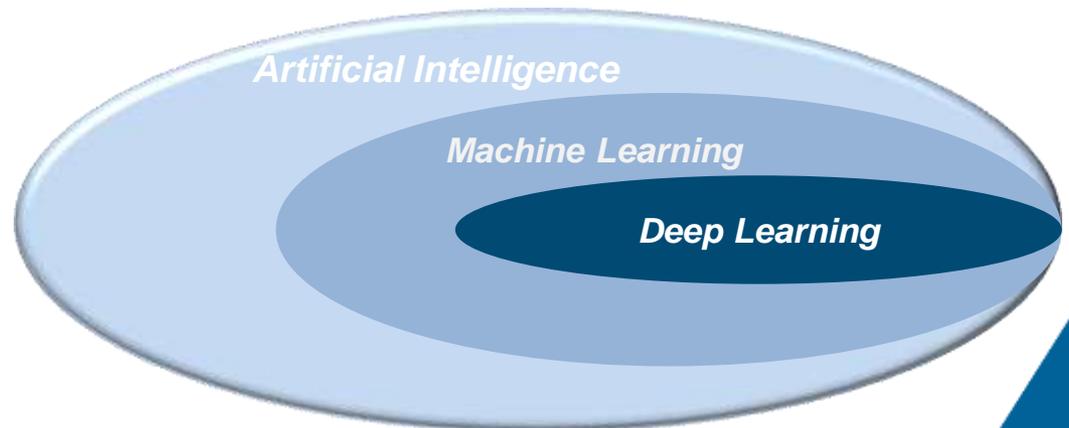
Deep Learning

MACHINE LEARNING (ML) VS DEEP LEARNING (DL)

- Difference: ability to process raw data
- ML requires manual features engineering, while in DL feature engineering is automatic…

Traditional Machine Learning Flow

Deep Learning Flow

Source: Moujahid (2016)

MODERN APPLICATIONS OF DEEP LEARNING ALGORITHMS

Health

- Melanoma cancer detection
- Detect cancerous cells in brain surgery

Engineering

- Dispersion of dust in drilling
- Response of buildings to earthquakes
- Prediction of traffic conditions

Finances

- Buy and sell stocks
- Predict corporate bankruptcy

Biology

- Detect and classify deep-sea animals
- Estimate concentrations of chlorophyll

Sound and Image

- Colorize black and white images
- Add sound to silent movies
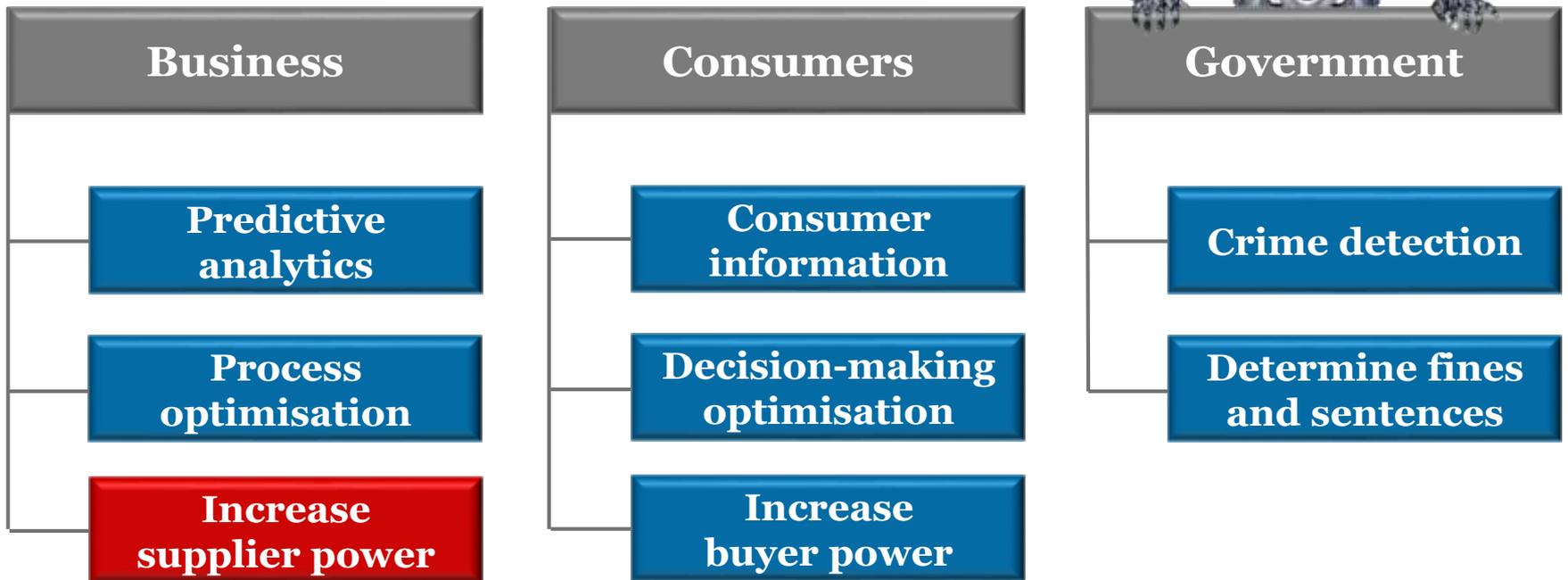
MAIN AREAS OF USE

Business	Consumers	Government
Predictive analytics	**Consumer information**	**Crime detection**
Process optimisation	**Decision-making optimisation**	**Determine fines and sentences**
Increase supplier power	**Increase buyer power**	

Positive impact on static and dynamic efficiency

- Pro-competitive use of algorithms by businesses

Predictive analytics

Optimisation of business processes

Supply-chain optimisation

Product innovation

Dynamic pricing

Target ads

Risk management

Price differentiation

Fraud prevention

Recommendations

Product Customisation
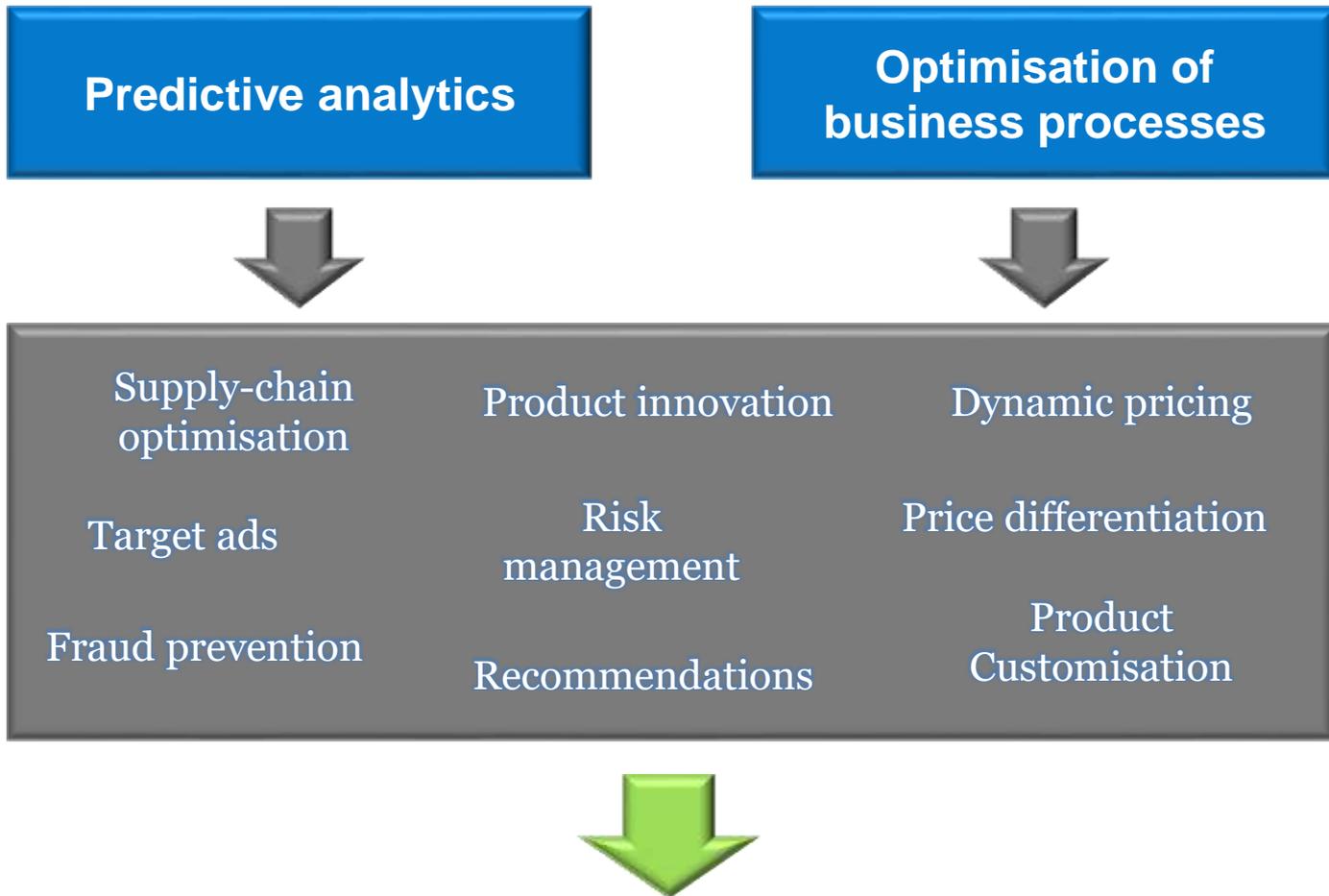
Positive impact on static and dynamic efficiency !!!!

ANTI-COMPETITIVE RISKS OF ALGORITHMS

Anti-competitive mergers

Unilateral conducts

Exploitative | **Exclusionary**

Collusion

Pre-emptive acquisition of potential disruptors detected by now-casting

Algorithmic bias in favour of incumbents' products

Close to perfect price discrimination

Algorithmic Collusion
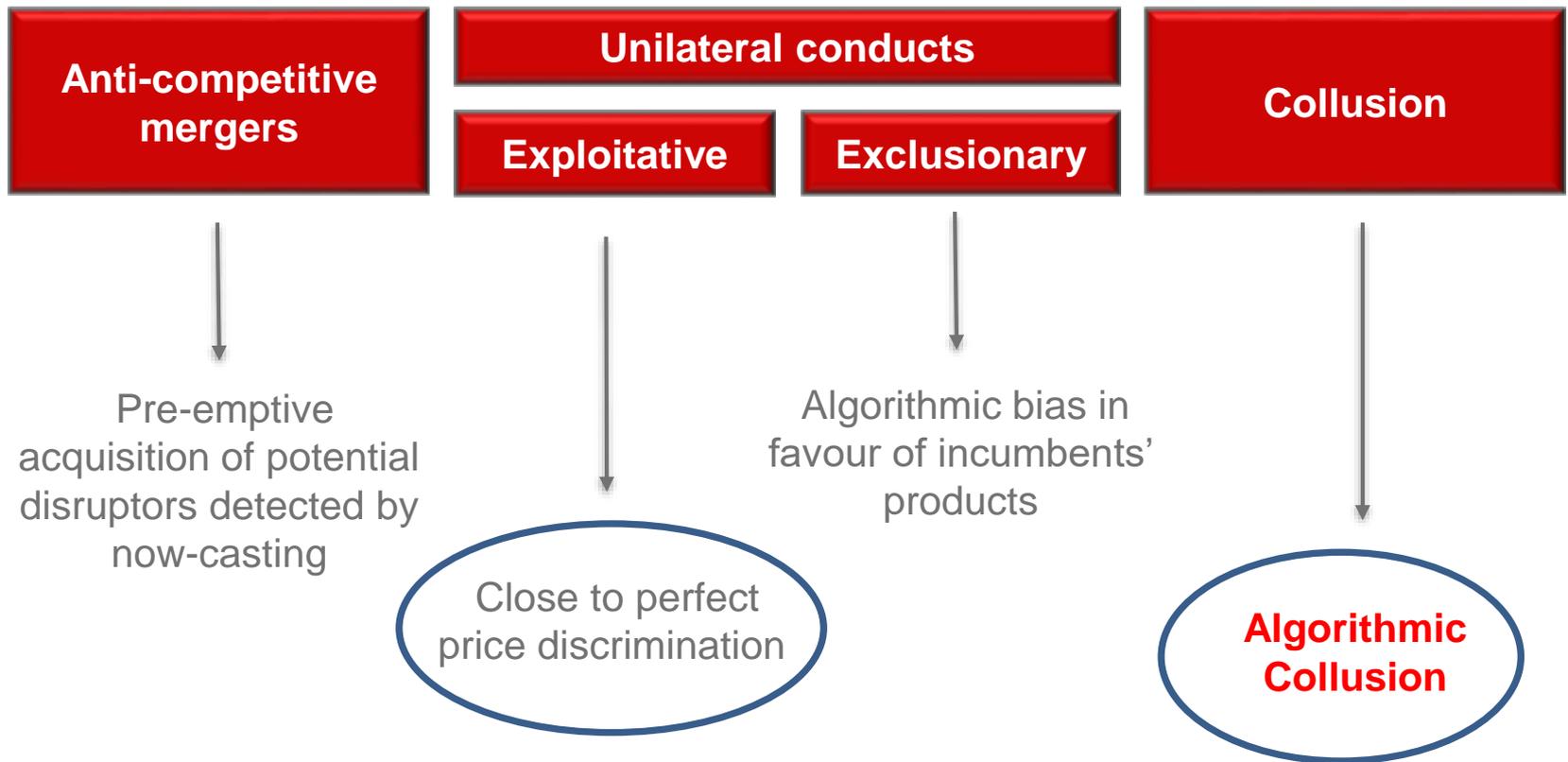
Is there an enforcement gap?

NEGATIVE IMPACT => RISKS

ALGORITHMS may transform business models, decision-making process and commercial interactions

- ✓ They can facilitate the exercise of market power ➡ Abuse of dominance
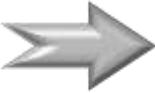
- ✓ algorithms change certain structural characteristics of the market -> increase the likelihood of collusion

- ✓ enable new forms of collusion ➡ "ALGORITHMIC COLLUSION"
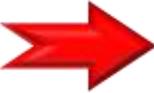
"Algorithmic collusion consists in any form of anti-competitive agreement or coordination among competing firms that is facilitated or implemented through means of automated systems."
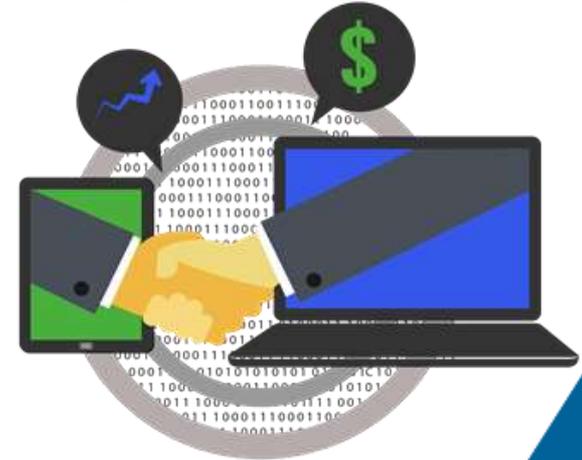
OECD: Roundtable on Algorithms and Collusion, June 2017

ALGORITHMS - THE RELEVANT FACTORS FOR COLLUSION

Relevant factors for collusion		Impact of algorithms on the likelihood of collusion
Structural characteristics	Number of firms	±
	Barriers to entry	±
	Market transparency	+
	Frequency of interaction	+
Demand variables	Demand growth	0
	Demand fluctuations	0
Supply variables	Innovation	-
	Cost asymmetry	-

Legend: + positive impact;   - negative impact;   0 neutral impact;   ± ambiguous impact

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ALGORITHMS - THE RELEVANT FACTORS FOR COLLUSION

- Despite the ambiguous effects on the some factors for collusion - algorithms change certain structural characteristics of the market, such as TRANSPARENCY and FREQUENCY OF INTERACTION

- Intuition:
  - If markets are transparent and companies react instantaneously to any deviation, the payoff from deviation is zero -> COLLUSION CAN ALWAYS BE SUSTAINED AS AN EQUILIBRIUM STRATEGY

- Clear risk that current changes in market conditions may facilitate anti-competitive strategies
  - similarities with the classic 'oligopoly problem' BUT tacit collusion could become sustainable in a wider range of circumstances -> expanding the oligopoly problem to non-oligopolistic market structures

ALGORITHMS and "TRADITIONAL" CARTELS

Coordination	Algorithms coordinate parallel behaviour by programming prices to follow a leader; or using the same third party algorithm.
Monitoring & punishing	Algorithms collect and process information from competitors and punish deviations
Signalling	Algorithms disclose and disseminate information in order to announce an intention to collude and negotiate the common policy.

ALGORITHMS and "TRADITIONAL" CARTELS – WHAT ARE THE CHALLENGES?

- Is the legal framework on anti-competitive agreements suitable to assess algorithms?

  => Agencies can rely on existing rules on anti-competitive agreements

  => Algorithms ought to be assessed together with the main infringement that they help enforcing.

- Challenges relate to:
  - Detection and evidence
  - Understanding how the technology works

- Is the legal framework on anti-competitive agreement suitable to assess algorithms?

  => Tacit collusion is not covered by the legal framework

- Policy question:

  => Should we adjust the legal framework?
  => How?

THE POLICY QUESTION

The only time we look at tacit collusion is when we look at ex ante analysis of mergers. Here we have an interesting question about legality and policy (…) The fact that [algorithms] can change the market characteristics gives rise to concern. That concern cannot be attacked under 101. Should we do something about it?

Ariel Ezrachi

(…) if we don't know the importance and the magnitude of the problem then it is very difficult to conclude that there is an enforcement gap.

BIAC

Competition laws were designed to deal with human facilitation of parallel conduct. (…) However, in a world in which tacit collusion becomes or is operated on a larger scale, maybe we need to rethink the reasons why we decided not to tackle tacit collusion in the first place.

Michal Gal

THE POSSIBLE ROLE OF COMPETITION AUTHORITIES

- **Expand existing antitrust tools in order to deal with algorithmic collusion**

  – Market studies & investigations

  – Ex-ante merger control

  – Commitments & remedies

- **Rethink traditional antitrust concepts?**

  – Tacit collusion

  – Agreement

  – Liability
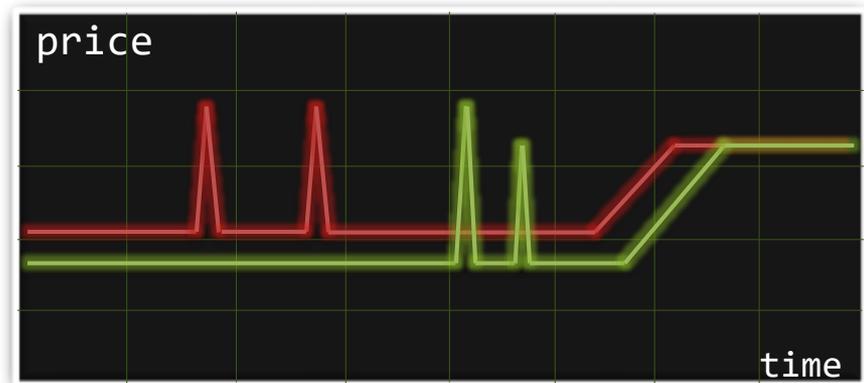
SOME REMEDIES OUTSIDE ANTITRUST

- Recent proposals to enforce algorithmic transparency & compliance by design with existing regulations

- Difficulties:

  - Incentives for investment and innovation

  - Complexity of program codes

  - Enforcement costs
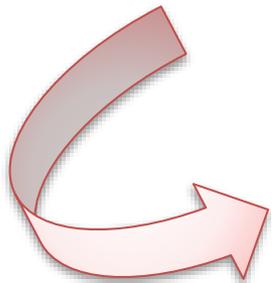
Risk that algorithmic transparency facilitates further algorithmic collusion

POSSIBLE REGULATORY ACTIONS…

- Extreme forms of algorithmic collusion may be hard to prevent through competition law

- As a result, should regulatory interventions to prevent algorithmic collusion be considered in the future?

Price regulation → **Market design** → **Algorithm design**
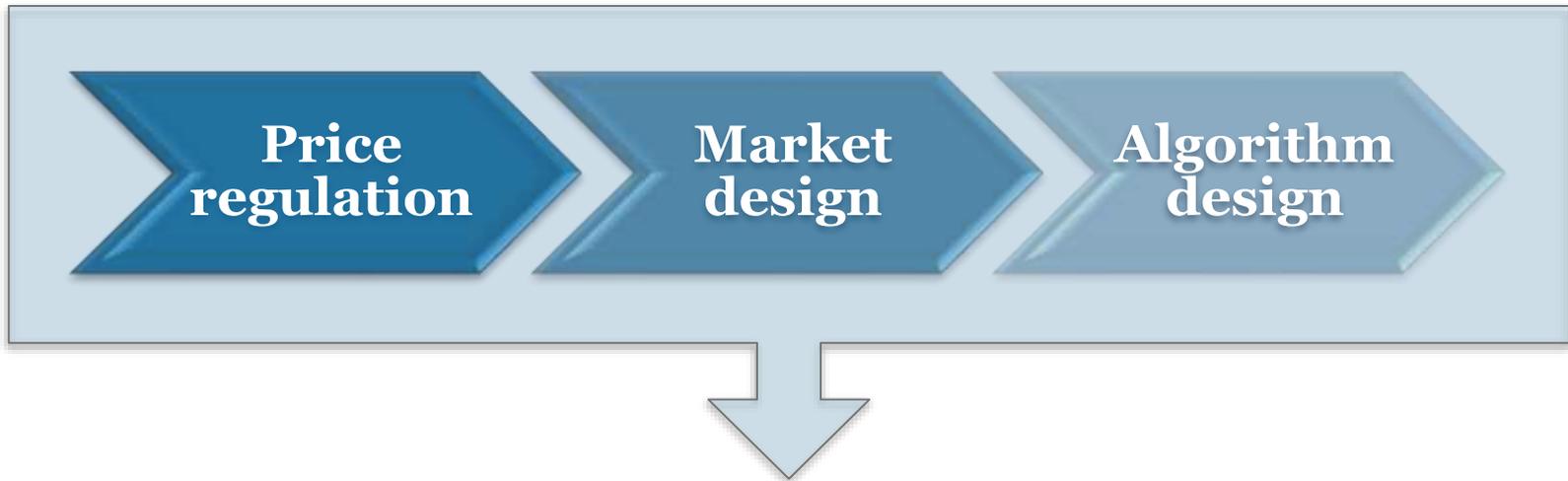
Risk of competitive impact

FURTHER INFORMATION

http://www.oecd.org/daf/competition/algorithms-and-collusion.htm

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THANK YOU FOR YOUR ATTENTION!

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