



DIGITAL CARTELS & ALGORITHMS

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

Melvin Kranzberg

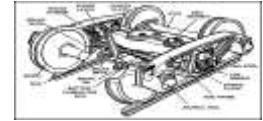


DEFINITION OF ALGORITHM



Instructions Manual

- Start by doing this
- Then of course do that.
- Yeah, that sounds good.

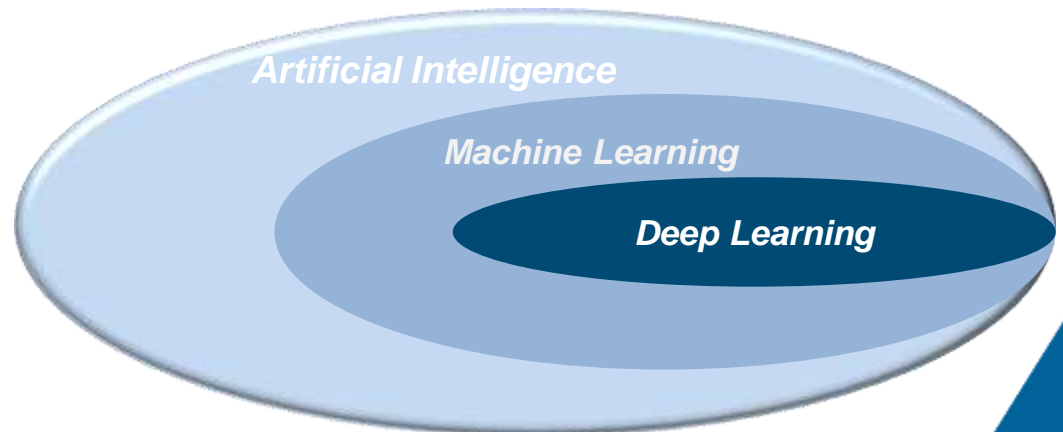


“An algorithm is an unambiguous, precise, list of simple operations applied mechanically and systematically to a set of tokens or objects. (...) The initial state of the tokens is the input; the final state is the output.”
Wilson and Keil (1999)



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...





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



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

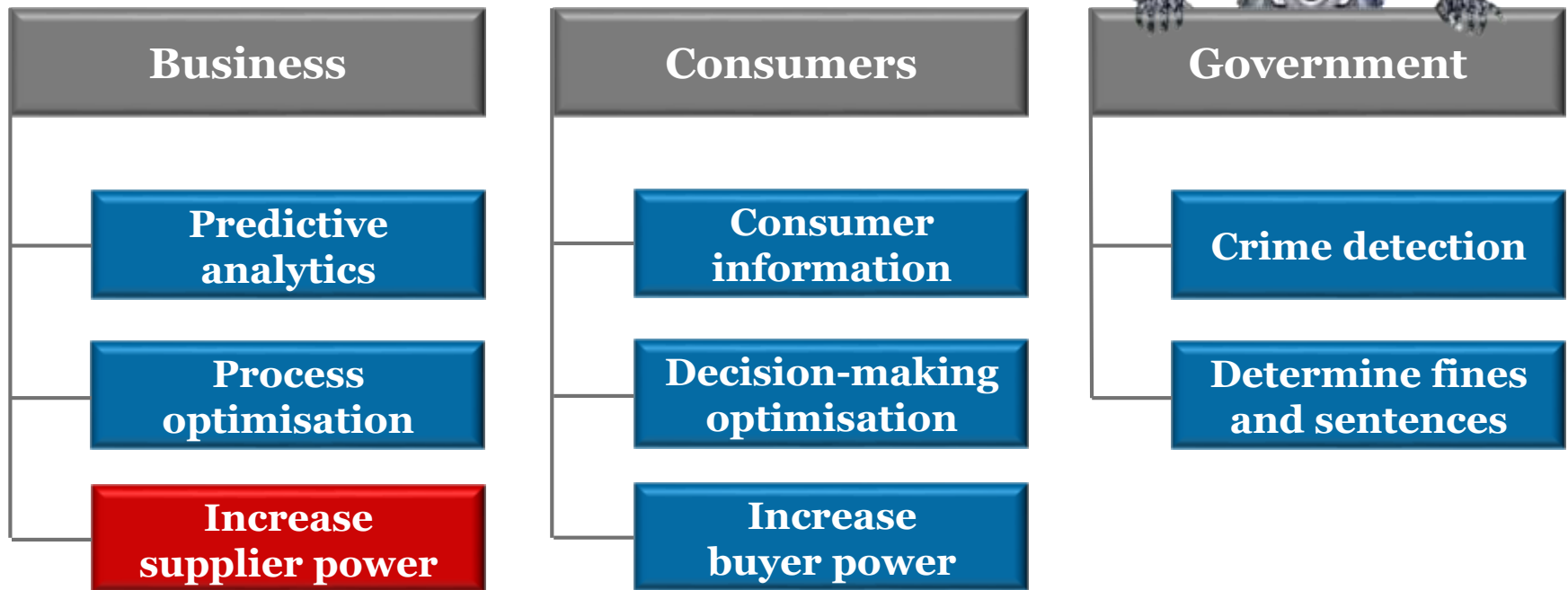
- Detect and classify deep-sea animals
- Estimate concentrations of chlorophyll

Sound and Image

- Colorize black and white images
- Add sound to silent movies



MAIN AREAS OF USE

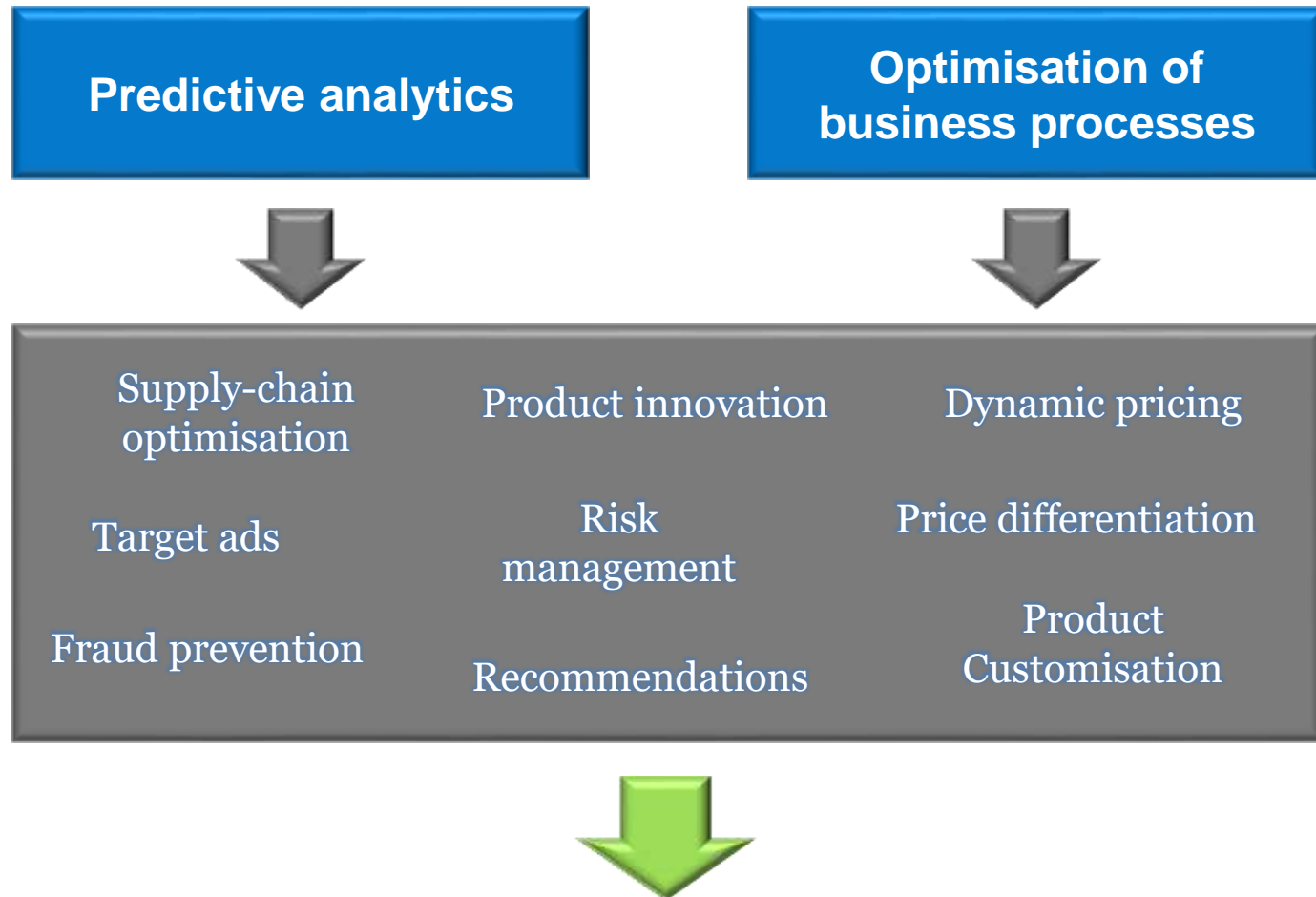


Positive impact on static and dynamic efficiency



MAIN AREAS OF USE - BUSINESSES

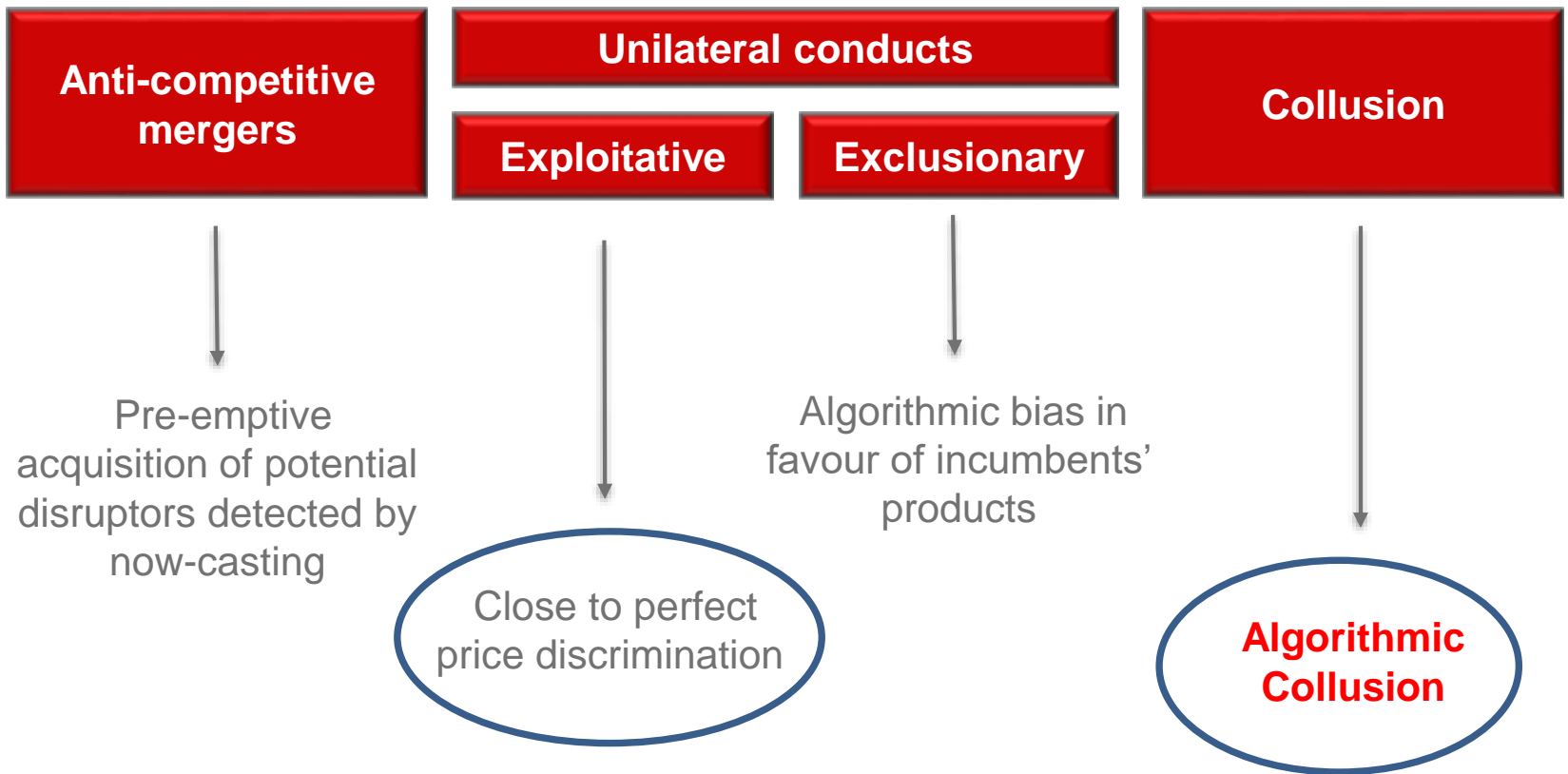
- Pro-competitive use of algorithms by businesses



Positive impact on static and dynamic efficiency !!!!



ANTI-COMPETITIVE RISKS OF ALGORITHMS



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



ALGORITHMS and “NEW” FORMS OF TACIT COLLUSION? – WHAT ARE THE CHALLENGES?

- 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

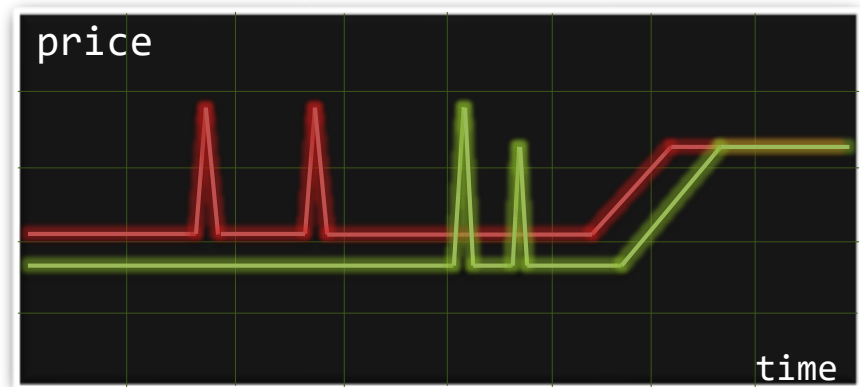
Competition laws were designed to deal with human facilitation of parallel conduct. (...) However, in a world in which tacit collusion becomes or is operated on a larger scale, maybe we need to rethink the reasons why we decided not to tackle tacit collusion in the first place.

Michal Gal



THE POSSIBLE ROLE OF COMPETITION AUTHORITIES

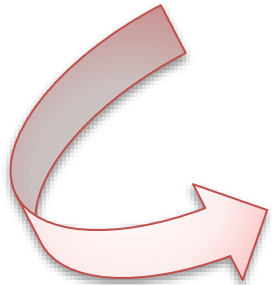
- **Expand existing antitrust tools in order to deal with algorithmic collusion**
 - Market studies & investigations
 - Ex-ante merger control
 - Commitments & remedies
- **Rethink traditional antitrust concepts?**
 - Tacit collusion
 - Agreement
 - Liability





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



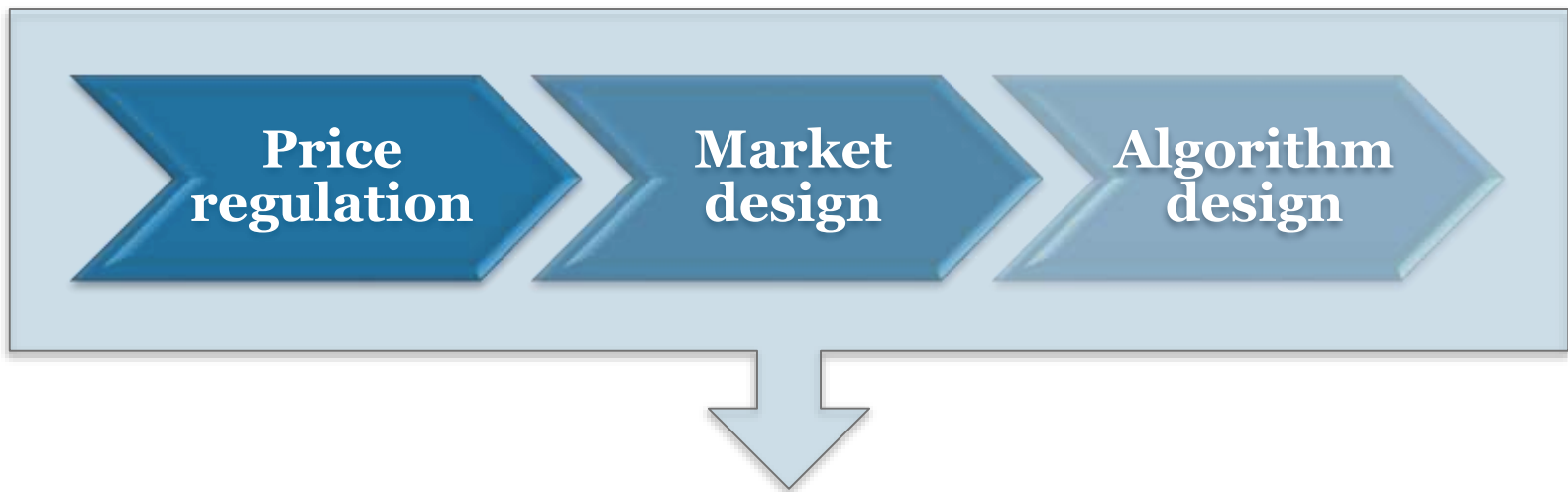
Risk that algorithmic transparency facilitates further algorithmic collusion





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?



Risk of competitive impact



FURTHER INFORMATION



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



FURTHER INFORMATION

The screenshot shows the OECD website's Competition section. At the top is the OECD logo with the tagline 'BETTER POLICIES FOR BETTER LIVES'. A navigation bar includes 'OECD Home', 'About', 'Countries', 'Topics', and a language selector for 'Français'. A search bar is located in the top right corner. The main heading is 'Competition'. On the left is a sidebar menu with categories like 'Bribery in international business', 'Competition', 'Abuse of dominance and monopolisation', 'Cartels and anti-competitive agreements', 'Competition enforcement practices', 'Liberalisation and competition intervention in regulated sectors', 'Mergers', 'Pro-competitive Policy Reforms', 'Corporate affairs', 'Financial markets, insurance and pensions', and 'International investment'. The 'Competition' category is selected. The main content area is divided into 'Find' and 'What's new' sections. The 'Find' section lists links for 'Best practice roundtables', 'Competition assessment toolkit', 'Guidelines for fighting bid rigging', 'Country reviews', and 'Recommendations', with a 'Latest Documents' button below. The 'What's new' section features a highlighted article 'Review of procurement rules and practices of PEMEX in Mexico' with a 'Read more' link, and another article 'The resolution of competition cases by specialised and generalist courts: Stocktaking of international experiences'. Below these, there are two more articles: 'Well-designed competition law, effective enforcement and competition-based economic reform promote growth and employment...' and 'Reference guide on ex-post evaluation of competition enforcement decisions'. At the bottom right, there is a video player titled 'Competition Assessment Review of...' showing a map of Mexico.

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What's new

- >> **Review of procurement rules and practices of PEMEX in Mexico**

Mexico City, 11/01/2017 - This report analyses procurement rules and regulations in Mexico's state-owned petroleum company (PEMEX) and makes policy recommendations to promote competition and fight bid rigging in accordance with international best practices.

>> [Read more](#)
- >> **The resolution of competition cases by specialised and generalist courts: Stocktaking of international experiences**
- >> **Market Examinations in Mexico: A manual by the OECD Secretariat**

Well-designed competition law, effective enforcement and competition-based economic reform promote growth and employment. The OECD actively encourages governments to tackle anti-competitive practices and fosters market-oriented reform throughout the world.

Reference guide on ex-post evaluation of competition enforcement decisions

Challenges of international co-operation in competition law enforcement

Competition Assessment Review of...

in tenders for public works and increasing transparency.

www.oecd.org/daf/competition



THANK YOU FOR YOUR ATTENTION!

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