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Information Sharing in Competition Policy – Note by Portugal

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1. Introduction

1. Information exchanges among competitors have progressively emerged as a central issue in competition enforcement. Information can generate substantial efficiencies by reducing knowledge asymmetries, improving forecasts and facilitating more effective responses to demand and supply conditions. In many sectors, information sharing may be necessary for normal commercial interactions and can contribute to improved decision making, lower transaction costs and greater market efficiency.

2. At the same time, information exchanges involving commercially sensitive variables may facilitate coordination among competitors by reducing strategic uncertainty and changing incentives to compete independently. The exchange of strategic information may enable competitors to better anticipate rivals' conduct, monitor deviations and sustain coordinated outcomes over time. Economic literature has consistently identified transparency as a factor capable of facilitating collusion, particularly in concentrated markets characterised by barriers to entry and repeated interactions.

3. European competition law has progressively developed an analytical framework for assessing such practices. The assessment of information exchanges has increasingly focused on the characteristics of the information exchanged and the features of the markets concerned. The developments in the case law of the Court of Justice of the EU (CJEU) have recognised that certain exchanges between competitors may, depending on their content and context, undermine the autonomous determination of market conduct and facilitate coordinated behaviour. Portugal's enforcement experience in the banking sector illustrates many of these issues.

4. Recent developments also suggest that information exchange concerns are extending beyond traditional product market settings. Digitalisation has significantly increased firms' access to granular data and expanded the use of algorithmic tools capable of processing information in real time. Advances in artificial intelligence and pricing systems may alter the conditions under which firms compete, potentially increasing monitoring capabilities and facilitating coordination mechanisms. Simultaneously, labour market practices have become an increasing focus of competition enforcement and exchanges involving salaries, hiring conditions and recruitment strategies may raise concerns analogous to those traditionally associated with prices, output or customer information.

5. Against this background, this note discusses the Portuguese experience and reflects on broader developments concerning information sharing in contemporary market environments. It first reviews the economic and legal framework applicable to information exchanges and discusses key developments in economic literature and in European competition law. It then examines lessons emerging from the Portuguese banking experience before considering challenges associated with algorithmic environments and emerging issues relating to labour market information exchanges.

2. Information Exchange: Economic and Legal Framework

2.1. Relationship between information and competition

6. Competitive markets operate under conditions in which firms independently determine their conduct without knowing with certainty how rivals will behave. Uncertainty regarding future pricing, output, investment or other strategic variables creates incentives for firms to compete aggressively and independently.

7. Nonetheless, information is crucial to the functioning of competitive markets. Firms routinely rely on information concerning demand conditions, costs, consumer preferences and market developments to make commercial decisions and adapt to changing circumstances.

8. Consequently, information may improve market outcomes by reducing asymmetries, lowering transaction costs and facilitating more efficient allocation of resources. In some contexts, information sharing can also contribute to innovation and the diffusion of knowledge.

9. From a competition policy perspective, information exchanges may therefore generate substantial efficiencies. The economic literature has long recognised that information sharing can improve market performance under certain conditions, including where uncertainty is high or information asymmetries significantly distort market functioning.[1] In this respect, transparency does not constitute an objective that is inherently inconsistent with competition. On the contrary, competitive markets frequently rely upon a certain degree of information availability in order to function effectively.

10. At the same time, the mechanisms capable of generating efficiencies may also change firms' incentives to compete. Information may affect not merely firms' knowledge of market conditions but also the strategic environment within which they operate. This dual nature explains why information exchanges have traditionally occupied an intermediate position between legitimate commercial interactions and more explicit forms of coordination.

11. Economic literature has repeatedly emphasised that transparency may facilitate collusion as well as anti-competitive foreclosure. Increased visibility over competitors' conduct may reduce uncertainty concerning rivals' strategies and improve firms' ability to anticipate and react to one another's behaviour.[2] Particularly in concentrated markets characterised by repeated interactions, transparency can create conditions under which coordinated outcomes become easier to sustain. The effect of information exchanges therefore depends not only on the content of the information itself but also on broader market characteristics and strategic interactions among firms.

12. Collusion typically depends on firms' ability to coordinate expectations over time and to identify deviations from cooperative outcomes. Information exchanges may facilitate these conditions by increasing firms' ability to monitor market developments and infer competitors' behaviour.

13. The notion of strategic uncertainty occupies a particularly important position within this analytical framework. The reduction of strategic uncertainty has progressively become

[1] Kühn, Kai Ulrich and Xavier Vives (1995), Information Exchanges Among Firms and Their Impact on Competition.

[2] Ibid.

a central concept in both economic analysis and competition law. Rather than focusing exclusively on explicit coordination outcomes, modern approaches to competition law increasingly examine whether exchanges allow competitors to predict rivals' future conduct with greater accuracy and thereby substitute independent decision making with forms of practical cooperation.

14. The challenge for competition policy therefore lies in distinguishing forms of transparency that improve market functioning from those capable of reducing strategic uncertainty to an extent that changes incentives for independent competitive conduct.

2.2. How information exchange facilitates coordination

15. The competitive significance of information exchanges depends not only on the characteristics of the information exchanged but also on the role such information may play in facilitating coordinated behaviour. Economic theory has long recognised that collusion is difficult to sustain in environments characterised by imperfect information. Coordination among competitors requires firms not only to align their expectations regarding market conduct but also to ensure that deviations from coordinated behaviour can be identified and addressed over time. Information exchanges may contribute to these processes by reducing informational frictions and strengthening the conditions necessary for coordination.

16. Economic literature identifies several mechanisms through which information exchanges may facilitate coordinated outcomes. First, information may assist firms in identifying the terms around which coordination can emerge. Second, it may improve firms' ability to monitor compliance with coordinated conduct and detect deviations. Third, it may facilitate punishment strategies capable of sustaining collusive equilibria over time. These mechanisms are closely interrelated and jointly contribute to the internal stability of coordinated behaviour.

17. A first concern for firms attempting to coordinate relates to the identification of common terms of coordination. In this context, competitors must converge, either explicitly or tacitly, on patterns of behaviour. Information exchanges may contribute to this process by reducing uncertainty regarding competitors' commercial strategies and market conditions. Information concerning prices, output levels, capacity utilisation, market shares or future commercial intentions may provide focal points around which firms can align expectations and coordinate behaviour. Increased transparency may therefore reduce ambiguity regarding the strategic parameters on which coordination can be sustained.

18. The second mechanism concerns monitoring. Coordination becomes more effective if firms possess sufficient capacity to observe competitors' conduct and detect deviations from expected behaviour. Information asymmetries may otherwise create incentives for individual firms to deviate secretly from coordinated outcomes while continuing to benefit from supracompetitive conditions. Information exchanges may strengthen monitoring capabilities by increasing visibility regarding rivals' conduct and reducing the time required to identify deviations.

19. A third mechanism concerns punishment. Once a deviation is detected, firms shall possess the ability to react credibly and sufficiently rapidly to discourage future departures from coordinated behaviour. Information exchanges may facilitate retaliation mechanisms by shortening reaction times. Increased access to information may therefore improve the credibility and effectiveness of punishment strategies, thereby contributing to the sustainability of collusion.

20. Information exchanges may also contribute to the external stability of coordination. External stability concerns firms' ability to identify and respond to threats capable of

destabilising coordination, including market entry, expansion by fringe competitors or reactions from the customers. Information flows may improve firms' ability to anticipate and react collectively to such developments, thereby preserving coordinated outcomes over time.

21. These mechanisms are closely related to the conditions identified in the case law of the European Union courts. In Airtours, the General Court identified three cumulative conditions generally associated with sustainable coordination: (i) firms must possess sufficient ability to monitor each other's conduct; (ii) deviations must be capable of triggering credible deterrence mechanisms; and (iii) coordinated outcomes must be resilient to reactions from outsiders, including competitors and customers.[3] These conditions broadly correspond to the mechanisms identified in economic literature and provide a useful framework for understanding the competitive significance of information exchanges.

2.3. Assessment of information exchange under competition rules

22. Information sharing arrangements differ significantly in their characteristics, objectives and competitive implications. The EU Guidelines on Horizontal Cooperation Agreements[4] recall that information may be exchanged directly between competitors, or indirectly, by or through a third party. The Guidelines also highlight the importance of analyzing the content of the information exchanged, its objectives and the respective legal and economic context of the conduct.

23. Furthermore, the Guidelines suggest the consideration of two interrelated dimensions: the nature and characteristics of the information exchanged and the characteristics of the relevant market.

2.3.1. Nature and characteristics of the information exchanged

24. A first important consideration relates to the nature and characteristics of the information itself. Competition concerns are closely linked to the exchange of information that reduces uncertainty regarding competitors' strategic conduct.

25. The strategic relevance of the information exchanged plays an important role. Competition concerns increase where exchanges concern variables directly linked to competitive decision making, such as prices, sales volumes, production levels, commercial conditions or future strategies. Information concerning such variables may significantly reduce strategic uncertainty.

26. A central distinction concerns whether information refers to future, current or historical conduct. Information concerning intended future behaviour generally raises more concerns because it may directly reveal firms' strategic intentions and reduce uncertainty regarding future market conduct. By contrast, historical information may be less likely to affect competitive dynamics where it no longer retains strategic relevance. The significance of this distinction may nevertheless depend on market conditions, including the speed at which information loses value.

[3] Case T-342/99, Airtours plc v Commission, ECLI:EU:T:2002:146, EU:T:2002:146, judgment of 6 June 2002.

[4] Communication from the Commission, Guidelines on the applicability of Article 101 of the Treaty on the Functioning of the European Union to horizontal co-operation agreements, C/2023/4752, OJ C 259, 21.7.2023, pp. 1–125.

27. The public or non-public character of information also influences the assessment. Information broadly available to market participants may contribute to market transparency and improve decision making. Conversely, exchanges limited to competitors may selectively increase transparency among rivals and create informational advantages unavailable to customers or potential entrants. Such selective transparency may facilitate coordination by reducing asymmetries among competitors.

28. The level of aggregation of information also matters. Aggregated information may generally create fewer concerns than firm specific or transaction specific data. Information relating to individual firms may facilitate identification of competitors' conduct and strengthen firms' ability to monitor market behaviour.

29. Finally, the conditions under which exchanges occur may also influence the competition assessment. Factors such as the frequency of exchanges and market coverage can affect the way information increases transparency and facilitates coordination.

2.3.2. Market characteristics

30. The competitive significance of information exchanges also depends on the characteristics of the market concerned. The same information may produce different effects depending on market structure and competitive conditions. Economic literature and decisional practice have repeatedly recognised that information exchanges are more likely to facilitate coordination in markets displaying characteristics favourable to collusion.[5]

31. Market concentration constitutes a particularly relevant consideration. Coordination may become easier where a limited number of firms interact repeatedly and possess significant visibility over each other's conduct.

32. Barriers to entry also influence the assessment. Information exchanges may raise greater concerns where markets are insulated from competitive pressures and potential entrants face obstacles limiting their ability to challenge coordinated outcomes.

33. The frequency and stability of interactions among firms also play an important role. Repeated interactions may strengthen incentives to sustain coordinated conduct by facilitating monitoring and increasing the credibility of punishment mechanisms over time. Economic literature has also identified other market characteristics capable of facilitating coordination, including cost symmetry among competitors and multimarket contacts.

34. These considerations should not be assessed in isolation but rather as part of a broader contextual analysis examining the interaction between multiple market characteristics and their cumulative impact on the likelihood of coordination.

3. Evolution of EU Competition Law on Information Exchange

3.1. From parallelism to concertation

35. The assessment of information exchanges under EU competition law developed against a broader debate concerning the distinction between lawful parallel conduct and unlawful coordination among competitors. Competition authorities and courts have long

[5] Ivaldi, Marc, Bruno Jullien, Patrick Rey, Paul Seabright and Jean Tirole (2003), The Economics of Tacit Collusion, Final Report for DG Competition; Kühn, Kai Ulrich and Xavier Vives (1995), Information Exchanges Among Firms and Their Impact on Competition; Commission Decision of 17 February 1992, Case IV/31.370 and 31.446 - UK Agricultural Tractor Registration Exchange, OJ L 68.

recognised that firms operating in oligopolistic markets may adopt similar conduct without entering into agreements or concerted practices. Parallel market behaviour may emerge naturally where firms face similar market conditions and react rationally to common economic incentives. The existence of parallel conduct alone cannot therefore constitute sufficient evidence of coordination.

36. This principle was clearly articulated by the CJEU in the *Wood Pulp* judgment.[6] In that case, the European Commission argued that parallel pricing behaviour among producers of wood pulp reflected a concerted practice contrary to Article 101 TFEU. The CJEU rejected the proposition that parallel conduct itself constituted sufficient evidence of unlawful coordination and held that parallel behaviour may simply reflect rational market responses under oligopolistic conditions.[7]

37. The CJEU stated that parallel conduct cannot by itself be regarded as evidence of concertation unless it represents the only plausible explanation for the observed behaviour. Where firms operate in concentrated markets characterised by interdependence, similar pricing or behavioural patterns may arise from firms independently adapting to prevailing market conditions. The judgment therefore recognised an important distinction between coordinated conduct and conscious parallelism resulting from normal market interactions.[8]

38. The significance of *Wood Pulp* extends beyond its specific facts. The judgment established an important interpretation for competition enforcement by recognising that competition law does not prohibit interdependence as such. Oligopolistic markets frequently involve strategic interaction in which firms take account of competitors' likely reactions when making commercial decisions. Such conduct forms part of normal competitive processes and does not in itself imply coordination.

39. At the same time, *Wood Pulp* also clarified an important implication for competition policy. If parallel conduct alone cannot establish unlawful coordination, authorities must gather additional evidence capable of demonstrating a departure from independent market behaviour. This challenge became particularly relevant in cases involving information exchanges.

40. The evolution of decisional practice following *Wood Pulp* progressively shifted from observed market outcomes toward the processes through which competitors acquire and communicate information. Rather than inferring coordination solely from parallel conduct, authorities increasingly examine whether contacts between competitors reduce uncertainty and facilitate collusion.

41. This shift from parallelism to concertation would become particularly visible in later decisional practice concerning information exchanges and concerted practices, where increasing emphasis was placed on communication mechanisms capable of reducing strategic uncertainty.

42. The economic reasoning has also helped explain the treatment of future or current strategic information in competition law and the development of the object category in information exchange cases. Certain forms of information exchange are considered sufficiently likely to harm competition that a detailed examination of actual market effects

[6] Joined Cases C-89/85, C-104/85, C-114/85, C-116/85, C-117/85 and C-125/85 to C-129/85, Ahlström Osakeyhtiö and Others v Commission ("Wood Pulp"), ECLI:EU:C:1993:120, judgment of 31 March 1993.

[7] Ibid.

[8] Ibid.

becomes unnecessary, in particular where the information is commercially sensitive and the exchange is capable of removing uncertainty between competitors.

3.2. Information exchanges as standalone infringements of competition rules

43. The recognition of information exchanges as a standalone infringement of competition rules emerged progressively in decisional practice.

44. One of the earliest and most influential examples was the European Commission decision in UK Agricultural Tractor Registration Exchange.[9] The Commission considered that the information exchange system significantly increased market transparency through the dissemination of detailed and commercially sensitive information concerning tractor registrations and sales. The information exchanged was non-public, recent and sufficiently disaggregated to allow market participants to identify competitors' conduct and infer strategic commercial behaviour. Although the system did not involve direct exchanges of future prices or output decisions, the granularity and frequency of the information reduced uncertainty concerning rivals and enhanced firms' ability to monitor one another.

45. The Commission placed particular emphasis on the broader market structure, which exhibited characteristics commonly identified in economic literature as facilitating coordination. The market was relatively concentrated, protected by significant barriers to entry and characterised by repeated interactions among competitors. These features reduced competitive constraints and reinforced the significance of information flows among market participants.

46. The European Union courts subsequently upheld this approach and confirmed that the competitive significance of information exchanges depends on the interaction between the nature of the information exchanged and market conditions.

47. This approach was articulated with particular clarity in the T-Mobile ruling.[10] The CJEU emphasised that information exchanges capable of removing uncertainty concerning competitors' future conduct may undermine the independent determination of market behaviour. The judgment further confirmed that even a single exchange of strategic information may affect competitive conditions where it is capable of influencing competitors' conduct in the market.

3.2.1. The Portuguese Banking Case: Information Exchange as a Standalone Restriction

Background

48. The Portuguese banking information exchange case represents one of the most significant recent European investigations concerning information exchanges as a standalone restriction of competition rules. The case concerned a long-standing system of information sharing involving major financial institutions operating in Portugal and raised fundamental questions regarding the legal treatment of strategic information exchanges in concentrated markets. The investigation culminated in a prohibition decision adopted by

[9] Commission Decision of 17 February 1992, Case IV/31.370 and 31.446 - UK Agricultural Tractor Registration Exchange, OJ L 68,

[10] Case C-8/08, T-Mobile Netherlands BV, KPN Mobile NV, Orange Nederland NV and Vodafone Libertel NV v Raad van bestuur van de Nederlandse Mededingingsautoriteit, ECLI:EU:C:2009:343.

the AdC concerning exchanges that occurred over a period exceeding ten years in retail banking markets, notably in mortgage credit, consumer credit and corporate lending.[11]

49. The information exchange involved two broad categories of strategic variables corresponding to core dimensions of competitive conduct: commercial conditions and production data. The first category included commercially sensitive variables relating to pricing and market offers, such as spreads and other lending conditions. According to the AdC, these variables often concerned information that was not publicly available at the time of exchange and, in certain instances, corresponding to intended future conduct or forthcoming changes in commercial offers. The second category concerned production information, consisting of monthly individualised data regarding lending volumes and values attributed to each bank. The data provided detailed visibility regarding the commercial performance and market activity of competitors.

50. The AdC considered several characteristics of the exchanged information particularly relevant. The information was strategic, non-public, current or future oriented, individualised and exchanged on a recurring basis. Exchanges occurred through institutionalised channels, including email communications among employees and formed part of regular business interactions over an extended period. The AdC considered that these features substantially increased transparency among competitors and reduced uncertainty regarding rivals' conduct.

51. Market structure also occupied a central role in the analysis. The exchanges took place in a relatively concentrated sector in which the six largest institutions represented more than eighty per cent of the relevant markets. The combination of concentration, repeated interactions and systematic exchanges of recent and strategic information was considered capable of creating conditions conducive to coordination.

52. The case therefore combined many of the factors previously identified in EU case law and economic literature as relevant to the competition assessment of information exchanges.

Judicial scrutiny of the legal and economic issues

53. The Portuguese banking case raised one of the most significant legal questions in recent EU competition law concerning whether a standalone exchange of information, absent evidence of an explicit cartel agreement, may itself constitute a restriction of competition by object. The case addressed the boundaries between traditional cartel analysis and the treatment of information exchanges as autonomous infringements capable of distorting competitive processes.

54. The alleged infringement concerned a systematic exchange of commercially sensitive information among competitors. The question before the Portuguese Competition, Regulation and Supervision Court was therefore whether the nature and characteristics of the information exchanged and the surrounding economic context revealed a sufficient degree of harm to competition such that proof of actual market effects would not be required.

55. The proceedings also generated extensive debate concerning potential efficiencies associated with the exchanges. Several banks submitted economic studies arguing that the information sharing arrangements could produce procompetitive effects, including benchmarking, preventing adverse selection, enhancing risk assessment and reductions in search costs.

[11] Autoridade da Concorrência (2019), PRC/2012/9 – Decisão Final.

56. However, contrary to the efficiency claims, the evidence suggested that the exchanged information was highly specific, individualised, recurrent and limited to competitors. The studies advanced by the banks did not establish convincingly why the information exchanged, especially information concerning commercial conditions and strategic variables, was necessary to generate the alleged benefits or why comparable efficiencies could not have been achieved through less restrictive mechanisms.

57. The reference for a preliminary ruling provided the CJEU with an opportunity to clarify the treatment of standalone information exchanges under Article 101 TFEU. The CJEU did not establish a presumption that exchanges involving strategic information automatically constitute restrictions by object.[12] Rather, it reaffirmed the need for a contextual assessment capable of determining whether the conduct displays a sufficient degree of harm to competition.

58. However, the CJEU simultaneously identified a number of characteristics capable of indicating such harm in information exchange cases, including the strategic nature of the information exchanged, its individualised and non-public character, its future orientation and its capacity to reduce uncertainty concerning competitors' conduct.[13]

59. Viewed against the factual characteristics of the Portuguese banking case, the CJEU reasoning appears particularly significant. The exchanges involved commercially sensitive variables directly linked to competitive behaviour, including commercial conditions and production data, the information was individualised, non-public, current or future oriented and exchanged regularly in a concentrated market characterised by repeated interactions.[14]

60. These were precisely the factors identified by the CJEU as relevant to the assessment of whether an information exchange may reveal a sufficient degree of harm to competition. Although the CJEU formally left the ultimate application to the referring court, its analytical framework strongly suggested that exchanges possessing such characteristics may be capable of falling within the restriction by object category.

4. Information Sharing in Digital and Algorithmic Environments

4.1. From Traditional Information Exchange to Algorithms

61. Digitalisation has transformed the information conditions under which firms operate. Competition concerns traditionally associated with information exchanges used to emerge in environments where communication occurred through trade association meetings or direct contacts between competitors. Firms now operate in environments characterised by large-scale data generation, continuous information flows and algorithmic systems capable of collecting, processing and reacting to market information at unprecedented speed and scale.

62. The competitive significance of these developments does not arise solely from the increased quantity of available information. Information abundance is not inherently problematic and may generate substantial efficiencies through improved decision making, more accurate forecasting and reductions in information asymmetries. Rather, competition

[12] Case C-298/22, Banco BPN/BIC Português SA and Others v Autoridade da Concorrência, ECLI:EU:C:2023.

[13] Ibid.

[14] Ibid.

concerns emerge where technological tools change the mechanisms through which firms acquire, process and react to market information and thereby affect strategic interaction among competitors.

63. The AdC's Issues Paper on Digital Ecosystems, Big Data and Algorithms recognises that algorithmic tools may influence competitive dynamics by changing how firms collect information and adapt commercial behaviour.[15] Rather than replacing traditional competition concerns, algorithms may reinforce existing mechanisms associated with transparency, prediction and coordination. In this respect, algorithmic environments may be understood as potentially amplifying informational conditions already identified in economic literature as relevant to coordination.

64. The first category concerns monitoring algorithms. Such systems enable firms to collect and process information concerning competitors' market conduct continuously and automatically. Monitoring technologies may track prices, promotional strategies, inventories and market developments in real time. Compared with traditional forms of information gathering, algorithmic monitoring significantly reduces the cost and increases the speed and granularity of information collection.

65. From a competition perspective, such technologies may strengthen firms' ability to identify deviations from expected market behaviour and improve monitoring capabilities. Algorithmic monitoring tools may therefore reduce informational frictions that previously constrained coordinated behaviour.

66. A second category concerns pricing algorithms. Pricing systems increasingly rely on automated tools capable of adjusting prices dynamically in response to market conditions and competitors' conduct. Such algorithms may produce substantial efficiencies through faster responses to demand conditions and more effective allocation of resources.

67. However, several theories have emerged concerning the relationship between pricing algorithms and coordination. Three broad scenarios may be identified: (i) pricing algorithms may operate simply as tools implementing pre-existing agreements among competitors, (ii) pricing algorithms may facilitate signalling, monitoring and strategic adaptation mechanisms capable of reinforcing tacit coordination, and (iii) self-learning pricing algorithms may independently converge towards supracompetitive outcomes through repeated interactions and adaptive processes.

4.2. Pricing Algorithms and the New Architecture of Information Exchange

68. There are several scenarios through which pricing algorithms may become relevant from a competition law perspective. At one end of the spectrum, pricing algorithms may function merely as instruments implementing pre-existing agreements. The Amazon poster cases illustrate situations in which pricing software served as a mechanism for executing and monitoring conventional cartel arrangements.[16]

[15] Autoridade da Concorrência (2019), Issues Paper on Digital Ecosystems, Big Data and Algorithms. Available at: https://www.concorrencia.pt/sites/default/files/processos/epr/Digital%20Ecosystems%2C%20Big%20Data%20and%20Algorithms%20-%20Issues%20Paper.pdf

[16] See the Amazon poster cases, including United States v Topkins (DOJ, 2015) and proceedings involving Trod before the DOJ and the UK Competition and Markets Authority (2016), where competitors agreed to use pricing algorithms to coordinate prices of posters sold through Amazon Marketplace.

69. The cases involved explicit agreements among competitors to coordinate prices through the use of a common pricing algorithm and were supported by documentary evidence, including email communications. The algorithm was considered particularly important because manual monitoring and coordination would have been impracticable given the large number of products involved. In such circumstances, the algorithm operates as a facilitating tool rather than an independent source of collusion.

70. More difficult questions arise where algorithms facilitate coordination without explicit agreements. This possibility has attracted particular attention in the economic literature concerning reinforcement learning and Q-learning systems. Certain theoretical studies suggest that autonomous pricing agents interacting repeatedly may converge toward supracompetitive outcomes without express instructions to collude.[17] Through iterative learning processes, algorithms may discover strategies resembling coordinated behaviour and develop responses discouraging price deviations. Such studies generated concerns that certain types of pricing algorithms might facilitate forms of tacit coordination difficult to detect or sanction under traditional competition law frameworks.

71. Conversely, digital technologies may also reduce search costs and increase customer responsiveness to price changes, potentially increasing incentives to deviate from coordinated outcomes. The relationship between algorithms and coordination therefore remains context dependent and does not support broad assumptions that greater technological sophistication necessarily increases collusive risks.

72. In addition, theoretical possibilities should be distinguished from observed market behaviour. Many studies rely on highly stylised simulations involving simplified market environments and assumptions not necessarily representative of real market settings. The question is therefore not whether algorithms can theoretically sustain collusion under laboratory conditions, but whether empirical evidence demonstrates similar effects in actual markets.

73. Recent empirical evidence has contributed to the debate concerning algorithmic pricing and coordination. Using data from retail gasoline markets in Germany, Assad and co-authors examined the effects of pricing software supplied by the Danish company a2i Systems, which began offering algorithmic pricing tools to petrol stations in 2017 and achieved significant market penetration within a relatively short period.[18] The study found that where competing stations within local markets simultaneously adopted the software, profit margins increased significantly, with estimated average effects reaching approximately 28%.

74. These findings have attracted considerable attention because they represent one of the first attempts to identify the competitive effects of pricing algorithms using observed market data rather than laboratory simulations or theoretical models.

75. Recent economic papers also suggest that developments in artificial intelligence may play a significant role in the future. Sarah Fisher and co-authors argue that increasingly sophisticated AI pricing systems may significantly improve prediction capabilities, pattern recognition and strategic adaptation.[19] Rather than merely reacting to market signals, future

[17] Calvano, Calzolari, Denicolò and Pastorello (2020), Artificial Intelligence, Algorithmic Pricing, and Collusion; Klein, Timo (2021), Autonomous Algorithmic Collusion: Q Learning under Sequential Pricing.

[18] Stephanie Assad, Robert Clark, Daniel Ershov and Lei Xu (2024), Algorithmic Pricing and Competition: Empirical Evidence from the German Retail Gasoline Market.

[19] Sara Fish, Yannai A. Gonczarowski and Ran Shorrer, Algorithmic Collusion by Large Language Models,

systems may become more effective at anticipating competitors' conduct and identifying profitable strategic responses.

76. These developments suggest that traditional information exchange principles may provide a useful analytical framework for digital environments. The central issue is not whether algorithms independently generate collusion, but whether technological infrastructures create forms of selective transparency capable of reducing strategic uncertainty and facilitating coordination.

77. This discussion also connects to the reasoning adopted in *Eturas,* which illustrates some of the difficulties associated with applying traditional hub-and-spoke theories in digital environments. The case concerned the *Eturas* online booking platform used by more than thirty travel agencies in Lithuania. The platform acted as an intermediary between travel agencies and service providers and allowed participating agencies to apply discounts to standard prices. Following communications initiated by the platform operator, a system notice announced a limitation on discounts to 3%, accompanied by a technical modification that capped discounts within the platform, although larger discounts remained possible through manual intervention.

78. The CJUE held that liability could not arise merely from the transmission of a message through the system.[20] Rather, establishing participation in a concerted practice required evidence that undertakings were aware of the communication or the system modification and that objective and consistent indicia supported a presumption of participation. That presumption could in turn be rebutted, including through evidence demonstrating conduct inconsistent with the alleged coordination, such as the application of larger discounts.

79. Although arising in a different context, *Eturas* highlights broader challenges increasingly relevant in algorithmic environments. Shared technological systems may create informational links among market participants, but proving participation through hub-and-spoke theories may become difficult where awareness and knowledge of coordination mechanisms cannot readily be established.

80. In such circumstances, a framework centred on information exchange may sometimes provide a more suitable analytical route. Rather than requiring proof that firms knowingly participated in a coordinated scheme, the focus may shift toward whether shared systems collect, aggregate and disseminate strategic information in ways capable of reducing strategic uncertainty.

5. Emerging Frontier: Information Exchanges in Labour Markets

81. In recent years, there has been an increased attention to practices capable of affecting competition for labour, including wage fixing agreements, no poach arrangements and exchanges of employment-related information.

82. The AdC has been particularly active in this area through a combination of enforcement and advocacy initiatives. On the enforcement side, the AdC has investigated and sanctioned practices capable of restricting competition in labour markets, including no

[20] Case C-74/14, Eturas and Others v Lietuvos Respublikos konkurencijos taryba, ECLI:EU:C:2016:42

poach arrangements and other labour market restrictions in sectors such as sports, information technology, beverages and temporary employment.[21]

83. In parallel, the AdC has pursued a broader advocacy strategy through its *Issues Paper on Labour Market Agreements and Competition Policy*, aimed at raising awareness of competition risks in employment markets and promoting a broader understanding of competition principles among firms, workers and other stakeholders.[22]

84. From an analytical perspective, information exchanges in labour markets do not require fundamentally new legal or economic frameworks. In fact, they largely involve applying established principles developed in product markets to a different competitive setting. Firms compete not only through prices and commercial conditions offered to consumers but also through wages, benefits and employment conditions offered to workers.

85. The translation from traditional competition analysis is relatively straightforward. In product markets, firms compete for customers through prices and commercial strategies; in labour markets, firms compete for workers through wages and employment conditions. Information concerning salaries, compensation structures, recruitment strategies or hiring intentions may therefore constitute strategic variables in labour markets in the same way that prices, quantities or commercial conditions constitute strategic variables in product markets.

86. The economic mechanisms previously discussed also remain relevant. Information exchanges may facilitate identification of focal points concerning remuneration policies, improve firms' ability to monitor rivals' conduct and strengthen reactions to deviations from expected behaviour. Strategic uncertainty continues to play a central role. Information capable of revealing competitors' conduct may reduce informational frictions and change incentives in ways similar to those identified in traditional product market settings.

87. The existing analytical framework developed in EU decisional practice also remains applicable. The competitive significance of exchanges depends on the nature and characteristics of the information exchanged and market features. Information concerning current or future wages, individualised salary data or non-public recruitment practices may raise concerns analogous to those traditionally associated with exchanges involving prices or commercial conditions.

6. Conclusion

88. Information exchanges occupy an increasingly important position in contemporary competition enforcement. Information sharing arrangements may generate substantial efficiencies by reducing asymmetries, improving forecasts and facilitating commercial decision making. In contrast, information exchanges involving strategic information may facilitate coordination among competitors.

[21] Autoridade da Concorrência (2025), PRC/2025/2 – Decisão Final; Autoridade da Concorrência (2024), PRC/2024/1 – Decisão Final; Autoridade da Concorrência (2022), PRC/2022/3 – Decisão Final; Autoridade da Concorrência (2020), PRC/2020/1 – Decisão Final.

[22] Autoridade da Concorrência (2021), Issues Paper on Labour Market Agreements and Competition Policy. Available at: https://www.concorrencia.pt/sites/default/files/Issues%20Paper_Labour%20Market%20Agreements%20and%20Competition%20Policy.pdf

89. Developments in the economic literature and EU competition law have progressively converged around a common analytical framework. Modern approaches to competition law increasingly examine whether information exchanges reduce strategic uncertainty and change the informational conditions under which firms compete. Information capable of revealing competitors' strategic conduct may facilitate the identification of coordination terms, strengthen monitoring and punishment mechanisms thereby facilitating the emergence and stability of coordinated outcomes.

90. The Portuguese banking case illustrates many of these developments. The case demonstrated that exchanges involving non-public, individualised and strategically significant information may raise serious competition concerns. It further highlighted the importance of contextual analysis and the interaction between information characteristics and market structure in assessing consumer harm.

91. At the same time, recent developments suggest that information exchange concerns increasingly extend beyond traditional settings. Digitalisation, algorithmic tools and artificial intelligence may facilitate information exchange and bring new forms of anticompetitive cooperation between competitors. Algorithms reinforce established mechanisms by increasing monitoring capabilities, reducing reaction times and creating new forms of informational transparency. Similarly, common digital platforms increasingly raise questions resembling traditional information exchange concerns.

92. Finally, the increasing attention to labour markets points in a similar direction. There is a clear recognition that firms compete not only for customers but also for workers. Information concerning salaries, hiring intentions and employment conditions may perform functions comparable to prices and commercial strategies in product markets. Existing analytical principles therefore continue to provide useful guidance in identifying circumstances in which exchanges may reduce uncertainty and affect competitive conduct.