Quantitative Methods and Mergers Effects in Competition Policy: the Brazilian case

Camila C. Pires-Alves[*], Marcos Puccioni de Oliveira Lyra[**], Marina Maria Gutierrez Bonfatti[***]

ABSTRACT: The paper aims to discuss the use of quantitative methods in quantifying merger effects as evidence, taking the particularities of the Brazilian experience and considering both technical, institutional and policy issues. Therefore, the paper investigates evolution and patterns in the Brazilian institutional framework and jurisprudence in terms of technical aspects and adequacy of implementation, policy issues regarding the acceptance within the administrative tribunal and the main challenges imposed. The information collected considered all the merger cases, as far as we know, in which quantitative methods were applied by CADE in order to measure, estimate or imply the merger's potential anticompetitive effect on prices. Among the conclusions we find that the models are employed in few complex cases and mostly to sustain some restriction by the authority and the authority seems concerned about sensibility analysis, in some cases revealed by the combination of the use of different methods and/or competitive models.

Keywords: competition policy, antitrust, merger effects, quantitative methods, quantitative tools, CADE, Brazil, simulation models, UPP.

JEL: L40

[*] Professor at Institute of Economics – Universidade Federal do Rio de Janeiro and coordinator of Gdec (Research Group on Law, Economics and Competition - Universidade Federal do Rio de Janeiro), camila.alves@ie.ufrj.br.

[**] PhD student at Institute of Economics – Universidade Federal do Rio de Janeiro and researcher at Gdec, marcosplyra@gmail.com.

[***] Bachelor in Economics at Institute of Economics – Universidade Federal do Rio de Janeiro, marinagbonfatti@gmail.com.

1. Introduction[1]

Quantitative tools have been increasingly used by competition policy authorities and by parties when evaluating the potential anticompetitive (unilateral and coordinated) effects of mergers. This is the case in many countries, considering the technical advances and competition policy developments. As it could not be different, this is also the Brazilian case, as it has a Well-established antitrust system mainly since 1994. However, the use of this sort of tools is not a trivial matter considering the model's technical attributes and the legal and institutional challenges to the use of this sort of economic evidence. On the other hand, the antitrust practice constantly claims for more precise answers from economic analysis in order to enhance an effective competitive assessment of mergers and acquisitions.

The use of quantitative methods in competition policy and its limitations have been widely discussed by the literature, featuring three main approaches: technical, institutional (law and economics) and Policy-oriented reviews or comparative analysis. From a technical perspective, authors have considered the features, advantages and limitations of quantitative methods developed and applied in the area. In particular, quantitative methods used to estimate mergers' impact on prices are essentially discussed by the literature with regard to their hypotheses and features, their objectives and purposes (screening, price effect, pressure), and their time and data requirements.[2]Furthermore, the last three decades have given us a diversity of quantitative models, varying into those categories, each one considered regarding their advantages and limitations, not only technically, but also considering their use as a source of evidence in Competition Policy.

The institutional view, in turn, appears in the literature as a Law and Economics perspective, by taking into account the requirements for the ideal application of these tools within the institutional environment, which we will call in this paper the Antitrust System (comprising its actors and institutions). In this scenario, the literature explores the admissibility and credibility matters of economic evidence, and its limitations.[3]

Finally, by what we could call the Policy-oriented literature, there are some contributions that offer reviews and analyses regarding national experiences in the application of methods or regarding their application within courts.[4]

Following the literature advances commented above, and choosing for a complete and holistic view, the paper aims to discuss the use of quantitative methods in quantifying merger effects as evidence, considering the particularities of the Brazilian experience. Therefore, the paper investigates the evolution and patterns in the Brazilian case not only in terms of technical aspects (such as types of models, their adequacy to the market and goals, and the technique applied), but also in terms of institutional and policy

---

[1] This paper is a result of a research project that counted with Pibic/CNPq support and with the support of the undergraduate student Stefanie Scheidegger Araújo. The authors would also like to thank Prof. Eduardo Pontual Ribeiro for the helpful suggestions. The authors are grateful to all the experts and economists, including former commissioners and former chief economists at Cade, that kindly contributed to build our case list. This paper is forthcoming in World Competition Law and Economics Review. Please cite published version.

[2] See Gregory J. Werden & Luke M. Froeb, *The effects of mergers in differentiated products industries: Logit demand and merger policy*, 10 J. L. Econ. & Org. 407, (1994), Gregory J. Werden & Luke M. Froeb, Unilateral competitive effects of horizontal mergers, SSRN (2006), https://ssrn.com/abstract=927913 (accessed 19 Jun. 2019), Joseph Farrell & Carl Shapiro, *Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition*, 10 The B.E. Journal of Theoretical Economics 1, (2010a), Roy J. Epstein & Daniel L. Rubinfeld, *Understanding UPP*, 10 The B.E. Journal of Theoretical Economics 1, (2010), Joseph Farrell & Carl Shapiro, *Upward Pricing Pressure in Horizontal Merger Analysis: Reply to Epstein and Rubinfeld*, 10 The B.E. Journal of Theoretical Economics 1, (2010b).

[3] See Gregory J. Werden, Luke M. Froeb & David T. Scheffman, *A Daubert Discipline for Merger Simulation*, 18 Antitrust 89, (2004), Mike Walker, *Merger Simulation models: useful or just dangerous?*, *mimeo* 19, (2005) and Oliver Budzinski & Isabel Ruhmer, *Merger simulation in Competition Policy: A Survey*, 6 Journal of Competition Law and Economics 277, (2010).

[4] See Ioannis Lianos & Christos Genakos, *Econometric evidence in EU competition law: an empirical and theoretical analysis*, 6 CLES Research Paper Series, (2012), Marcel Boyer, Thomas W. Ross & Ralph A. Winter, *The rise of economics in competition policy: A Canadian perspective*, 50(5) Canadian Journal of Economics 1489, (2017) and Yannis Katsoulacos, Svetlana Avdasheva & Svetlana Golovanova, *A Methodology for Empirically Measuring the Extent of Economic Analysis and Evidence and for Identifying the Legal Standards in Competition Law Enforcement*, in *Standing Up for Convergence and Relevance in Antitrust* (Nicholas Charbit & Sonia Ahmad, eds., Frédéric Jenny Liber Amicorum, 2019).

issues regarding the acceptance within the administrative tribunal and the main challenges to the production and use of quantitative tools as source of evidence.

Under the technical perspective, the paper takes the advantage of the existence of such a mature discussion briefly reviewing it, to further check whether the Brazilian experience has been connected with the economic literature over the years and find and evaluate patterns of application of this sort of tools.

The institutional questions to be made concerning the Brazilian experience include verifying whether this sort of economic evidence has been applied with proper caution. A vast collection of best practices for the usage of economic evidence has been produced over the world during the beginning of this decade, including in Brazil.

At the end, it is possible to weigh the costs and benefits of each model, also considering the institutional challenges, and to verify whether the Brazilian experience has evolved in a proper way with regard to the choice of models and its success in overcoming the models' limitations, in order to defend them as a relevant source of evidence to the solution of cases. The paper also intends to identify some positive and negative aspects, and to set main recommendations to the Brazilian Competition Policy.

With respect to the Brazilian experience, it is important to make the following remark. The Brazilian recent institutional changes - including the creation of the Department of Economic Studies (DEE) within the competition authority and the approval of the new competition law[5], which established new standards of analysis - made Brazil's experience more interesting. One of the main reasons is that the Brazilian system now counts with requirements (related to time and procedure) applicable to merger analysis and to the production of economic evidence that are closer to the ones of developed countries, although it still faces relevant differences and difficulties familiar to developing countries. Also, the high transparency of the Brazilian antitrust authority, the Administrative Council of Economic Defense (CADE), and its Economic Department, by giving access to case files (it is possible to have open access to public versions of very descriptive decisions and technical studies used during cases and considered in the final decision), allows us to answer properly the questions raised by the paper. Lastly, the Civil Law experience provides an interpretation of the challenges over an administrative tribunal, which are also similar, as we will show, to aspects of the discussion of the use of evidence in judicial courts and the admissibility of economic evidence.

With concern to methodological aspects related to the data collection, it was possible to gather all the merger cases, as far as we know, in which quantitative methods were applied by CADE in order to measure, estimate or imply the merger's potential anticompetitive effect on prices. Due to data restriction, the list of cases is limited to the ones in which we could find the production of this source of evidence by the agency, although expanding the research to the cases in which the parties themselves submitted economic evidence is hereafter our attempt.[6]

The paper is organized into 5 sections, including this introduction. In the next section, the paper presents briefly the main quantitative tools and models offered by the economic literature to estimate merger's effects on prices, in the past 30 years. The section provides a wide and short view and comparison between the available models, including their technical features and limitations. The third section leaves aside the technical issues for a while in order to discuss under an institutional perspective the role of economic evidence and the challenges regarding the admissibility of economic evidence. In the fourth section, the paper examines the Brazilian experience, considered under its perspective - that is by a technical and institutional approach. So, it discusses the institutional evolution at the Administrative Council for Economic Defense (CADE), especially regarding the introduction of the new Competition Law and its influence on the capability of producing and analyzing quantitative economic evidence. Later, it examines the Brazilian case, in special the mergers in which the institution produced the evidence. Finally, the paper provides its conclusions in the last section.

---

[5] L. 12529/2011

[6] The case law, although widely transparent and open to public access, does not have a smart feature of search by terms, so the case list considered by the study was collected through interviews with the economists that worked in the agencies at high positions (Commissioners and Chief-Economists).

2. Main Quantitative tools and Competitive Models

In the last three decades, there has been a wide introduction of quantitative methods to consider the potential effect of horizontal mergers on prices into both the academic and antitrust practice debates. The main methods used by antitrust authorities are merger simulation, Upward Pricing Pressure (UPP) test and its derivations (such as GUPPI and CPPI), and natural experiments. As the technical features are not our focus in this paper, the next paragraphs will discuss these models briefly, pointing their main properties and attributes.

In the 90s, *simulation models* based on both the Cournot and Bertrand models began to gain ground in the antitrust practice with initial contributions made by Farrell & Shapiro and Werden & Froeb[7]. After defining relevant markets and/or estimating the demand elasticities through econometric methods, it is possible to use simulations to predict postmerger prices and quantities (unilateral merger effects) and check whether those variables will change significantly by including the estimated elasticities in the firm's maximizing decision in the previously selected model.[8]

The process of producing the simulation model can be divided in four steps: (1) definition of products to be included in the relevant market; (2) estimating elasticities based on data regarding prices and production, as well as choosing a functional form for the demand; (3) including estimated elasticities in the first order conditions for profit maximization (assuming the chosen oligopoly model and (4) simulating postmerger equilibrium prices and production.[9]

In the case of simulation based on Cournot, after reorganizing the first order conditions,[10] it is possible to observe that there is a relation between marginal costs and prices and that marginal costs should be sufficiently smaller than prices to enable a postmerger price decrease defined by individual shares of merging parties and the absolute value of price elasticity of market demand.[11] The analyst must estimate the data to properly check whether there will be a price increase. Cournot simulation models are usually applied to homogeneous goods.

Two differences arise when dealing with Bertrand-based models in differentiated markets. The first one is the need to estimate the cross-price elasticities of demand, not just the market elasticity of demand. Second, deciding which brands will be included is not trivial as in the case of homogeneous demand.[12] Regardless of the difficulties, when dealing with markets with differentiated products Bertrand models are more frequently used than Cournot.

Three major comments about the procedures must be made. First, note that a reorganized version of the first order conditions for the merged firm in a Bertrand model can be used for the last step of the merger simulation.[13] Supposing that firms behave as Bertrand in both scenarios, the analyst is able to

---

[7] Joseph Farrell & Carl Shapiro. *Horizontal mergers: an equilibrium analysis*. 80 The American Economic Review 107, (1990) and Werden & Froeb (1994), *supra* n. 2.

[8] Camila C. Pires-Alves, *Métodos Quantitativos na Avaliação dos Efeitos de Fusões e Aquisições: uma análise econômica e jurídico-institucional*, Doctoral Thesis IE/UFRJ, 25-6 (2010).

[9] *Ibid*, at 26.

[10] This reorganized version can be represented as:

$$MC_m(q_i + q_j) < p\left(1 - \frac{s_i + s_j}{\varepsilon}\right)$$

MC_m is the marginal cost for the merged firm, q_i and q_j are the output for merging firms *i* and *j*, s_i and s_j are market-shares for firms *i* and *j*, ε is the elasticity of market demand. See.Farrel & Shapiro, *supra* n. 7, at 112.

[11] Pires-Alves, *supra* n. 8, at 17.

[12] *Ibid*, at 28.

[13] It can be represented as:

$$s_i(p_i^B, p_{-i}^B) + s_i(p_i^B, p_{-i}^B)\frac{(p_i^B - MC_i)}{p_i^B}\varepsilon_{ii}(p_i^B, p_{-i}^B) + s_j(p_j^B, p_{-j}^B)\frac{(p_j^B - MC_j)}{p_j^B}\varepsilon_{ji}(p_j^B, p_{-j}^B) = 0$$

p_i^B and p_j^B are the premerger prices in equilibrium for firms *i* and *j*, p_{-i}^B and p_{-j}^B are the vectors of premerger prices in equilibrium for other firms, ε_{ii} and ε_{jj} are the price elasticities of demand for firms *i* and *j*. See Cristian Huse & Alberto Salvo,

quantify unilateral effects of the merger through postmerger margin estimates by obtaining cross-price and price elasticities of demand and market shares. [14]

Second, there are different types of systems of demand that can be used for Bertrand models, such as: linear and log-linear demands, logit, nested logit, random coefficients logit, and AIDS. Third, there are basically two major easier ways to take on Bertrand-based simulations, which are through the Antitrust Logit Model (ALM) and the Proportionally Calibrated AIDS (PCAIDS) demand systems.[15]There are advantages and disadvantages of using simulations for measuring merger effects. Undoubtedly, simulation models intend to give precise answers about the effects of merger on prices through a complex and structured model, something that was not possible before the development of econometrics and computing. The analyst can also check counterbalanced effects in different scenarios, including efficiency gains through reductions of marginal cost. Besides, simulations have clear hypotheses that can be tested through sensitivity analysis[16] However, there are also many sources of criticism about the use of simulation models. Basically, the critics regard mainly the restrictive hypotheses of the model, their capacity to explain the market properly and the difficult of dealing with their impact to the sensibility of the results. The hypotheses subject to criticism generally consist: the hypotheses undertaken in general, the functional forms of demand chosen[17], and the choice between competitive models (mostly unilateral effects and price/quantity competition under Bertrand/Cournot model).[18] [19]

The Upward Pricing Pressure (UPP) test measures incentives to postmerger price increases.[20] A simpler version of the UPP is the Gross Upward Pricing Pressure Index (GUPPI), created by Salop & Moresi[21], which only measures the potential anticompetitive effects of the merger, without considering efficiencies.[22]

Estimação e Identificação de Demanda e Oferta, at 32, in *Métodos Quantitativos em defesa da concorrência e regulação econômica* (Eduardo P. S. Fiúza & Ronaldo S. da Motta eds., Ipea, 2006).

[14] Pires-Alves, *supra* n. 8, at 23.

[15] Huse & Salvo, *supra* n. 13, at 26. For more development on this debate check also Pires-Alves, *supra* n. 8, at 38.

[16] See Werden, Froeb & Scheffman, *supra* n. 3.

[17] There is a Trade-off between choosing substitution patterns which are more flexible and realistic vs more rigid and more easily applicable one. For more information check Philip Crooke, Luke Froeb, Steven Tschantz & Gregory J. Werden. *Effects of Assumed Demand Form on Simulated Postmerger Equilibria*, 15 Review of Industrial Organization 205, (1999). The authors studied four different demand forms and their relevant differences in the simulation results. They concluded that unless it is possible to make any assumptions about the demand of the market, simulations should be repeated with multiple demand forms to test the robustness of the result (*Id.*, at 216).

[18] Bertrand is more frequently chosen when dealing with differentiated products, but this model gets biased results toward lower prices when compared to Cournot as concluded by Pioner & Cânedo-Pinheiro. See Heleno M. Pioner & Mauricio Cânedo-Pinheiro, *Margens de erro e eficiências em fusões*, at 163 in *Métodos quantitativos em defesa da concorrência e regulação econômica* (Eduardo P. S. Fiuza & Rosângela S. Motta eds., Ipea 2006).

[19] Some considerations must be made about the adequacy of the model to the conditions of the markets, such as: (1) the importance of competition in other variables besides prices, (2) how adequate the models capture price changes, the introduction of new products or different past shocks, (3) differences between predicted and actual margins in products that took place in the merger and its substitutes. See Werden, Froeb & Scheffman, supra n. 3, at 90. Other issues are the possibility of collusion after the merger, entry and repositioning and also the fact that data is collected in the final consumption of the product (while the merger happens at production level). See Dennis W. Carlton, *The relevance for Antitrust Policy of theoretical and empirical advances in industrial organization*, 12 Geo. Manson L. Rev. 47, 61 (2003) and David A. Weiskopf, *Merger Simulation*, 17 Antitrust Magazine 57, 58-9 (2003).

[20] It compares the profitability of recapturing lost sales with the efficiency gains obtainable from the merger. Farrell & Shapiro (2010b, *supra* n. 2, at 12) define the UPP index as:

$$UPP_1 = D_{12}(P_2 - C_2) - E_1 C_1$$

D_{12} is the deviation ratio from product 1 to product 2, P_2 is price of product 2, C_1 and C_2 are the marginal costs for firms 1 and 2, $E_1$is the efficiencies obtained in producing good 1. If UPP_1 is positive or negative, the net effect is prejudicial or beneficial to the competitive process, respectively.

[21] Steven C. Salop & Serge Moresi, Updating the Merger Guidelines: Comments, Georgetown Law Journal, (2009), https://ssrn.com/abstract=2756487 (accessed 19 Jun. 2019).

[22] GUPPI is the product of the first term of UPP_1 and the price ratio: $GUPPI_1 = D_{12}(P_2 - C_2)\, P_2/P_1$

Both UPP and GUPPI are obtained through first order condition of the Bertrand model. Therefore, the critics and limitations due to the choice of competitive model that apply to merger simulation as mentioned above also apply to UPP and its derivations mostly, although its application is simpler than most complex simulation models.

Finally, Moresi et al[23] developed a pricing pressure index that is concerned with coordinated effects (anticompetitive effects - or price increases from coordinated strategies after the merger), unlike simulation, UPP and GUPPI, which measure unilateral effects only. Specifically, the Coordinated Price Pressure Index (CPPI) is concerned with parallel accommodating conduct[24] and tests the maximum price increase that can be successfully implemented by two firms.[25]

The delta CPPI (difference between Post-merger and premerger CPPI) indicates whether the firm will most likely undertake parallel price increases or not. This is not, as argued by the authors, a full equilibrium prediction of how prices will be after the merger, but an index to consider the threat of coordinated effects engaged by two firms through parallel accommodating strategies in a Non-dynamic game (one round price increase). Once more, the Bertrand model is the competitive model assumed.

An important debate concerning UPP and derived models and merger simulations is related to their objectives, appropriate use, and assumptions.[26] On the one hand, there are arguments that consider UPP a special case of merger simulation with the significant difference being the use of diversion ratios instead of elasticities, with less data requirement. Also, the advantages of using UPP as a screening tool for differentiated products in opposition to the Herfindahl Hirschman Index are clear as, with the first one, it is not necessary to previously define relevant market, and in addition it is better connected to Bertrand models, while the linkage between HHI and Lerner index are only directly inferred by the Cournot model. On the other hand, the model requires the same restrictive assumptions, including its competitive model, with less clear methodological steps, as it is an index calculation.

Finally, *natural experiments and reduction forms* are alternatives to simulations and UPP. The idea is, when possible, to compare geographical markets of the same product, considering differences in the composition of the market, the number of firms and the firms involved in the merger, and isolate the effects of the specific structures on prices inside each setting. This can also be done through the study of specific shocks in the market.[27]The pros and cons include differences of necessary and restrictive assumptions, data requirements, and difficulty to control other variables and endogeneity issues[28].

The quantitative tools presented in this section have different properties and may be more or less adequate to different situations. Besides, it is relevant to mention that, despite their development and

---

[23] Serge Moresi, David Reitman, Steven C. Salop & Yianis Sarafidis, *Gauging Parallel Accommodating Conduct Concerns with the CPPI*, SSRN (2011), https://ssrn.com/abstract=1924516 (accessed 19 Jun. 2019).

[24] Parallel accommodating conduct (PAC) is a type of conduct that does not require an explicit agreement. A firm engages in a conduct with the expectation that at least one competitor will follow (Moresi et al, *supra* n. 23, at 2).

[25] It can be defined as:

$$CPPI = \min\{LSIP_A, LSIP_B\}$$

And $LSIP_A$and $LSIP_B$ can be defined as:

$$LSIP_A = \min\{S_A^I, S_B^M\}$$
$$LSIP_B = \min\{S_B^I, S_A^M\}$$

S_A^I and S_B^I are the maximum price increase that A and B are willing to initiate, respectively, assuming that the other firm will match the price. S_A^M and $S_B^M$are the maximum price increases that A and B are willing to match, respectively. Note that $LSIP_A$ and $LSIP_B$ are the Largest Sustainable Price Increase for firms A and B, in other words, they are the smaller of the two maximum price increases for A and B, respectively. As $S_A^I < S_A^M$ and $S_B^I < S_B^M$, we can conclude that:

$$CPPI = \min\{S_A^I, S_B^I\}$$

See Moresi et al, *supra* n. 23, at 13-4.

[26] For more details, see Farrell & Shapiro, *supra* n. 2 and Epstein & Rubinfeld, *supra* n. 2.

[27] See Malcolm B. Coate, *The use of natural experiments in merger analysis*, 1 Journal of Antitrust Enforcement 437, (2013).

[28] See Carlton, *supra* n. 19 and Werden, Froeb & Scheffman, *supra* n. 3.

application, there are few studies that discuss and give us evidence regarding the efficacy of all the models presented.

Summing up: there are advantages and disadvantages when using different quantitative tools, and they are presented below in Table 1.

Table 1 - Advantages and Disadvantages of each Competitive Tool

Model	Advantages	Weaknesses
Simulations	They aim to estimate the merger final effect on prices Possibility of checking counterbalanced effects Assumptions are clear	Restrictive assumptions Trade-off when choosing functional forms of demand (Flexible and Realistic X Rigid and Easily Applicable) Choice of competitive model and absence of coordination effect Little evidence on its efficacy
UPP	Works as a screening device for differentiated products Not necessary to previously define relevant market in the beginning of the analysis	Similar restrictive assumptions not so evident as in simulation Undefined debate about the correct use in the analysis (screening, effect, pressure x measure, relevant market) Does not necessarily require less data than simulations Little evidence on its efficacy
Natural Experiments	Analyze the market based on empirical evidence. Does not depend on market behavior or demand estimation Not necessary to make assumptions about post-merger competitive form	Difficulties in controlling for other variables or endogeneity Using past mergers' data is rarely viable and may inspire little confidence

Source: own elaboration

The next section will discuss more deeply the practical use of the quantitative methods in competition policy and the criteria for admissibility and credibility of this sort of evidence.

3. Discussion about the Employment of Quantitative Methods in Competition Policy and a Broader view of the Techniques

3.1. Systemic view of the Competition Policy

In competition policy, law and enforcement target improvements in the competitive environment and pursues these advances through a wide number of agents. Decision makers, particularly, should be concerned about the economic basis and the impact of their decisions.

Both the economic and Legal-institutional dimensions are simultaneously working and influencing each other. Economic measures are undertaken within a Legal-institutional framework and the choice of economic ideas and approaches are defined by legislation and jurisprudence. Constraints are also defined

by the institutions and agents that apply the economic measures themselves. It is possible to consider that 'in important ways, 'law' still constrains Economics, just as economics has come to constrain the law'.[29]

In this viewpoint, a complete examination of antitrust policy should include that: (1) there is an interdisciplinary connection between Economics and Law; (2) its application is undertaken by agents and specialized institutions; (3) economic and legal basis guide the action of those agents and institutional players, which are subject to legislation; (4) there are Legal-institutional tools, reliant on all of the dimensions (and their interactions) above. So, it is imperative to see the system as an integrated body – the 'competition system'.[30]

The system is composed of the legislation and the public actors held responsible for its enforcement, as well as other public and private agents, including: (1) agencies and courts (as well as their employees), (2) economists, lawyers (hired professionals), (3) university and academic staff involved in researching in the field; (iv) other social organizations that work to promote competition.[31] So, the economists that produce economic evidence within the agency, and in particular chief economists' offices, are definitely part of this system.

When using the rule of reason, which applies to mergers and most conduct cases, one must show the economic impact and the net effects of a conduct or transaction, and this is true for judges and administrative tribunals, such as CADE. Therefore, the assessment is done on a Case-by-case basis, considering the characteristics of markets which may suggest a potential abuse of market power by firms. Therefore, economic evidence, both in quantitative and qualitative forms, plays a significant role in the competition policy arena.[32]

3.2. Requirements to the Admissibility and Credibility of Quantitative Methods

The submission of economic evidence in the antitrust analysis began in the United States. The American experience, in the last decades, has generated an intense and relevant debate regarding the advantages and limitations of the employment of this kind of evidence in the solution of antitrust cases. In the US, the employment of economic evidence occurs both in specialized agencies and in judicial courts, where the cases are decided. In the judicial disputes, it is common for parties (merging companies and government) to base their economic arguments on an expert's testimony.[33]

In the US, judges act as gatekeepers: they decide when to exclude economic evidence that do not properly fulfill the admissibility requirements. Besides the case law, FRE 702[34] also establishes the crucial elements that should influence the Decision-maker: *'[...]* (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case*'*.[35] In general, it is expected that the expert be experienced in the matter and he should have considerable knowledge of the subject in order to issue an opinion.

---

[29] Andrew I. Gavil, *Defining Reliable Forensic Economics in the Post-Daubert/ Kumho Tire Era: Case Studies from Antitrust*, 57 Wash & Lee. Law Review 831, 838 (2000).

[30] Pires-Alves, *supra* n. 8, at 61-2.

[31] See Andrew I. Gavil, William E. Kovacic & Jonathan B. Baker, *Antitrust Law in Perspective: cases, concepts and problems in competition policy* (2nd ed. 2008) and Andrew I. Gavil, *The challenges of economic proof in a decentralized and privatized European competition policy: lessons from the American experience*, 4 Journal of Competition Law and Economics 177, 181 (2007).

[32] However, they are frequently underused. Katsoulacos, Avdasheva & Golovanova provide an interesting explanation based on empirical evidence. See Yannis Katsoulacos, Svetlana Avdasheva & Svetlana Golovanova, *Legal standards and the role of economics in Competition Law enforcement*, 12 European Competition Journal 277, (2016).

[33] This section is based on Pires-Alves *supra* n. 8 and Camila C. Pires-Alves, *Evidências Econômicas e Política Antitruste: desafios impostos e saídas institucionais*, 9 Economic Analysis of Law Review 368, (2018).

[34] 28 U.S.C App Fed R Evid Rule 702: Testimony by Expert Witnesses

[35] *Ibid*.

The three conditions mentioned above were the most remarkable changes in the general revision in 2000, which incorporated changes based on the case law, specially due to Daubert[36] case (1993) and Kumho[37] case (1999).[38]

The matter of reliability is the one that raises the most intense debate. The Supreme Court's ruling on the *Daubert v. Merrel Dow Pharms* case was of great importance and resulted in the Daubert Doctrine, especially relevant to the discussion about the admissibility of scientific testimony.[39] With regard to the reliability of the testimony, in the Daubert case, the discussion focused on what should be considered scientific knowledge, which included the employment of a reliable scientific method and the issuance of an opinion based on solid grounds of scientific knowledge, considering the specificities of the subject.[40]

The Court's ruling on Daubert established Hard Science methods criteria to be observed, which were: 'whether the expert's proposed methodology or technique had been tested, whether it had been subjected to peer review and publication, whether it had known or knowable error rate, whether it was generally accepted [in the scientific community]'.[41] There was a debate about the applicability of such criteria to subjects of different nature, until the Kumho case, in which it was decided that the methodology established in the Daubert case should be applicable to all kinds of expert's testimonies, regardless of the field of knowledge[42] As a consequence, also in the Kumho case, it was decided that the list of criteria established in the Daubert case should not be applicable in an inflexible way to other cases, varying from case to case, depending on the specific field of knowledge and according to the academic and professional specificities.[43] The objective is to make sure that the expert employs, in his testimony, the same scientific rigor employed in the field.[44]

As mentioned by Gavil[45], after Daubert-Kumho, it was established a Three-step procedure for the definition of reliability criteria: (1) identification and isolation of the fields of knowledge touched by the testimony; (2) the same for the different methodologies and testimony steps, individually evaluated; and (3) identification, by the judge and the parties, of specific criteria that should apply to each field and methodology employed in the testimony. Also, after the Kumho case,it was made clear that it should be equally evaluated the application of the methodology to the facts of the case.[46] Hence, the *fit the facts* mentioned in the FRE 702 should be understood as indicating that the expert's testimony – qualitative or quantitative – must be in accordance with the facts of the case. In other words, the methodology and economic models should be based on consistent hypotheses, coherent with the available information.[47]

It is important to remark that the application of the FREs, in the United States, together with the Daubert-Kumho doctrine, have not been enough to solve all the issues that arise regarding the submission of scientific evidence in judicial courts. In particular, there are relevant challenges concerning the verification of the credibility degree of evidence based on Economics.

The application of Daubert Discipline was discussed by Werden, Froeb & Scheffman[48] with an application to the use of simulation models. There is also an important debate about the most cited

---

[36] Daubert v. Merrell Dow Pharms, Inc., 509 U.S. 579 (1993).
[37] Kumho Tire Co. v. Carmichael, 526 U.S. 137, 141 (1999).
[38] See Gregory J. Werden, *The Admissibility of Expert Economic Testimony in Antitrust Cases*, *mimeo*, 1, 1 (2007) and John E. Lopatka & William H. Page, *Economic Authority and the Limits of Expertise in Antitrust Cases*, 90 Cornell L. Rev. 617, 628 (2004-2005).
[39] According to Gavil (*supra* n. 29, at 845), before Daubert the admissibility of economic evidence in antitrust was essentially based on summary judgement.
[40] Roger D. Blair & Jill Boylston Herndon, *The Implications of Daubert of Economic Evidence in Antitrust Cases*, 57 Wash. & Lee L. Rev. 801, 805-6 (2000) and Werden, *supra* n. 38, at 814-5
[41] Gavil, *supra* n. 31, at 189-190.
[42] '*the trial judge's general 'gatekeeping' obligation... applies not only to testimony based on 'scientific' knowledge, but also to testimony based on 'technical' and 'other specialized knowledge*'". Werden (*supra* n. 38, at 2).
[43] Gavil, *supra* n. 31 at 190, Gavil *supra* n. 29, at 844-8, Blair & Herndon, *supra* n. 38, at 4, Werden, *supra* n. 38.
[44] Werden, *supra* n. 38, at 2
[45] Gavil, *supra* n. 29, at 847
[46] Blair & Herndon, *supra* n. 40, at 4
[47] Lopatka & Page, *supra* n. 38, at 15-6
[48] Werden, Froeb & Scheffman, *supra* n. 3.

challenges mentioned above.[49] The matter of plurality is an important issue in Economics. Different admissible pieces of evidence can generate disparate conclusions, and even mutually exclusive conclusions, which is called in the literature as *battle of experts*. Besides, even if the testimony is based on Well-established methods in the field of Economics, there may be divergences between experts.[50]In such case, the judge will have to choose one of the conclusions, ignoring the others.[51] Also, the judge will have to rule on the admissibility of each testimony, regarding the expert's qualifications, as well as the testimony's relevance and reliability. Also the judge may not being able to give the legal system a definite solution as to the weight of scientific evidence upon the solution of the case, but definitely will have to give a final opinion on disputes that may appear.[52]

With regard to economic models, mere adjustments in the models' hypotheses may not be enough to solve the lack of consensus about the economic interpretation of the facts, both in the academy and in courts.[53] Specifically about the antitrust analysis, it is important to deepen the evaluation concerning the models' assumptions and limitations, as well as the methodological steps, even if it is a Well-established methodology. Different methodologies and models can lead to completely different results, even if based on the same data.

Finally, it is important to keep in mind that every model is essentially irrealistic in some degree. The conquence to the discussion would be that the degree of realism required is related to the necessity of accuracy and to the objective of the use of the model.[54] For this paper subject, we are dealing with a high degree of accuracy and definitive implication, as the model may interfere in the decision about a merger and its impacts on welfare. In this sense, science and legal or administrative use may differ in the realism standards required.

There are, therefore, two main issues: (1) it is important – especially in the antitrust analysis – to verify the degree of realism of each hypothesis and methodology, and its impact on the accuracy and reliability of the model, according to its objectives; and (2) it is also important to evaluate the relevance of the employment of the model to address the purposes of the competition policy.[55]

There are two commonly applied methods to help judges fulfil their roles as gatekeepers:(1) the possibility of a Court-appointed expert, in order to solve methodological disputes;[56] (2) the observation of best practices rules for the submission of economic evidence, in order to increase the degree of transparency about data, hypotheses and methodology employed.

The challenges pointed out above are also present in administrative bodies' decisions, as it is the case in Brazil and CADE, as the economic evidence applied in a case must be evaluated and contemplated with different degrees of acceptance in the decision and by a multidisciplinary body (lawyers and economists, mainly). The court appointed expert is replaced by the chief economist office, which also produces part of the economic evidence used by the agencies' analyses. Also, battles and disputes may still figure in the arena. In the following, we address the Brazilian peculiarities and institutional design, to further investigate the universe of cases in which the methods were introduced by the agency.

4. The Brazilian Experience

---

[49] See Jeffrey K. Mackie-Mason & Richard A. Pfau, *Inducements to Advocacy: The Economist as Independent Expert*, in *The Expert Economist in Antitrust Litigation* (Daniel Slottje, ed.,1999), Juan D. Gutiérrez, Expert Testimony, *Economic Evidence and Asymmetry of Information in Antitrust Cases*, 7 CEDEC Competition Law & Economics Working Papers, (2007), Richard A. Posner, The Law and Economics of the Economic Expert Witness, 13 The Journal of Economic Perspectives 91, (1999), Michael J. Mandel, *Going for the Gold: Economists as Expert Witnesses*, 13 The Journal of Economic Perspectives 113, (1999) and Roberto Thornton & John Ward, *The economist in tort litigation*, 13 Journal of Economic Perspectives 101, (1999).

[50] Mackie-Mason & Pfau, *supra* n. 49, at 2-3

[51] Posner, *supra* n. 49, at. 93

[52] Blair & Herndon, *supra* n. 40, at 811

[53] Gutiérrez, *supra* n. 49, at 6.

[54] For more about this discussion, see Pires-Alves, *supra* n. 8

[55] Pires-Alves, *supra* n. 33, at 395

[56] *Ibid.*, at 377-8.

The scope of this section is to provide a description of all the mergers and acquisitions which used quantitative tools, since the Nestlé/Garoto case (2002) decided by CADE, in which it has been employed some quantitative method to measure merger effects on price. As proposed in the last section, we are focusing on the model's characteristics, type of use, adequacy to requirements of admissibility and credibility (hypotheses and fitting to the market) and its influence over the authority's final decision. Before, we will present some institutional developments that took place in Brazil over those years.

4.1. Institutional Evolution

In Brazil, there has been an increase in the number of cases submitted to the Brazilian antitrust authority (CADE – Administrative Council for Economic Defense) in which has been employed some kind of quantitative method to evaluate anticompetitive effects of mergers and acquisitions.

One important institutional aspect that explains, in a great deal, this phenomenon, was the creation, firstly by CADE's Resolution n. 53, of 2009, and then institutionalized by the New Antitrust Law,[57]of the Department of Economic Studies (DEE) - one of the bodies which compose CADE, together with the General Superintendence and the Administrative Tribunal of Economic Defense. One of DEE's main activities is the elaboration of economic studies, providing a technical and thorough analysis to help the authority reach a decision concerning more complex cases.

It is precisely regarding these cases that the institutional role of DEE has been so important as to the dissemination of the use of quantitative methods to analyze anticompetitive effects of mergers and acquisitions. DEE, as a specialized body, with highly qualified staff, contributes actively to the production of quantitative evidence, leading the discussion to a more technical and objective (if possible) level.

From a legal perspective, it is important to remark that the edition of the New Antitrust established new patterns of analysis and promoted an institutional reorganization. The law explicitly states that parties, as also the DEE, can submit all kinds of studies and pieces of evidence they understand necessary to prove their case, which undoubtedly includes the use of quantitative methods.

As for the persuasive effect of economic evidence, and in accordance with Best Practices over the world[58], CADE's Resolution n. 4, of 2012, states that the credibility of the model depends on its hypotheses, limitations and its adequacy to reality. Also, it recommends that all quantitative evidence be submitted with a clear and assertive presentation regarding its assumptions, the methodological steps and the results. According to these elements, the persuasive power of the economic evidence can vary in a great deal.[59]

Regarding procedural rules, after the new law, the General Superintendence is responsible for the first analysis of mergers, being able to either approve the transaction without restrictions or send it to the Tribunal. Therefore, only the cases considered of greater relevance and higher complexity - for which the General Superintendence has recommended the rejection or approval with restrictions - proceed to the Tribunal, which is competent to approve with or without restrictions or reject the intended merger. The new law also established a deadline within which the authority must conclude the merger analysis: 240 days, prolongable for additional 90 days. The introduction of the 240-day deadline and of the Pre-merger authorization turned the competition authority's procedures more efficient and increased the efficacy of

---

[57] L. 12529/2011

[58] See the best practices published by the European Commission at: DG COMPETITION, *Best Practices For The Submission Of Economic Evidence And Data Collection In Cases Concerning The Application Of Articles 101 And 102 Tfeu And In Merger Cases*, http://ec.europa.eu/competition/consultations/2010_best_practices/best_practice_submissions.pdf (accessed 19 Jun. 2019) and by the Bundeskartellamt (German agency) at: Bundeskartellamt, *Best practices for expert economic* opinions, https://www.bundeskartellamt.de/SharedDocs/Publikation/EN/Bekanntmachungen/Notice%20-%20Standards%20for%20economic%20opinions.pdf?__blob=publicationFile&v=2, (accessed 19 Jun. 2019).

[59] CADE has recently released its Guidelines on Data submission. See: CADE, *Guia para envio de dados ao Departamento de Estudos Econômicos do Cade*, http://www.cade.gov.br/acesso-a-informacao/publicacoes-institucionais/guias_do_Cade/guia-para-envio-de-dados-ao-dee-do-cade_final_site.pdf, (accessed 19 Jun. 2019).

the merger control, reducing the incentives for judicial dispute.[60] However, the time length can be exiguous for a complex case, in which the quantitative exercises are usually employed, leaving not much space and time for endless technical debate.

4.2. The Brazilian Experience since Nestlé/Garoto Case (2002 – 2018)

4.2.1. General view and Methodology

The universe of cases considered in the further analysis contains all the merger cases in which CADE, and also the other extinct agency that used to be involved in the application of the previous competition law in Brazil (named *Secretaria de Acompanhamento Econômico – SEAE*), has produced quantitative methods to evaluate the merger effect on prices. The cases were selected among a universe of 8.464 mergers submitted to CADE from January of 2002 until February of 2017.

The first case to count with the support of quantitative methods to estimate the merger effects on prices was the Nestlé/Garoto merger, submitted to Brazilian authorities in 2002. As there is no possible search for terms in the CADE's jurisprudence and website, the cases were selected with the contribution of economists that occupied high positions at the Brazilian Competition Policy System, especially at CADE, during the period, such as Commissioners and Chief-Economists. The collection of information was favored by the transparency of CADE's decisions: the public version of Commissioners' decisions, as well as technical notes issued by the General Superintendence and the Department of Economic Studies are available in the agency website, and served as the main source of information to the cases examined in the paper.[61]

The research identified 18 cases[62] , mainly concentrated after 2012, when the stock of merger cases filed under the previous law had their final decisions issued by the administrative tribunal. Also, the creation of the Department of Economic Studies (DEE) contributed to this evolution, as, after the new Law, it enhanced its staff and importance inside the agency.

Considering the total number of cases decided by the authority over the years, it is possible to say that 18 cases represent a small number. Even if considered only the cases eligible to the use of quantitative methods, said the ordinary cases (which include the most complex cases, or exclude the summary cases), there has been a modest application of this sort of methods.

Since the Nestlé/Garoto case (2002) and until February of 2018, CADE has decided 8.464 cases, from which 15 were blocked/denied and 430 were approved with remedies (Figure 1). The percentage of cases that were restricted or blocked over time is relatively constant and around 5%. In the universe of the 18 cases in which some quantitative method was employed, statistics are considerably different: 5 were blocked/denied and 9 were approved with restrictions, resulting in a percentage of 78% of cases that were restricted or blocked (Figure 2). It means that most cases which counted with the use of quantitative methods resulted in some kind of restriction applied by the authority. Nevertheless, these 14 cases that employed some type of quantitative method and were restricted (9) or blocked (5) represent 3% of the total number of cases processed and decided by the authority. If we consider the universe of cases that were blocked by CADE, the percentage of cases that counted with the use of the examined quantitative methods rounds up to 33% (that is, 5 of 15 cases).

Figure 1 – CADE's Decision from January 2002 to February 2018 by type of Decision

<Insert Figure 1>

[60] Under the previous law (L. 8884/94), the parties had to submit the merger to the agency scrutiny after the deal had been sealed.

[61] The referred documents are available in: https://sei.cade.gov.br/sei/modulos/pesquisa/md_pesq_processo_pesquisar.php?acao_externa=protocolo_pesquisar&acao_origem_externa=protocolo_pesquisar&id_orgao_acesso_externo=0

[62] The case list is available in Appendix I. It is important to notice that the methods used in Nestlé/Garoto were submitted by the parties and not produced by Cade, so the case list does not include this one.

.

Source: own elaboration based on data available at: http://www.cade.gov.br/.

This can be explained by the fact that cases which count with the support of quantitative methods are the ones of higher complexity and therefore are more capable of raising competitive concerns (they are, in general, more likely to produce undesired anticompetitive effects). It is a logical consequence that such cases tend to be more susceptible to being approved with remedies or blocked by the authority.

Figure 2 – CADE's Decisions on cases that Employed Quantitative Methods by type of Decision

<Insert Figure 2>

Source: own elaboration based on data available at: http://www.cade.gov.br/

4.2.2. Types of model: Relevant Market and over Timing Analysis

The agency used a total of 31 quantitative tools in the 18 cases studied, including 11 simulation models - 6 Bertrand models, 4 Cournot and 1 Monte Carlo (other) -, 16 UPPs or derivations - 6 UPPs, 6 GUPPI, 3 CPPI, 1 GPP - and 4 natural experiments. The list of cases with the correspondent types of quantitative methods used is in the Appendix II.

An interesting point is that in 9 cases CADE used a combination of models, establishing some patterns:

(i) *Different types of simulation:* Ultragaz/Liquigás.

(ii) *Different types of UPP and derivations (except CPPI)*: HSBC/Bradesco; Reckitt Benckinser/Hypermarcas, Ultragaz/Liquigás.

(iii) *Simulation + Natural experiments:* Continental/Veyance Tech.

(iv) *Simulation + UPP and derivations (except CPPI)*: Braskem/Solvay; Reckitt Benckiser/Hypermarcas; Ultragaz/Liquigás; ArcelorMittal/Votorantim.

(v) *UPP and derivations + CPPI*: HSBC/Bradesco; SBT/Record/RedeTV; Ipiranga Alesat.

The above makes sense in terms of the technical properties of the models discussed in the first section. The combination of simulations using Bertrand and Cournot sounds unreasonable unless the case concerns different relevant markets under different competition models (Ultragaz/Liquigas is the only case where CADE used both types of models in the same case). In opposite, the combination of different versions of the UPP does make sense, as they offer different interpretations having in common the same fundamental assumptions.

The CPPI was considered above separately from the other UPP derivations because it is the only model in the list (in view of the ones that make assumptions about the competitive model – and not considering the natural experiments/reduced form exercises) that contemplates the possibility of coordinated effects. It is relevant to note that we have cases that employ a combination of UPP derivation tests, which assume Non-cooperative Nash equilibrium, and tests for coordinated effects (CPPI).

Finally, simulation models and natural experiments intend to check for final effect but they may have complementary functions: in most of the cases, the natural experiment was used to check for rivalry pressure and influence of the parties over the relevant market (comparing markets where both parties were competing with the ones where there was only one of the parties operating). The same can be

observed for simulation models and UPP, although, as previously seen, they may be used with different purposes (screening x final effect). We will discuss this later in the section.

In terms of the choice of competitive models considering the nature of the relevant markets, since the Nestlé/Garoto case, Bertrand simulations have been the most commonly used simulation when there is a market with product differentiation, whereas Cournot models have been most frequently employed to markets with homogeneous goods, as expected. It is important to note, as we could conclude from the combinations listed above, that it is intriguing that the agency decided to consider estimations in both Cournot and Bertrand explicitly, or implicitly, as the combined use of *simulation with Cournot + UPP derivations* was also a choice in some cases (e.g. Braskem/Solvay and Ultragaz/Liquigas). Another conclusion is that the UPP derivations and Bertrand simulations were employed even in homogeneous products markets, as it is the case of ArcelorMittal/Votorantim, Braskem/Solvay, and Capsugel/Genix.

In terms of the chronological introduction of the models, it follows the literature advance as presented in section 2. The earliest models applied were the merger simulation models, followed by the UPP test, first used in 2009, in the Sadia/Perdigão merger. In 2015, the HSBC/ Bradesco merger was the pioneer in the employment of both the GUPPI and the CPPI tests. The natural experiments or reduced forms appeared as alternatives where there is data and enough variety (e.g. many geographic dimensions).

Overall, the Brazilian experience in the last fifteen years has consisted of a progressive increase in the use of quantitative methods to analyze anticompetitive effects of mergers and acquisitions. While in the earliest cases the use of simulation models prevailed, the latest cases count, in general, with a combination of different quantitative methods, with predominance of UPP, GUPPI and CPPI tests, together with some merger simulation model or empirical study.

4.2.3. Objective of the tools

Simulation models and UPP derivations are both used to consider anticompetitive effects or pressure, as evidence of the likelihood of anticompetitive effects. The screening role of the UPP model appeared only in Reckitt Benckiser/Hypermarcas and HSBC/Bradesco. There is also the intent of using these methods to estimate the required efficiencies and cost reduction, so that the merger would not result in higher prices (TV SBT/Record/RedeTV, Braskem/Solvay and Ultragaz/Liquigas).

4.2.4. Institutional issues: Source of Evidence

From the 18 cases where the methods were employed by CADE, 12 had an economist commissioner leading the discussion in the tribunal (only 5 of them were leaded by a lawyer commissioner). This is relevant as it follows the concerns regarding the acceptance of this sort of evidence among Non-economist audiences.

Overall, the Brazilian experience is representative to illustrate the importance of the Economic Studies Department as the most important source of this sort of evidence. From the universe of 31 models calculated by the agency, the economic team produced 24 models by its own initiative or to assist the Commissioner/Superintendence teams.

Another significant finding is that the model presented by CADE can also be produced as a response to quantitative evidence submitted by the parties. The authority, for example, altered the parameters of quantitative exercises presented by the parties in Sadia/Perdigão and in Leão/Recofarma.

4.2.5. Institutional Issues: Sensibility tests, Hypotheses Discussion, and Transparency

The models presented are usually followed by some discussion about sensibility of the results to changes in parameters, especially elasticities, margins, and efficiencies estimates. This means that the models' results regarding price increase are usually presented in terms of percentage ranges. The discussion about the competitive model, *fit the past* tests, and effects on the results related to the estimation of other competitive strategy or conduct (such as repositioning, strategic barrier to entry, and

collusion) is not open in the documents, although it is not possible to say that it has not been taken into account during the internal evaluation concerning the right method to use.

However, the combined use of CPPI and unilateral effects' estimation methods and also of Bertrand and Cournot models may be seen as a form of sensibility test of the results in response to changes in the competition models' assumptions. One precaution that must be considered is that it is not possible for both assumptions and estimates to be simultaneously correct, as the same market cannot work as Bertrand and Cournot at the same time. The same can be said to the combination between coordination and unilateral effects, as both price effects cannot be seen separately (and UPP/simulation does not take into account changes in the competition model after the merger, which means that the coordinated effects on price are not taken into account by the application of this tool).

4.2.6. Institutional Issues: Decision's Influence and Alignment

Following the conclusions of the third section, our analysis requires some consideration about alignment between the models applied by the agency and the authority's final decision. In all the 18 cases, the tribunal's final understanding regarding the likelihood of the occurrence of anticompetitive effects was aligned with the conclusion of the models.

There is an important assumption here: we consider the quantitative method to be aligned with the decision when the economic evidence points to the existence of potential anticompetitive harm and the case is approved with restrictions or blocked. Or when there is no potential harm identified by the quantitative evidence and the authority approves the merger without restrictions. Without denying their importance, and only due to simplification reasons, we always consider the final decision, ignoring divergences along the administrative process (e.g. Superintendence's opinion, or a Commissioner's opinion when outvoted). When the model is produced internally by CADE (usually by DEE), what can be seen is that the conclusions drawn by the model are, in general, coherent with the authority's final decision, even though not rarely there are divergent opinions along the administrative process.

In order to consider the influence and alignment of the quantitative methods and CADE's final decisions, it is relevant to classify them by a score scale, defined by Lianos and Genakos,[63] which includes, according to the author: '(i) The technique was discarded (score 1); (ii) Strong objections were raised on aspects of the technique and the technique had no significant impact to conclusions (score 2); (iii) The technique was taken into consideration as evidence, albeit with reservations (score 3); (iv) The technique was taken seriously into consideration as evidence, however it was not solely relied upon reach conclusion (score 4); and (v) The technique was very convincing as constituted solid bases for a conclusion (score 5)'. [64]

Considering this rating, in all the cases, we can say that the quantitative methods played a subsidiary role. As expected, we could not find any score 5 between the 18 cases studied: even tough quantitative methods are important, they were always analyzed together with qualitative evidence. Besides, as we could notice, most cases were rated as score 4, as the techniques were cited in the arguments that based the decision, with no substantial discussion about methods, conclusions or assumptions, although never as a sole argument. However, this was not the case in Reckitt Benckinser/Hypermarcas and Recofarma/Leão, where we found that the technique was taken into consideration as evidence, albeit with reservation (score 3).[65]

Therefore, quantitative methods are mostly seem as a useful tool, but have always been evaluated along with qualitative evidence, as described in CADE's Guideline for Horizontal Mergers and Acquisitions' Analysis, which establishes the main steps of the traditional antitrust analysis. The use of

---

[63] Lianos & Genakos, *supra* n. 4.

[64] *Ibid.*, at 116

[65] In Recofarma/Leão, DEE used a linear model in the simulation, but the commissioner considered that a Non-linear model would estimate more precisely the increase in price. Still, he considered that the results of the model were relevant for the assessment of the case. In Reckitt Beckinser/Hypermarcas, the commissioner considered that two models of three models (the other one being a simulation model) estimated by DEE - GUPPI and UPP, both used for screening purposes - underestimated brand preferences. In the end, the commissioner agreed to the models' general results and used them to support his decision.

quantitative methods played a more important role in cases where there was a doubt about the rivalry potential of competitors, and mainly due to the necessity, in the most complex cases, of considering the length of the necessary counterbalancing efficiencies.

5. Conclusion

The paper aimed to discuss the use of quantitative methods in quantifying merger effects as evidence, taking the particularities of the Brazilian experience, and with a technical, institutional and Policy-oriented approaches.

As we could see along the discussions, there are many models that are used with the objective of getting an estimation of price effect. The most commonly used models have different features, varying from higher simplicity in terms of estimation, time and data requirements, to more complexity. Also, they may have distinct roles in the analysis. They can be used as screenings, to consider directly the final price effect - coordinated or unilateral -, to consider the potential pressure, or even to get some impression of the sufficiency of the alleged efficiencies. They can also be applied more specifically to homogeneous or differentiated products.

The third section presented briefly the debate about admissibility and credibility assessment of economic evidence within the United States. Although we recognize that there are important differences between the American and Brazilian regimes (Common and Civil Law, respectively), there are important challenges that are shared by both experiences. Some results in the Brazilian experience confirm this interpretation: (1) the fact that most cases identified were leaded by an economist commissioner, showing some possible resistance or least intention of appreciation of this sort of models by non-economist decision makers[66]; (2) the revision of the parties' evidence as the reason for CADE's production of the models; (3) the role of DEE's production of evidence and its alignment with the authority's final decision, working as a *Court-appointed expert*.

Both approaches (technical and institutional) helped us to design the proper questions to the Brazilian experience. We were favored by a relatively transparent production of evidence, as there are available public versions of the studies applied by the authority for most of the recent cases. The same is true for the transparency and access to cases' decisions.

We conclude, from the Brazilian experience, that the number of cases in which some method was employed by CADE can be considered low (18 mergers), since 2002. However, this is less true when considered solely the cases blocked by the authority, as in 33% of the blocked cases in the period (2002-2018 April), CADE applied some kind of the studied quantitative methods. As expected, the methods are generally applied to the more complex cases.

Considering the technical aspects, we noticed some important peculiarities: CADE usually employs a combination of different and technically alternative models (which may have different assumptions about the competitive model - Cournot and Bertrand-, or coordinated and unilateral effects). This strategy may be adopted as a form of sensibility test, to check whether the interpretation changes too much with a different choice of model, although it is important to remark that it does not exempt from the necessity of evaluating the credibility of the results. Still about the choice of model, we identified less interest in natural experiments analyses, even considering their advantages especially when the authority is not so sure about the most adequate competitive model to use or when Bertrand and Cournot do not account for the most relevant competitive attributes of the relevant market. Finally, all sorts of models have been used to evaluate a merger's effect on price, and usually later in the analysis, mainly. Also, UPP test, despite its simplicity and strong hypotheses, has not been applied as a screen filter in most of cases.

This led us to important connections regarding the institutional debate we explored in section 3. The authority seems concerned about sensibility analysis in most of the cases (in special with regard to the adoption of estimates – elasticities, cost reductions, etc.), although *fit the past* tests are not commonly adopted, as far as we could see by the public versions of the studies and decisions. As argued, this is an

[66] However, it is important to mention that the model may be introduced during the General-Superintendence investigation, as it was in some of the cases examined.

important step considering the precision and accuracy that is required of models that attempt to give estimates of the final effect of the merger (especially when they are not being used as screens).

In addition, the paper investigated the models' influence upon the authority's decision and their alignment with the authority's understanding. From what we could see, in general, the conclusions of the models are coherent with CADE's final decision. Although such alignment should be expected, considering that we are looking solely into CADE's production of evidence, it is important to notice that the possible battles of experts or internal differences about the validity of the applied models did not cause a reduction in their admissibility within the authority. Another conclusion is that this sort of tools is employed by the authority based on the understanding that it should be complementary to qualitative evidence produced during the investigation and never substitutive.

To conclude, further and necessary development must be made in the case list to include all models and pieces of evidence produced by the parties - and not only the ones produced by the authority. Despite being an imperative for a complete evaluation of the Brazilian experience, this is a hard task, as CADE's jurisprudence cannot be searched by terms and the cases are not identifiable. Another issue that may be investigated in further developments of this paper is the influence of the models' results upon the design of remedies in the authority's final decision (e.g. choice of relevant markets, types and size of remedies, assets to be divested).

Appendix I

Table 2 - Case List

Submission/ Decision Year	Case Number	Parties	Relevant Markets
2003-2005	AC 8012.007603/2003-66	AGCO/ Kone	Three types of market according to the power of tractors. Geographic market is national.
2007-2009	AC 08012.001383/2007-91	Recofarma/ Leão	Relevant markets in iced tea and matte (type of cold tea popular in Brazil). Two geographic markets: one national and one limited to Rio de Janeiro.
2009-2011	AC 08012.004423/2009-18	Sadia/ Perdigão	Several relevant markets (25 in total) in meat (in natura, processed), frozen food, among others. Geographic market is national.
2012-2013	AC 08012.006043/2012-13	Raia Drogasil/ Santa Marta e King	Resale of medicines and resale of hygiene and beauty products. Geographic is pulverized.
2013-2014	AC 08700.009924/2013-19	Videolar/ Innova	Two markets: styrene monomer (international); and polystyrene (national).
2014-2016	AC 08700.009988/2014-09	Tigre S.A. - Tubos e Conexões/ Condor Pincéis Ltda.	Several types of brushes, paint rollers and accessories. Geographic market is national.
2014-2015	AC 08700.009732/2014-93	Vivo/ GVT	Long distance telecommunications (national market) and local distance telecommunications (municipal market); transport and distribution; infrastructure; and mobile termination.
2014-2015	AC 08700.004185/2014-50	Continental Aktiengesel Ischaft/ Veyance Technologies, Inc.	Relevant markets of different varieties of pneumatic springs, conveyor belts, transmission belts, automotive hoses and industrial hoses. In all cases, except one (in which the relevant market is Brazil and Mexico), the geographic market is national.
2014-2015	AC 08700.009711/2014-78	Capsugel/ Genix	Hard capsules (for medicines).
2014-2015	AC 08700.010224/2014-58	Dow Chemical Company/ Univation Technologies	Markets HDPE, LLDPE, technological market for production of resins and catalysts.
2014-2015	AC 09700.000436/2014-27	Braskem/ Solvay	PVC Suspension, PVC Emulsion. Geographic market is South America.
2015-2016	AC 08700.010790/2015-41	Bradesco/ HSBC	Several banking and financial services.
2015-2016	AC 08700.006723/2015-21	TV SBT/ Record/ Rede TV	Open access to cable TV.
2016-2016	AC 08700.003462/2016-79	Reckitt Benckiser (Brasil) Ltda. e Hypermarcas S.A.	Masculine preservative and lubricant.
2016-2017	AC 08700.006444/2016-49	Ipiranga S.A./ Alesat Combustíveis S.A.	Fuel distribution.
2016-2017	AC 08700.006185/2016-56	Kroton/ Estácio	Several undergraduate courses (divided into classroom-based distance learning).
2017-2018	AC 08700.002155/2017-51	Companhia Ultragaz S.A./ Liquigás Distribuidora S.A.	Liquefied Petroleum Gas distribution.
2017-2018	AC 08700.002165/2017-97	ArcelorMittal/ Votorantim	Several relevant markets in Common Long Steel.

Source: own elaboration based on data available at: http://www.cade.gov.br/

Appendix II

Figure 3 - List of merger cases and correspondent types of quantitative methods in Brazil (2003-2018)

<Insert Figure 3>

Source: own elaboration based on data available at: http://www.cade.gov.br/