Reference guide on ex-post evaluation of competition agencies' enforcement decisions

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Governments everywhere are increasingly interested in assessing the effects of their policies and the effectiveness of public institutions, and competition agencies are no exception.

This Reference Guide contains an in-depth overview of all the issues linked to ex-post assessments and contains numerous examples and references. It constitutes an excellent resource both for the competition authorities who are planning to start performing ex-post evaluations and for those who already do it but want to improve the quality of their assessment.

The Reference Guide complements a *Guide for assessing the impact of competition authorities' activities* (2014) and a *Factsheet on how competition policy affects macro-economic outcomes* (2014).

Find information relating to this work on the OECD website at http://oe.cd/J3

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Introduction

The enforcement challenge faced by competition agencies is enormous. With limited information and time competition agencies must evaluate the likely competitive impact of often unprecedented changes in how markets operate. Horizontal merger analysis, for example, is necessarily forward-looking. Agencies, by statute, must make predictions about how a proposed merger will affect competition. Competition agencies combine the best information available at the time of the transaction with methodologies that have been developed over time to predict how mergers will affect competition. Periodic ex post analysis of enforcement decisions are one tool that can help agencies improve future decision making.

An ex-post evaluation is an examination of an enforcement decision that tries to determine the effects that the decision has had in the market sometime after the decision has been issued. Many evaluations focus on the effect caused on the prices of the goods and services traded on the market affected by the decision, but in some cases they also look at changes in other variables, such as quality, variety, innovation, and entry. Some evaluations rely on econometric techniques to quantify the sign and magnitude of the changes, others rely on qualitative methods and only try to determine the direction of these changes. In both cases the evaluations tries to ascertain if there is a link of causality between these changes and the enforcement decision.

The number of studies of this kind has grown considerably in the last decade. More authorities are undertaking them (or want to do so, depending on available resources), and a few have already performed many. Academics are also getting increasingly involved in this area of work. Discussions with numerous authorities have shown the need to take stock of the existing experience in the field and to organise it in a manner that would make it easily accessible. With this Guide the OECD aims to achieve this by providing an introduction to the topic and a source of extensive references to the work done so far in this area.

Why is there so much interest in ex-post evaluations of competition enforcement decisions?

First and foremost, an increasing number of competition authorities is interested in the impact their activities have on markets and on consumers, both to justify their work and their budget to stakeholders and to improve their internal investigative and decision making process. This is a general trend that is influencing institutions across the public policy spectrum, not just in the area of competition enforcement, in many OECD countries.

Indeed ex-post evaluations can help to determine if an intervention (or non-intervention) has achieved its objectives and, if not, the reasons it failed to do so. This help to better design future interventions. Such an assessment may cover the whole decision (e.g. was it appropriate to clear a specific merger or should it have been blocked?), or it may focus only on some elements of it, such as the effectiveness of the remedies imposed or the actual validity of anticipated market developments.

Further, the results of these assessments can help authorities to test the validity and the precision of the quantitative predictive techniques used in the analysis underpinning the decision

and to improve their design and use. They also help verify the soundness of the economic theories on which the decisions are based, thus contributing to the growth and improvement of this discipline.

Published assessments also provide greater transparency about the work undertaken by competition authorities, and allow the beneficial impacts of competition interventions (and non-interventions) to be communicated.

Finally, ex-post evaluations can help to gain a better understanding of the likely effects of competition enforcement interventions in specific sectors that are important for the economy of a given jurisdiction, or in which an authority is especially active.

Because of all these benefits, ex-post evaluation has become an area of interest for competition agencies and this Guide aims to provide them with an introduction to the challenges this type of analysis poses and to the options available to address them.

The OECD Reference Guide

This is not a step-by-step guide on how to perform an ex-post evaluation, and it does not suggest a specific approach on how to undertake one: there are too many methodological options and each agency has to choose the approach that best fits its needs and capabilities. This Guide discusses the benefits that can be derived from evaluations, as well as the main practical issues that competition authorities should consider when they decide to perform them, including an overview of the methodologies that can be used. It should be of use both to experienced authorities, which may want to further improve their work, and to authorities that are just getting started and need a general introduction.

The Guide is divided into two parts. Part I discusses why retrospective studies of enforcement decisions are undertaken and presents in details the benefits that can accrue from them, with some examples from the experience of the authorities most active in this area. Part II outlines the steps involved in an ex-post evaluation and what each one requires. It highlights the main challenges authorities are faced with and examine some the options available to address them through practical examples and references to the existing literature.

The Guide also includes three Annexes and a bibliography.

- Annex A analyses a specific subset of ex-post evaluations of enforcement decisions: the studies that assess the effectiveness of merger remedies.
- Annex B provides an overview of the methodologies that have been most frequently used in the literature to perform ex-post evaluations.
- Annex C includes an extensive, though totally non-exhaustive, list of ex-post studies done by authorities and academics. The results gathered have been classified according to: i) the type of publication studied (peer reviewed journal or other); ii) the type of decision assessed; iii) the sector; iv) the methodology employed, and v) the variables studied. Annex C is meant as a tool that researchers can use to identify those studies that could best satisfy their interest and provide them with ideas and suggestions for their own work.

Part I: What are ex-post evaluations of enforcement decisions and why they are undertaken

This part of the Guide discusses what ex-post evaluations of enforcement decisions are and why they are undertaken. By enforcement decisions we mean antitrust and merger control decisions. Hence this Guide will not discuss the evaluation of other types of activities undertaken by competition agencies, such as market studies and sectoral enquiries. [1]

1. What is an ex-post evaluation?

An ex-post evaluation of an enforcement decision is an examination that tries to determine the impact that the decision has effectively had in the market. Hence, such an evaluation is done sometime after the decision has been issued to benefit from the availability of information on how the affected market has evolved.

Many evaluations focus on the effect caused on the prices of the goods and services traded on the market affected by the decision, but in some cases they also look at changes in other variables, such as quality, variety, innovation, and entry. Some evaluations rely on econometric techniques to quantify the sign and magnitude of the changes, other rely on qualitative methods and only try to determine the direction of these changes. In both cases the evaluations tries to ascertain if there is a link of causality between these changes and the enforcement decision, whether it was an intervention or non-intervention. However, usually they only estimate the direct effect of competition interventions or non-interventions, (e.g. in terms of their impact on prices, innovation, variety), while they do not account for indirect effects, such as the avoided harm from deterred anticompetitive behaviours and mergers, or the impact of such decisions on macroeconomic variables (such as growth, productivity or employment)[2].

There are also evaluations that try to determine what has been the impact of enforcement decisions, but that do not rely on information on how markets have actually evolved as a result of these decisions. These evaluations employ information available at the time of the decisions, or immediately after, to predict how markets will evolve. These are not considered to be ex-post evaluations for the purpose of this Guide, because they lack the ex-post element: they do not wait until the effects of the decisions start to manifest themselves to assess them, but try to forecast them. An example of this approach are those studies that use stock market reactions to the

[1] This Guide does not discuss the evaluation of state aid, since state aid rules only exist in the European Union (EU). However, it is worth mentioning that the EU has developed a framework for the ex-post evaluation of state aid. Following the State Aid Modernisation in 2014, EU Member States enjoy a wider margin to design and implement aid measures. In return, the European Commission may require Member States to conduct independent evaluations of large state aid schemes in order to identify their actual impact. At the outset of a scheme's implementation, the Commission reviews and approves such evaluation plans to ensure high quality standards. More details can be found at: http://ec.europa.eu/competition/publications/cpb/2014/007_en.pdf

[2] The indirect effects of competition policy interventions cannot easily be calculated, and, in particular, so far there is no well-established methodology to assess the amount of deterrence specific decisions manage to generate. The Dutch and UK competition authorities and the European Commission jointly organised a conference on the topic of assessing the indirect and macroeconomic effects of competition policy interventions, in September 2015. More information on this initiative can be found at : http://ec.europa.eu/competition/information/macroeconomy/index.html.

announcement of enforcement decisions to determine how the decisions are expected to influence firms' profitability and then from this derive conclusions on the likely changes in the affected markets[3].

This Guide will mostly focus on ex-post evaluations as defined above, but will also briefly cover evaluations of enforcement decisions that do not rely on ex-post information on how markets have effectively evolved. The Guide will not address the ex-post evaluation of other types of interventions made by competition authorities (CAs), such as market studies and sector inquiries.

Box 1. The terminology used in this Guide

This Guide is addressed to a variety of jurisdictions, which may have different competition systems and may employ different terms to refer to similar competition law procedures and violations. Since a choice had to be made on the terminology, this Guide tends to adopt a terminology that is mostly used in Europe. Nevertheless, its content is meant to apply to all jurisdictions that have a competition law. This means that, for example, any reference to abuses of dominance also applies to monopolization cases.

This problem is especially acute with respect to merger review decisions, for which it has been impossible to adopt a terminology that fitted both with administrative and judicial merger review systems. Again the terms herein used refer to an administrative system, hence:

- a decision by a CA to clear a merger would be equivalent, in a court based system, to the case in which the authority decides not to challenge a merger or the court rejects the CA's request to block it;
- a decision by a CA to block a merger would be equivalent, in a court based system, to the case in which the court supports an authority's request to block a merger;
- a decision by a CA to clear a merger with remedies would be equivalent, in a court based system, to the agreement between the parties and the authority to modify a merger so that the transaction will not be challenged, or to the court's decision to permit the merger provided the parties make some changes to it.

2. Why are ex-post evaluations of enforcement decisions undertaken?

Before discussing why ex-post evaluations of enforcement decisions are undertaken, it is worth considering, more in general, why ex-post evaluations of public policies are, and should be, undertaken.

Ex-post evaluations can help determine if a policy intervention has reached the objectives it was aimed to achieve and, if not, for what reasons. This in turn can provide useful lessons for the better design of future interventions. These assessments also provide greater transparency about the work undertaken by policy institutions, and allow successes to be measured and communicated.

The OECD advocates, as appropriate, ex-post evaluation of policy interventions as a means to improve their quality. And the OECD has worked extensively to provide guidance to governments on how to perform evaluations of regulatory policies, and on how to ensure that ex-post evaluations become embedded in the process of designing and implementing these policies.[4]

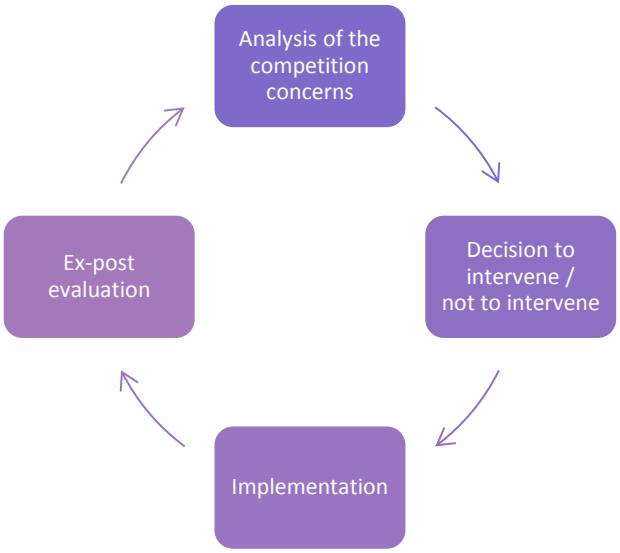
[3] The methodology that relies on stock market reactions to determine the impact of a specific event, such as a CA's enforcement decision, is usually referred to as the event study methodology.

[4] In 2014 the OECD has released a framework for regulatory policy evaluation http://www.oecd.org/gov/regulatory-policy/framework-for-regulatory-policy-evaluation.htm.

Competition enforcement decisions, as all other policy interventions, could benefit from such ex-post reviews[5]. When ex-post evaluations offer reliable results, these assessments can help authorities to improve their decision making process, to test the effectiveness of tools and economic theories they employ in their analyses, to verify the validity of the assumptions on which they base their decisions, to improve the design and implementation of remedies, to increase their knowledge on the likely effects of interventions in specific markets, and to gather useful evidence on the actual impact of specific cases. Further, ex-post evaluations, when published, can increase CAs' accountability by making the outcome of interventions and non-interventions more transparent, and by showing the benefits of their enforcement activity.

Figure 1 below shows how ex-post evaluation would fit in the decision-making process of a CA.

Figure 1. The role of ex-post evaluation in the decision making process of a CA



Below we discuss the benefits of ex-post evaluation in more details[6].

2.1 Improve decision making by learning from past experiences

As highlighted by Kovacic (2001, 2006), enforcement decisions are taken in conditions of uncertainty based on best available information and, hence, involve a substantial experimental element. This feature calls for their evaluation to determine which forecasts, assumptions and hypotheses proved to be true and which did not. Under this general framework, the specific objectives that ex-post evaluations try to achieve can be various and often overlapping.

2.1.1 Determining if the decision was the appropriate one

An ex-post evaluation can be used to determine if a specific decision had been the appropriate one to take, compared with the possible alternative decisions the CA could have made.

5 See Ormosi (2015) and Ormosi and Duso (2015).

6 The recent review of ex-post evaluation literature published by the European Commission (EU, 2015) compares in a very clear manner the objectives and scope (as well as other elements) of the ex-post evaluation activities undertaken by the CAs of four major jurisdictions (EU, UK, US and Netherlands). See in particular table I7 p. 47. Please note that the definition of ex-post evaluation adopted in DG Comp study is wider than the one adopted in this Guide.

In order to determine if a decision was the appropriate one, it is necessary to refer to the goal that the CA pursues when applying the competition law. This goal defines the variables that are relevant for evaluating the effects of the decision. If the goal of the CA is to protect consumer welfare, a decision is appropriate if it has not reduced consumer welfare compared to the most likely counterfactual scenarios - i.e. to the most likely alternative decisions that could have been taken[7]. But, since assessing welfare changes can be very difficult, usually ex-post evaluations focus on some of the variables that determine the level of welfare (usually prices) and try to assess how these have changed relative to the counterfactuals. Then, from these results, the evaluations try to reach an overall conclusion on the appropriateness of the decisions.

Useful lessons can be drawn both from evaluations that show that a decision was appropriate, as well as from evaluations that show that a decision was not the most appropriate one. The issue of the lessons that can be learnt from ex-post evaluations is further discussed in section 9 of part II below.

2.1.2 Testing key assumptions and expectations

Ex-post assessments can also be employed to test if key assumptions about market characteristics and developments used in reaching enforcement decisions are well-founded. This permits to identify pitfalls, limitations, sometimes even errors, in the analysis that underpinned the decisions and to improve the CAs' future decision-making process.

For example, the UK CA (CC 2009) reviewed 8 merger decisions and concluded that it could improve its ex-ante analysis of proposed mergers by better assessing the extent of barriers to entry and expansions in the affected markets, as these had been too often overstated.

Some decisions indeed hinge on a few factors, such as whether entry is possible, and checking whether the predictions were validated by market developments following the decision can yield interesting lessons. Box 2 below shows an example of an approach developed by the New Zealand Commerce Commission that relies on testing key hypotheses and predictions.

Box 2. Testing the validity of specific expectations: the New Zealand Commerce Commission's approach

The CA in New Zealand has recently decided not to undertake full ex-post evaluations of individual decisions, but rather to examine whether anticipated market developments that were key to a number of its decisions did take place as predicted or not. The purpose is to refine and improve the techniques and types of evidence used in forming those expectations.

The authority has selected all merger decisions in which mergers were cleared primarily because strong expectations were formed around one or more of four clear-cut issues:

1. barriers to entry in the market were low and entry was likely, or
2. there would have been enough effective competition in the market after the merger, or
3. divestiture would satisfy competition concerns; or
4. buyers had countervailing power as they could sponsor entry.

The decisions had all been taken over a period panning between two and five years before, in order to allow sufficient time for market changing developments to take place, but not so far in the past to make the information collection exercise and the assessment too difficult.

The authority has then tested whether these hypotheses/expectations have proven correct, relying on publicly available information on how the affected market(s) had developed and on interviews to market participants.

[7] Competition agencies can also have other goals, for example they may try to maximise social welfare rather than consumer welfare.

This study led to a number of conclusions related to the importance of exchange rates when assessing the likelihood of imports as a competitive constraint, the possibility of exits when markets are very concentrated (e.g. duopolies), the role of sunk costs in entry decisions and the factors that may affect the decision to enter the NZ market by multinational companies.

The study, hence, has not tried to determine whether the decisions were appropriate, but rather to test the validity of the main expectations about the evolution of the market that had led to the merger clearances. The authority considers this to be easier to achieve, in terms of time, data availability and resources, and to lead to more reliable results than a full evaluation of the appropriateness of the decisions.

This exercise has so far been done once, but the authority plans to repeat it regularly and, possibly, to include other hypotheses/expected market developments as well.

2.1.3 Improving analytical tools and economic theories

A more specific aim of ex-post evaluations can be to test the validity and the precision of specific quantitative techniques employed to determine the likely impact of the decisions in the ex-ante assessment, and to improve their design and use. Ashenfelter et al (2009) argue for the regular ex-post analyses of past mergers to evaluate the techniques used to predict price effects.

By measuring the actual effects of decisions it is possible to determine if these had been correctly forecast, given the information available at the time when the decision was taken, and how the use of these predictive techniques could be improved[8]. For example, Hosken (2011) discusses how recent research on the price effects of mergers in the US hospital sector have provided useful information on the effectiveness of a tool often used in the analysis of this kind of mergers to define market boundaries: the Elzinga-Hogarty test[9] (see also **Box 11** below).

Further, competition economics is an evolving discipline and the analysis of past enforcement decisions can provide a contribution to its growth and improvement. Ex-post studies can provide a good opportunity to test the predictive value of specific economic theories and to draw useful conclusions that can be used to inform future interventions (as well as to direct academic research). Lafontaine and Slade (2008) provide an interesting review of ex-post studies that try to determine the actual effects of competition policies towards vertical agreements between upstream firms and downstream retailers in order to test the validity of the predictions of the existing economic models.

2.1.4 Better understanding competition enforcement in specific sectors

Ex-post studies can also be performed to gather knowledge on how best to address competition concerns in a specific sector where the CA is especially active or that it is considered to be important for the economy. This is achieved by performing several evaluations in the same industry.

8 All judgements on the validity of the analysis have to consider what the CA could have done at the time given the information that was available at the time. Hence, if information on subsequent market changes was not available when the decision was taken, this should be accounted for in the ex-post evaluation.

9 For a definition of the Elzinga-Hogarty (E-H) test see Ashenfelter et al. (2011): "The goal of E–H analysis is to identify a region in which firms compete that is sufficiently isolated from other regions, such that consumers do not enter or leave the region to consume the service being analysed. In hospital markets, "sufficiently isolated" is defined by analysing the patient in- and outflows from a given geographic area. The analysis begins with a proposed candidate geographic market (usually the "primary service area" of one or both hospitals). The E–H approach then measures in- and out-migration of patients from that candidate market. A region is defined as a market if: (1) most consumers living within the region consume the service in their region, and (2) relatively few consumers who live outside of the market enter the market to consume the service." See also Elzinga and Hogarty (1973).

This approach has been followed by the US FTC and has held some very useful and important results that have helped the agency to better design future interventions (See Box 11 below).

Amelia Fletcher during a 2014 OECD discussion on ex-post evaluation has insisted on the potential of such a sector-focused approach, which can help agencies to better understand and operate in important sectors of the economy or in industries subject to intense merger or cartel activity.

2.1.5 Gathering useful evidence on the actual impact of specific cases

Ex-post evaluations can also provide evidence on the actual impact of specific decisions that can be valuable to agencies in determining future priorities, as it helps to better identify which cases are likely to have a higher impact on markets and on consumers. This evidence can also help to calculate fines, when these are meant to reflect the harm caused, and to determine the damages (especially in cartel cases).

2.1.6 Enhancing the design and implementation of remedies

Some ex-post studies are designed not to assess a decision in its entirety, rather they consider only some elements of it. This is the case of the ex-post evaluations of the effectiveness of merger remedies, whose sole aim is to review the design and implementation of structural and behavioural remedies in order to identify those factors that tend to improve the effectiveness of remedies and those that tend to compromise it. Annex A provides further details about this type of ex-post studies.

2.1.7 Meta-analyses of collections of ex-post evaluations

These studies rely on the analysis, often through simple statistical comparisons, of the results of a large number of ex-post assessments to derive some general conclusions and lessons.

Box 3 below describes a recent example of this approach.[10]

Box 3. A review of merger decisions in the EU: What can we learn from ex-post evaluations? (Ormosi 2015)

DG COMP commissioned a team of academics (lead by Peter Ormosi) to review all existing ex-post evaluations of merger decisions taken by EU competition authorities. The report presenting the outcome of this work contains some interesting conclusions[11]:

- "On average, mergers in the sample were followed by a price increase that remained under 5 percent in the large majority of cases. The average price increase in unconditionally approved merger was just under 5 percent and in remedied mergers between 1 and 2 percent. A similar study by John Kwoka[12] on US merger decisions found that unconditionally approved mergers were followed by a price increase of 7% on average. However, contrary to the study for the EU, the Kwoka study found that in the US remedies had been largely ineffective in preventing price increases. [..]
- Market concentration is a strong driver of the estimated price effect of a merger. The average price increase is around zero in non-concentrated markets and between 10% and 20% in concentrated markets, although the remedies managed to mitigate the post-merger price hike even in concentrated markets. [..]

10 For more examples of this type of studies refer to Carlton (2009), Duso (2011), and Kwoka (2013).

11 Tough the author warns that, given the limited sample 27 price-estimating studies and 50 studies assessing non-price effects, these findings should be treated with some caution.

12 Kwoka (2013).

- An estimate that shows increased post-merger prices does not necessarily mean that the competition authority has made an error. Other reasons for the price increase might be that (i) non-price effects dominated price effects; (ii) the decision was based on faulty facts; or (iii) the post-merger price increase could be considered as a random variation in price at the time of the authority's decision. [..]

- Looking at how market structure changed post-merger may provide useful information for assessing the competition authority's decision. Developments in the joint market share of the merging firms, the level of rivalry, the level of concentration, and the size of the market are all informative for this purpose. We found that there is a non-trivial number of cases where the merger was followed by higher concentration, less rivalry, or larger market power of the merging firms. Time also seems to play an important role: studies that are conducted more than 5 years after the merger were less likely to find similar concerns. [..]

- Very few studies looked at how dynamic effects develop post-merger. This is somewhat surprising because these dynamic effects are typically the most debated part of merger decisions, and therefore it would be useful to improve our knowledge on how these effects unfold after the merger. Most of what we know is on market entry, in which case the sample of studies suggests that in general CAs do a good job in predicting where entry can potentially eliminate short-term competition concerns in the market."[13]

2.2 *Increasing accountability and advocating the role of competition authorities*

Ex-post evaluations can also be undertaken to provide transparency about a CA's work and to increase awareness about the benefits of a CA's enforcement activity: showing the positive impact of a CA's decisions on consumer welfare can help to support its role and its work.

However, as highlighted by Budzinsky (2011), there is a risk that ex-post evaluations could become a means to count the "mistakes and successes" of a CA. This could be damaging for the image of the CA and could influence the government's attitude towards the CA, and may lead to a reduction in the authority's budget or legal powers. In turn this may provide distorted incentives to the CA, whose response could be to perform only those evaluations that show a success, committing resources to an exercise that does not generate any real benefit. Similarly Neven and Zenger (2008, p. 480) argue that "internal control should be the focus of evaluation", because of the risk of distorted behavioural responses when ex-post evaluation results are used to show an authority's successes[14].

On the other hand one should consider, as does Kovacic (2001, p. 11), that, even though "candid self-assessment and internal discussion might elicit improvements", an evaluation system "is likely to be more informative if it engages outsiders and includes the disclosures, at least in some form, of the results".[15]

Both sets of arguments have their validity, but one should separate the need for accountability and transparency in the assessments, from the desire to advocate the positive role of an authority's work. The objective of any ex-post evaluation exercise should primarily be to improve the decision-making process of the authority, and CAs should be careful not to jeopardise this in order to avoid

13 Ormosi (2015) pages i to v.

14 However, there is also a risk in using ex-post evaluations for internal control because of the difficulty to measure the deterrent effect of competition policy decisions. This difficulty may lead the CA to disregard those infringements whose the direct effects on consumer welfare are low, even though some of these may be important because of their "indirect" deterrent effect.

15 This comment refers to both accountability and impartiality. Impartiality should always be guaranteed, or the outcomes of the evaluations would not be reliable. This could be done by involving external members in the evaluation team or by having the studies reviewed by experts, without having necessarily to publish the results of the study.

criticisms and boost the public's perception of their role. But, as will be discussed extensively in Part II[16], performing some form of peer-review can help to ensure the quality and reliability of the results of an ex-post evaluation; reaching this goal may be more complicated if the results are only kept within the organisation[17].

Transparency and accountability are a more complex matter. Exposing the results of the work of an authority that uses public funds and permitting their scrutiny is, in general, considered to be a good approach to policy making[18]. In addition, it allows the agency to share not just the outcome of the evaluation but also the analysis that led to it to an external review, which can help to further test their validity and reliability. Further, sharing the outcome of ex-post studies with other agencies and the academic community can contribute to the creation of a body of knowledge in this field and to the improvement of tools and techniques, as well as to a critical assessment of the outcomes of the study. Publishing the results of ex-post studies can also have advantages in terms of generating pressure for implementing the lessons learnt in them and, thus, lead to positive changes in decision-making.[19]

It should also be borne in mind that, as pointed out by Werden (2015) and Ormosi (2015)[20] not all the ex-post studies that obtain "unwelcome results" (e.g. a price increase after a merger clearance) are necessarily showing that the authority committed an error. "Unwelcome results" may be due to actual mistakes in the analysis, in the use of the predictive tools and/or in the assessment of the information collected, but they could also be due to other factors over which CAs have no real control. For example the information on which the analysis was based could have been incorrect or false, e.g. answers to information requests were untruthful or provided a distorted or partial view of the market. It is also possible that the unwelcome result, e.g. a price increase, is outweigh by other positive outcomes that cannot be quantified, e.g. an increase in quality or variety of the products. Further, unwelcome results may be due to random errors, as discussed in **Box 4** below.[21]

16 See also the paper prepared by Duso and Ormosi for the OECD (Duso and Ormosi, 2015)

17 Nevertheless, even if the competition authority decides not to publish a specific ex-post evaluation it can still retain an academic to perform a review that ensures the quality and reliability of the results. Confidentiality can be guaranteed through a specific agreement.

18 Many CAs pursue this advocacy purpose also by performing assessments of the overall impact of their decisions. This exercise is very different form an ex-post evaluation, even if it may share the same aim. An ex-post evaluation involves the assessment of the actual effects of an individual decision and is performed some years after a decision has been taken. An impact assessment, instead, provides an estimate of the likely effects of all decisions taken by the authority over a given period of time and is conducted soon after these decisions are taken. Usually impact assessments are performed with regularity (e.g. every year). The OECD Guide for helping competition authorities assess the expected impact of their activities (2014) suggests an approach that authorities could employ when carrying out an impact assessment of their activities. The Guide is available at http://www.oecd.org/daf/competition/guide-impact-assessment-competition-activities.htm

19 The protection of business secrets might preclude, however, the publication of the underlying data used to come to those results and therefore limit the possibility to replicate the analysis.

20 Ormosi (2015) provides an interesting and detailed discussion of sources of potential errors made by CAs when reaching their decisions and why these are not always real errors.

21 See Ormosi (2015) for a detailed discussion of the sources of potential errors.

Box 4. Ex-ante decisions are inevitably probabilistic

Damien Neven pointed out during a presentation on ex-post evaluation held at the OECD in December 2014 that all ex-ante enforcement decisions are inevitably probabilistic. No decision can be 100% sure, as it is based on hypotheses and predictions on how the market will evolve. Usually a given decision will be taken because the CA believes that it will have a probability of being correct higher than 50% (the higher the probability the more reliable the decision).

Hence, a decision may turn to be inappropriate merely because of an unfavourable realisation of the probability distribution. This result should thus be interpreted with reference to the degree of confidence in the initial decision and not just be considered as an outright error. There is indeed a difference if the decision-maker originally considered that the probability of the decision proving inappropriate was 49% or 10%. Such a concept may be difficult communicate to lawyers and judges, who are not familiar with statistics, but Neven argues that it is a very important factor to bear in mind when assessing the results of an ex-post evaluation.

To the best of our knowledge, the agencies that have been most active so far in undertaking ex-post studies, the US, the UK, and the Netherlands, have published all of their studies. And not all the results have always been favourable to the agencies. For example the assessment of 6 hospital mergers by the Dutch CA, has reached some negative conclusion – i.e. that some of the cleared mergers had actually generated a non-trivial price increase. [22] The agency, however, did not suffer as a result of the publication of the study. Similarly the UK CA, in its assessment of the decision it reached on the Shell/Rontec merger, concluded that its intervention had been effective in countervailing any petrol price increases that the merger could have caused, but not to prevent a rise in diesel prices. [23] These conclusions, which were made public, did not have any negative impact on the agency.

Nevertheless, this evidence is still too limited to permit to reach a firm conclusion on the lack of reputational and legal risks arising from being transparent, but it provides interesting evidence.

Overall, so far, one can only conclude that the choice whether or not to publish an ex-post evaluation should be made by each authority on a case-by-case basis, but in making such a choice CAs should seriously reflect on all the advantages – listed above – that can be derived by sharing the results of their ex-post assessments.

It is also important to be aware that if the ex-post evaluations are based on information collected from market players the option of not making public the results of analyses based on that data is very constrained. In many countries Freedom of Information legislation gives the firms to whom information was requested the right to ask for access to it. Whereas if the ex-post study is based on information that is publicly available or has been purchased, an authority has complete control over the decision of whether to disclose the outcome or keep it only for internal use.

2.3 The benefits of regular ex-post evaluations

As this Guide illustrates, there are many ways in which it is possible to learn from performing ex-post studies. Agencies should evaluate the options and decide which one best fits their needs and abilities.

A single or a few occasional ex-post analyses can provide the CA with valuable information, but the ability to generalize findings from a small number of case studies is limited. Instead, some regularity in ex post reviews of decisions might reveal more useful findings and allow a CA to

22 Kemp, R. G., Kersten, N., & Severijnen, A. M. (2012).

23 OFT (2014).

observe patterns that can more generally aid its future decision-making. This does not imply that a CA has to perform a specific (minimum) number of studies every year, what matters is to be aware that occasional studies do not yield very useful outcomes in terms of improving decision-making. Patterns, which can provide suggestions in future decision making, can be more easily identified for example by conducting a series of studies on the same type of decision (e.g. mergers, abuse of dominance) or on a specific problematic sector. Each authority should explore and determine what kind of evaluation program would better fit their needs and resources.

Just to provide two examples:

- As part of its Performance Framework, the UK CMA, and previously the UK OFT, are committed to performing the evaluation of two enforcement decisions and/or market studies every year[24]; while

- the US FTC has performed numerous studies, mostly concentrated in two sectors - hospitals and car fuel – from which they have derived some useful lessons (see **Box 11** below) but they have no regular annual commitment.

When conducting ex-post assessments, a CA should aim to have some clear objectives and a commitment to respect them. The CA should also have a strategy on how to disseminate the lessons learnt, so that these can be incorporated into the decision-making process (as in **Figure 1** above).

Building ex-post assessment into the standard work of an authority can also benefit these assessments. For example, decisions can be identified as candidates for ex-post review at the time when they are issued. This allows the case team to clearly signpost the key assumptions, the most relevant evidence and the most important analyses, as well as the most controversial issues (when it is legally possible to access the files of a case for a subsequent evaluation). In jurisdictions with the requisite authority, the CA could monitor the market and collect data on how major variables are evolving following a decision. All this can provide very useful guidance and support to the team that later on will perform the ex-post review and can save them considerable time[25].

Box 5. Seed- planting

At a 2011 OECD roundtable on Merger Retrospectives Prof. Andrew Gavil suggested that:

"One technique that may be relevant for any jurisdiction is identifying candidates for retrospective review at the time of initial review – and planting some seeds for future observation. Candidates for future reflection are not all that difficult to identify. The most obvious candidates will be transactions that are permitted on condition – by definition, these are "close call" cases. And the conditions reflect very specific assumptions about what will and will not solve the competitive problems likely to arise from the merger.[26]

24 The UK CC instead had in place a rolling programme of evaluation focusing mainly on merger remedies and decision making often undertaken jointly with the OFT. The CMA is planning to continue this work but not as part of a formal agreement with the Government.

25 This may not be possible in all competition regimes. In some jurisdictions it is not possible to use information from the case files for subsequent evaluations, or the CA may not have authority for ongoing data collection unrelated to an open investigation.

26 See paper by Andrew Gavil in OECD (2011a) p. 168.

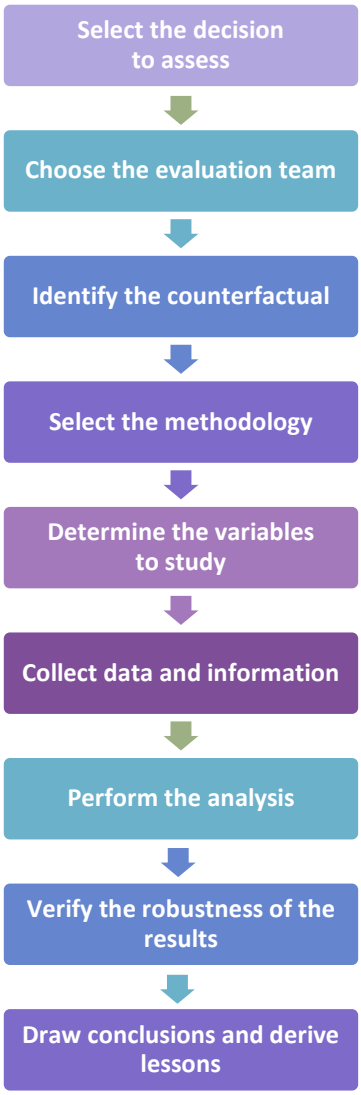
Part II: How to perform the ex-post evaluation of an enforcement decision

This part of the Guide briefly outlines what the design and execution of an ex-post evaluation involves, with the aim to provide CAs with a general idea of the issues that they have to deal with when they embark in such an exercise.

The key steps of an ex-post evaluation

The core part of an ex-post evaluation of an enforcement decision is the identification of the effects of the decision on the market and their comparison with the effects that would have arisen in the counterfactual scenario (or scenarios). A number of steps have to be taken to perform this assessment. Figure 2 below outlines them.

Figure 2. Outline of the steps involved in the assessment of the actual effects of an enforcement decision



In the following sections we briefly discuss each of these steps. The content of these sections is not meant to be the description of a methodology for performing an ex-post evaluation, but rather an outline of the key issues that a researcher should take into account and the choices she should make when designing and executing such an evaluation. Annex C contains a long list of references that should be consulted to obtain greater guidance on the issues herein discussed.

1. Select the decisions to assess

Agencies take numerous enforcement decisions every year, but they have limited human and financial resources that can be devoted to the ex-post evaluation of these decisions. Hence, they have to select which decisions to assess with the aim to maximise the benefit they can obtain from these exercises. A number of factors can be taken into account when making this choice to encourage an efficient use of the authority's resources. The most important ones can be:

- Nature of the decision;
- Availability of data;
- Learning opportunities;
- Specific interests driving the evaluation; and
- Time elapsed since the decision was made.

1.1 Nature of the decision

Some types of decisions are easier to assess than others, because the appropriate counterfactuals (i.e. the alternative decisions that could have been taken) against which to determine the effects are easier to build and the necessary data is less difficult to collect.

This implies that in selecting the decisions to assess one should be aware of the difficulties that sometimes could be faced in reconstructing the counterfactuals. Such difficulties include but are not limited to the availability of data and the data's reliability. These difficulties may in some cases limit the possibility to adopt a specific methodology, or make it impossible to adopt a specific methodology altogether.

The number of decisions of a certain type a CA has taken can also represent a constraint. Most ex-post assessments tend to focus on merger decisions, because authorities, even those in small jurisdictions, take a large number of those, whereas cases of abuses tend to be much rarer. The lower number renders the pool of decisions available for assessment very limited and reduces the interest of CAs in assessing this type of cases (Davies and Ormosi, 2012). However this does not at all imply that very useful lessons cannot be learnt also from the assessment of non-merger decisions, such as those on abuses of dominance, and horizontal and vertical agreements.

Box 6. Ex-post assessment of decisions concerning cartels

It is important to highlight that the motivation for the assessment of decisions concerning cartels is fundamentally different from the one behind the ex-post study of decisions on mergers, abuses and vertical agreements. This difference derives from the fact that in most jurisdictions cartels are prohibited per-se and, hence, the decision is by definition considered to be appropriate when there is evidence that the anti-competitive agreement existed.

As a result the ex-post assessments of cartel decisions do not examine how the affected markets have evolved following the decision and whether this has been effective in restoring competitive prices, rather they assume that the CA made the appropriate decision and focus on calculating the magnitude of the overcharge (i.e. margin above the competitive price) imposed by the cartel[27].

Hence, the ex-post assessments of cartel decisions are useful in terms of assessing the level of the damages incurred by customers and of determining if the fines imposed are effective deterrents against future violations, but these studies do not reveal anything about the effectiveness of the decision.

1.2 Availability of data and information for ex-post assessment

An ex-post evaluation involves a qualitative and, where possible, quantitative assessment of the actual effects that the decision has had on the relevant market. To perform such an assessment it is necessary to have quantitative data and qualitative information on the market at the time when the decision was made and on how the market has evolved afterwards.

Some of this data and information may be contained in the original decision and case files, but, due to legal constraints, it might not always be accessible to the reviewer. In some cases the necessary data is available from public sources, while in other cases it can be purchased, but the price for it may be high. Useful data could also be obtained from market participants, but these may not be willing to collect it and release it, unless the CA has the legal powers to force them. This reluctance may be due to a number of reasons, such as: the time involved in the collection exercise, confidentiality concerns and, in some cases, even fears about the outcome of the evaluation.

Hence, the availability of the data, as well as their quality (e.g. its completeness and level of disaggregation), varies from case to case and could limit the ability to assess a decision or to employ specific methodologies.[28][29] It is important to be aware of this and consider with care the likely availability and cost of the data before embarking into an evaluation.[30]

1.3 Learning opportunities

Since only few decisions can be evaluated, CAs should focus on those decisions that are likely to provide the greatest opportunity for learning. However, even doing so does not guarantee definitive findings.

Useful lessons can be derived from the assessment of controversial decisions, i.e. those that are on the margin between an infringement and an acquittal (for an antitrust infringement), or between a clearance and prohibition (for a merger). These are the decisions that have been the most difficult

27 However, as shown by recent studies on the evolution of markets following the sanctioning of cartels, these decisions are not always effective in restoring competition in the market and there is evidence that prices can remain close to cartel levels.

28 See Annex B for a discussion of the data requirement of existing methodologies.

29 Disaggregated data is more often available for certain sectors and markets, usually retail ones. For this reason most quantitative ex-post evaluations focus on consumer goods.

30 For a discussion of this issue see Duso and Ormosi, 2015.

to take, where the ex-ante analysis has been the most challenging, and where it has been difficult to reach an agreement on the stance to take.

Similarly the assessment of decisions in markets of high economic importance (e.g. because the market represents a high share of that jurisdiction's GDP or because it provides essential services or because the agency tends to have many cases in that sector) can provide useful insights on how to foster competition in these markets. For example the FTC has focused many of its ex-post evaluations on mergers in the petroleum and health industry, because of their relative economic importance for US consumers.

1.4 Specific interests driving the evaluation

The choice of the decision can also be driven by specific objectives a CA may have. For example, there may be a desire to better understand how effective decisions have been in a specific sector, or to verify the accurateness of a specific quantitative technique used in the ex-ante assessment of price effects. There may also be a desire to study decisions that have attracted severe criticisms by external stakeholders to determine if these criticisms were founded or to dispel them and strengthen the reputation of the CA.

1.5 Time elapsed since the decision was made

The time elapsed since a decision was taken can also influence the choice.

The passage of time ensures that the effects of the decision are stable and not just a temporary adjustment that would not last in a new equilibrium. For example, if an important assumption behind the decision to allow a merger was that new entry would soon happen, sufficient time should be allowed not just for entry to happen, but also to prove that it was successful and that a new competitor is now stably operating in the market.

If efficiencies played a role in the decision (as it can happen in merger cases), it is important to bear in mind that it can take long for these efficiencies to be exploited and transferred to the consumers. Hence, if not enough time has passed, it could be very difficult to determine if these efficiencies have actually materialised.

However, the longer the time between the decision and the assessment, the more other events – unrelated with the decision - may happen and influence market variables. This inevitably complicates the identification of the effects caused by the decision. Innovative and fast changing markets are more likely to present this problem than more mature markets.

Therefore, it is necessary to strike a balance between the time needed for the effects to manifest themselves, in particular efficiency driven effects, and the risk of new events occurring and making the identification of the effects too difficult. This varies depending on the nature of the market. There is no "right" figure for the number of years that a CA should wait before undertaking an ex-post study.[31]

[31] Buccirossi et al (2006), in their Guidance on the ex-post review of merger control decisions, argue that "the timeframe should be set so as to capture all the possible main effects of the decision, and overall, we believe that a period of about three years from the merger should be covered in the assessment, which could be reduced to two for very dynamic and innovative markets. In our view the benefits of such a long timeframe are stronger than its drawbacks".

Davies and Ormosi (2012) raise another issue concerning the timing of ex-post assessments:

> "There is also another, more general, concern about the time dimension which applies to any one-off evaluation (no matter what the methodology) — that it runs the risk of closing the story prematurely. The wider industrial organization literature (both theoretical and empirical) suggests various possibilities for how a specific event might trigger a sequence or chain of subsequent events — each of which might be evaluated independently, but that are, in reality, clearly path-dependent. This means that when evaluating an isolated intervention, we might ignore the longer-term consequences".[32]

This very valid concern, however, clashes with the inevitable difficulty of making reliable assessments of effects over a long period of time, given the presence of a number of confounding effects.

Box 7. Risk of a selection bias in the selection of the decisions to assess

Agencies can only perform a limited number of ex-post evaluations and their choice is usually guided by the factors just listed. This means that the sample of decisions that will be evaluated is likely to be biased, i.e. not statistically representative of the original pool of decisions that could be assessed. This may have an impact on the practice of the CA, as this will incorporate lessons only from a distorted sample of decisions.

This is particularly evident in the case of mergers, because very few merger prohibitions are assessed. This implies that CAs mostly identify decisions with type II errors - where they have cleared anticompetitive mergers that should have been stopped. As a consequence, authorities may become tougher in their merger control procedures. Nevertheless, they may have also committed type I errors - where they have blocked efficient mergers that should have been allowed – and hence, they would not need to change their approach to assessing mergers.

Neven and Zenger (2008) argue that the risk that this selection-bias may lead authorities to become more stringent in their appraisal of mergers is limited, at least in administrative systems, because other factors encourage an overly lenient application of competition law. Indeed they claim that "as prohibited mergers tend to be challenged in court more often than clearance decisions, authorities may be tempted to enforce too reluctantly, in order to prevent losses in court. Moreover, the lobbying influence of firms possibly induces under-enforcement".[33]

Another source of bias, which has been discussed in Part I above, could arise from a CA using the results of ex-post studies to show its successes to stakeholders. This may provide the CA with the distorted incentives to evaluate only those decisions that can show with certainty a positive outcome.

2. Choose the team who will perform the evaluation

The ex-post evaluation team could be composed of authority staff, external consultants - such as economic consultancies, individual independent consultants, and academics - or both.

An evaluation team made of CA staff can face less confidentiality constraints in accessing the information and the files relative to the original decision. Also, when an evaluation is internally-led, the lessons that can be derived from it are more likely to be retained by the organisation. Further, the exercise can be a good development and capacity building opportunity for the staff of the authority. A final benefit to choosing an internal team is that staff that worked on the original decision can provide valuable background knowledge that may not be available otherwise.

32 Davies and Ormosi (2012), p. 16.

33 Neven and Zenger (2008), p. 484.

An internal team, however, may be constrained by the unpredictable workload that characterises CAs and by the sometimes-scarce availability of economists with the necessary econometric skills (when these are required by the study). An internal team can also be more prone to overlook any "faults" in the decision than an external team and to avoid "criticising" the institution they work for and colleagues they work with.[34] This risk is likely to be higher when the team performing the evaluation includes staff that worked on the original decision. Furthermore, even if an internal evaluation team is scrupulously fair in its assessment, any positive findings might be regarded with scepticism by external observers[35].

An external team, if appropriately selected, may have better control over the timetable and may ensure that all the necessary most advanced technical skills are available. Such a team may be also more "objective" in its assessment. However, one should consider that this may be costly, there may be confidentiality issues in accessing the case files, and the CA may have more difficulties in retaining the lessons learnt from the exercise. Furthermore, by not being involved in the prior action, an external team's assessment may lack vital background knowledge or understanding.

When an external team is used, CAs should still try to involve some of their staff in the exercise. First, because this better ensures that the lessons learnt are retained by the agency and second, to test and question the work done by the consultants to ensure its quality and impartiality.

An alternative option, when the CA wants to undertake a quantitative assessment, is to have an internal team perform the study but to involve an external advisor, for example an academic. This advisor can verify the technical quality of the analysis and, when necessary, help to improve it. He can simultaneously ensure the objectivity of the study.[36] This approach can be useful for all those agencies that wish to retain control over the analysis and the lessons learnt, but that may not have internally all the skills and technical knowledge necessary to undertake a solid ex-post evaluation.

Hence, the choice of who to include in the evaluation team should take into account the following main factors:

- Expected duration of the evaluation and flexibility over its completion date;
- Predictability of internal workload;
- Skills required by the evaluation, which can range from technical skills – such as knowledge of specific econometric techniques and software - to knowledge of the market affected by the decision;
- Cost of the resources - for internal ones this is their opportunity cost;
- Confidentiality constraints – in some cases access to files from the original decision can only be provided to the staff of the authority, though non-disclosure agreements can help in addressing this issue. But there may also be cases in which market participants are more willing to provide information and views on how the market has evolved to an external team, under the agreement that this information will only be provided in an anonymous and consolidated manner in the report (and to the CA); and
- Ability to retain the knowledge and experience that can be derived from the exercise.

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34 Some CAs avoid this problem by having internally-led ex-post evaluations reviewed by expert academics.

35 This problem does not occur when the results are also published in peer reviewed journals.

36 The UK CA has been using this approach.

Box 8. A call for permitting more ex-post studies by external advisors, including academics

In a presentation she gave during an OECD Hearing on Ex-Post Evaluation in December 2014, Amelia Fletcher called for favouring a greater involvement of academics in performing ex-post evaluations. She highlighted that there is interest among academics to undertake own-initiative ex-post assessments of enforcement decisions, but that this interest is often thwarted by difficulties in accessing the relevant data.

She called for CAs, within the limit of their legal constraints, to provide academics with greater access to data and information on decisions to allow them to perform more ex-post evaluations. Given the limited resources of most agencies and skills required by ex-post evaluations, a greater involvement by academics could help to increase the number of such studies.

3. Identify the appropriate counterfactual(s)

The ex-post evaluation of a decision requires the identification of the appropriate counterfactuals against which the decision should be appraised. These represent how the relevant market would have evolved if an alternative decision had been taken.

Often more than one counterfactual is possible for a single decision. For example, in the case of a conditional clearance of a merger, the counterfactuals could be how the market would have evolved if the merger had been blocked, and how the market would have evolved if the merger had been cleared unconditionally. If more than one set of remedies had been proposed, these would also represent additional counterfactuals.

To determine all the possible counterfactuals for a specific decision it is necessary to understand the options that were considered when the case was originally examined. For example if a merger was blocked one should consider whether remedies had been proposed, or if an abuse of dominance was stopped and remedies were imposed, whether alternative remedies had also been proposed/considered. In addition, it is important to know if there are any legal constraints on the possible alternatives. For example, in some jurisdictions the remedies that can be imposed in a merger are only those proposed by the parties, hence no alternative set of remedies could be considered as a counterfactual[37].

Having identified the possible counterfactuals, one should then choose which ones to consider in the ex-post evaluation. Usually, to make the analysis more manageable, only one counterfactual is selected and the ex-post analysis is done with respect to this scenario. This counterfactual in general represents the most likely alternative to the decision that was finally taken. However, it is possible to consider more than one counterfactual, as shown by the example presented in **Box 9** below.

37 See Buccirossi et al (2006) for a detailed discussion of the choice of counterfactuals with respect to EU merger decisions, where such a legal constraint on possible remedies exist. The reasoning therein developed may also apply to other merger clearance systems that have a similar constraint.

Box 9. An example of an ex-post evaluation using more than one counterfactual

Friberg and Rohman (2014) assess the impact of the merger between Carlsberg and Pripps in the Swedish beer market, which had been cleared by the Swedish CA, conditional on the divestiture of a number of brands. These brands were acquired by a small rival firm.

The authors perform the analysis using various counterfactual scenarios:

1. what would have happened if the merger had been blocked,
2. what would have happened if the merger had been cleared without remedies and
3. what would have happened if the merger had been cleared with a different set of remedies,

To perform the analysis they use two different methodologies[38].

First they look at the counterfactual in which the merger had been blocked and they perform a difference-in-differences[39] analysis, using the merging parties' competitors as the control group. This analysis shows that prices would have been lower if the merger had not been allowed.

Then they build a structural model[40] to compare the actual merger with two simulated counterfactuals: the merger was cleared without remedies, and the merger cleared with the obligation to divest some brands (as in the original decision), but assuming that the brands were transferred to the firms' biggest rival rather than to a small one. The results of the simulations suggest that the divestitures limited post-merger price increases, and that their beneficial impact on prices would have been much less if the brands had been acquired by the biggest competitor.

4. Select the methodology

The choice of the methodology to employ in order to determine the difference between the actual effects caused by the decision and those that would have taken place in the counterfactual scenario is dictated by a number of factors. The key one is the goal of the study, but other considerations will also matter, such as the nature of the data available, the time available for the analysis, and the skills of the evaluation team – as some methods require an advanced knowledge of econometric techniques and software. In some cases the key elements of the decision can also play a role, because decisions may hinge mainly on consideration of factors some of which are quantifiable (e.g. prices) and some of them less so (e.g. entry, quality, innovation). Finally, any methodology will implicate a trade-off between the number of actions reviewed and the depth of their review; this trade-off should be considered when choosing which methodology to employ.

The most commonly used methodologies in the ex-post evaluations of competition enforcement decisions are:

- Comparator-based methods: before-and-after and difference-in-differences;
- Market-structure-based methods: simulations; and
- Surveys and interviews.

Comparator-based methods use data from actual transactions in markets, or time periods, that have not been affected by the decision to construct the counterfactual and compare it with actual market developments. These methods can involve: 1) comparisons of changes in the affected market before and after the decision – this approach is referred to as before-and-after, or 2) comparisons of changes between comparable market, or 3) a combination of the two that involves comparisons of the changes in the affected market before and after the decision with the changes

38 These methodologies are discussed in more details in Annex B.

39 This methodology is briefly explained in section 4 and more in details in Annex B.

40 This methodology is briefly explained in section 4 and more in details in Annex B.

that took place over the same time period in a comparable market not influenced by the decision – this approach is referred to as difference-in-differences.

Simulations use an economic model that mirrors how the affected market works to simulate prices and quantities in the counterfactual scenario. This approach is increasingly employed to predict the effects of proposed mergers using ex-ante data, but it can be adapted to simulate alternative scenarios for ex-post evaluations of merger decisions. It is also starting to be used in the ex-post evaluation of other enforcement decisions.

Surveys and interviews are used to elicit factual information and data on how the market has evolved from market players and industry experts, as well as to obtain views on what they consider to be the actual effects of the decision and on what could have happened in alternative scenarios. This information can be employed to verify the results obtained through another methodology, can provide data that can be analysed through one of the methodologies listed above[41], or can be used directly to determine the effects of the decision when a more qualitative approach is used. Surveys and interviews are especially useful for assessing those effects that cannot be easily quantified due to a lack of good quantitative data, such as changes in quality, in variety, or in the rate of innovation.

Annex B provides a more detailed introduction to these methodologies, which explains the intuition behind each one, outlines their main pros and cons, provides examples of their use, and lists methodological papers to refer to. Annex B, however, is not meant to suggest the most appropriate methodological approach(es) for undertaking an evaluation, which falls outside the scope of this Guide, but only to indicate what options are available for the researcher to choose from.

4.1 Other (non ex-post) methodologies

The three methodologies discussed above help to determine what has been the actual impact of enforcement decisions on key market variables by relying on information on how the affected markets have effectively evolved following the decisions. There are also methodologies that try to determine what has been the impact of enforcement decisions, but that only rely on information available at the time of the decisions. These methodologies are not strictly-speaking ex-post methodologies (see the definition of ex-post evaluation in part I section 1), because they lack the ex-post element - in that they do not rely on information about the actual effects of the decisions, but try to forecast them. An example are event studies, which use stock market reactions to the announcement of enforcement decisions to determine how these decisions are expected to influence firms' profitability and then from this derive conclusions on the likely changes in the affected markets.

4.2 Qualitative and quantitative assessments

Comparator-based methods and market-structure-based methods usually require the use of econometric techniques and statistical tests. This means that they grant a certain precision in the assessment of the sign, as well as of the magnitude, of the effects caused by enforcement decisions. In addition, the use of econometric techniques also allows the analyst to control for other potential explanatory factors in a systematic manner and, hence, can provide some certainly about the causal link between the decision and the effects identified[42].

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41 When a CA does not have the power to require market players to provide data and information for an ex-post assessment, researchers should be aware that (voluntary) surveys and interviews are unlikely to yield data of the quantity and quality necessary to employ econometric techniques.

42 The simple fact that these methodologies rely on the use of econometrics does not, however, guarantee the validity and robustness of their results. Reliable results can be obtained only if the methodology has been correctly applied and its results have been appropriately tested and verified.

These quantitative methodologies are powerful when correctly applied, but they also have some drawbacks. They are often sensitive to the underlying assumptions, to comparator selected or the chosen model of competition and to the value of the parameters in the model. Therefore, researchers must always make the assumptions explicit, acknowledge the limitations of the analysis and check the robustness of results. It is vital to get the research design right in order to obtain reliable results, and even then, quantitative models may not provide conclusive findings.

In some cases all the quantitative data necessary for the application of these techniques is not available, perhaps because: i) it is not accessible - e.g. only the parties affected by the decision hold it and they do not wish to share it – ii) it has not been collected or kept by market players (or other bodies), iii) it is not available with the necessary degree of disaggregation, iv) it is too costly to acquire, v) it does not exist because the relevant variables – e.g. innovation and quality - are difficult to quantify[43]. In these circumstances econometric-based techniques cannot be used.

If some quantitative data is available, it is still possible to employ a simplified version of these approaches, which involves a comparison of summary statistics or very simple market simulations. OFT (2011), which is also discussed in **Box B.1** in Annex B, provides a good example of a simplified before-and-after analysis, while CC (2008) uses very simple simulations to obtain a general sense of the magnitude of the price changes that followed four of the merger decisions therein assessed. Clearly when these more simplified approaches are employed, the causation of the effects is harder to determine and any quantification of the effect is much less precise.

When no quantitative data is available, the effects of a decision can be only determined through a more qualitative assessment that relies on the views of market players and industry experts (obtained through interviews or industry publications and reports) and on information on how the market has evolved collected through desk research of existing public and commercial sources.

When a more qualitative approach is used the assessment of the effects of a decision on market variables is inevitably less precise, and can often only provide an indication of the sign of these effects. Further, in these circumstances there can be less certainty about the causal relationship between the decisions and the effects identified. On the other hand, a more qualitative approach has the advantage that it can help to assess the impact of a decision on all those variables that cannot be quantified, for example on quality and variety. In addition, qualitative approaches are less time and resource intensive and do not require complex technical skills.

Ormosi (2015) devotes a whole chapter to the description of existing qualitative ex-post studies of EU merger decisions. This review provides examples of the variety of variables these studies have looked at, which include market shares, concentration, entry and exit, innovation, capacity, investments, buyer power, imports and service quality, thus showing the versatility of a qualitative approach in looking at non-price effects. He concludes by stating that:

> *"conducting simple studies on the non-price impact of the merger can provide an invaluable source of information and authorities should be given the right incentives to engage in such exercises on a regular basis."*[44]

Further examples of studies that are based on desk research, surveys and interviews are Deloitte (2009) and Chitale and Csorgo (2015).

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43 As mentioned repeatedly in this Guide, there are cases when quality and innovation can be measured.

44 See Ormosi (2015) p. 67.

It is important to point out that it is possible to perform a study that includes both a quantitative and a qualitative analysis. Combining the two approaches allows the researcher to enjoy the benefits of both – i.e. the precision and the identification of causal relationships afforded by the use of econometric estimation and the comprehensive assessment of non-price effect of a qualitative examination of the market. Annex C includes examples of studies that employ both approaches.

5. Determine the variables to study [45]

As mentioned earlier, to determine if a decision was the appropriate one to take the researcher should assess what has been its actual effect on all key market variables' such as prices, quality and variety[46]. But usually the focus of most quantitative assessments is on changes in prices, because data on this variable is easier to obtain.[47] [48] However, quality and variety are also important and should not be disregarded in the analysis of the effects of a decision.

However the lack of data is often the greatest constraint on the inclusion of these variables in the analysis. Sometimes quantitative measures of quality and variety are available and Table 1 shows some examples of studies that consider the impact on quality and variety using quantitative indicators. When such data is not available, the analysis will have to be undertaken in a more qualitative way, through the collection of factual information and of market players' views on the evolution of these variables.

Table 1. Some examples of quantitative assessments of the impact of mergers on non-price variables

Authors	Sector	Methodology	Variable
Aguzzoni et al (2013)	Books	Difference-in-Differences	**Quality:** The authors have tried to assess the impact of the merger on the quality of the services offered in the book stores and on the variety of books these offer. They asked the merging parties for data on the: number of staff, level of staff experience, number of book signings, opening hours, and the number of refurbishments, as this information was not publicly available nor could be acquired. Unfortunately the parties refused to provide it and the authors could only collect views of market players on changes in these two variables[49].
Ashenfelter et al (2013a)	Household appliances	Difference-in-Differences	**Market Shares and Variety:** The authors study the impact of the merger on market shares (in volume and value) and on a simple measure of product variety (represented by changes in the product offerings of the merging parties).

45 Annex C, which provides a list of ex-post studies, classifies them along a number of dimensions including the variables examined in the study.

46 These three variables are the main determinants of consumer welfare and the objective of most competition law is to maximise consumer welfare (though, as discussed previously, in some jurisdictions this objective may be different).

47 The effects on consumer welfare can sometimes also be indirectly derived by assessing the impact of the decision on the profitability of the affected firms and other market players. For example event studies permit to determine if the decision has led to an increase or a decrease of share prices, which reflect expectation about profits.

48 Even though data on prices is easier to obtain, this may require a costly endeavour. In addition the quality may not be sufficient to allow the use of some methodologies. See Ashenfelter, Hosken and Weinberg (2009) for a discussion on how the quality of price data can limit the retrospective analysis of merger decisions.

49 See CC (2012) p. 56.

Authors	Sector	Methodology	Variable
Berry and Waldfogel (2001)	Radio broadcasting	OLS and IV regressions	**Variety:** The authors consider the changes in the number of programming formats relative to the number of radio stations to determine whether the merger had had an impact on the variety of programs on offer.
Hüschelrath et al (2003)	Pharmaceutics	Simple Before-and-After	**Innovation:** The authors try to assess the impact of the merger on innovation. They perform a simple before and after comparison on a number of indicators of innovation: R&D expenditure, R&D/sales, number of patents registered and number of new generics launched on the market.
Kemp, Kersten and Severijnen (2012)	Hospitals	Difference-in-Differences	**Quality:** They control for quality changes by using the scores of each hospital in the annual survey run by a Dutch newspaper, which is based on 26 quality indicators formulated by the Netherlands Health Care Inspectorate. These scores consider the quality of a hospital as a whole (they come up as non-significant in the econometric analysis). **Quality:** Since they study the effect of the merger on the price of hip surgeries, they use the average travelling time of patients as a proxy for the quality of this treatment. The idea is that patients should be willing to travel longer in order to be better treated.
Mutter, Romano and Wong (2011)	Hospitals	Difference-in-Differences	**Quality:** The authors provide a good overview of measures of hospital quality used in various ex-post reviews of mergers in the sectors, discussing the benefits and limitations of each. **Quality: T**hey use a very large set of indicators of hospital quality ranging from in-hospital mortality to post-operative complications and explain how they have been derived and corrected in their estimation.
Romano and Balan (2010)[50]	Hospitals	Difference-in-Differences	**Quality:** The quality measures used in this paper are derived from the list of Inpatient Quality Indicators (IQIs) and Patient Safety Indicators (PSIs) developed by the Agency for Healthcare Research and Quality. Both sets of indicators make use of hospital inpatient administrative data and focus principally on short-term patient outcomes. The IQIs reflect quality of care inside hospitals, including inpatient mortality for medical conditions and surgical procedures, and the PSIs focus on potentially avoidable complications and iatrogenic events.

Sometimes the ex-post assessment may try to answer specific questions, in which case variables other than prices may be used in the analysis. For example the ex-post study may be interested in determining the impact of a specific decision on firms' productivity, as in OFT (2008), or may focus on whether cost efficiency did indeed materialise after a merger approval, as in Koetter (2005) and Ashenfelter et al (2013b).

[50] In the full version of this paper, presented by the FTC in court when the merger was challenged, the authors considered a wider set of quality measure: 1) quantitative measures of clinical quality, based on outcomes on patients, 2) structural quality measures, based on human resources and technical infrastructure, and 3) process measures, based on the diagnostic and therapeutic services provided.

6. Collect data and information

There are a number of sources that can be used to collect qualitative information and quantitative data on how the market has evolved since the decision was made and on the possible counterfactual scenarios, some of which are freely accessible and some of which can only be consulted at a cost. This is a non-exhaustive list of possible sources:

- **Parties originally investigated** – These firms are likely to have the most exhaustive qualitative and quantitative data necessary for a good analysis. But if they have no obligation to provide this information when an ex-post evaluation is undertaken, they may not be willing to cooperate.
- **Other relevant market players** – These are competitors, customers, and suppliers of the parties originally investigated. These firms have no obligation to co-operate with the ex-post evaluation, but may have less resistance to do so than the originally investigated parties. They may not have information on the prices and quantities sold by the parties originally investigated, but they may have useful information on how the market has evolved after the decision was issued. In addition they may be able to provide valuable opinions on the likely evolution of the market in alternative hypothetical scenarios, which can be helpful in building counterfactuals.
- **Industry experts –** Academics or market analysts, who specialise in the market affected by the decision, can hold useful information on how the market has evolved as well as views on how it might have evolved in alternative scenarios.
- **Original files of the decision** – The official decision may not contain a detailed explanation of the analysis that led to it and it is unlikely to contain the disaggregated data used to support this analysis. Access to the original files gives the evaluation team all this information, but not in all jurisdictions access can be provided. In some legal systems the information collected for the purpose of the original investigation cannot be reused for other purposes, even an ex-post assessment of that original decision.
- **Commercial databases** – In some markets (in general in those for consumer goods) there are firms that systematically collect disaggregated data on prices charged and quantities sold by individual firms, and sometimes also on other market variables. This information can be bought, though the cost can be substantial.
- **Sector publications/websites** – In some sectors there are publications/websites that regularly collect and publish average prices and quantities of the goods and services sold in the markets, and sometimes even more disaggregated data. It may be necessary to purchase a subscription to access them. Trade associations may also be a good source for such kind of data.
- **Market reports and intelligence** – In many sectors there are specialised firms that produce regular reports on market developments and trends, which provide a wealth of qualitative and quantitative information. Again these must usually be bought.
- **Official government statistical agencies** – These agencies collect data on many variables that may prove useful during assessments, for example as control variables in econometric estimates.
- **Stock prices databases** – The daily values of the stock prices of firms quoted on the stock exchange are collected by specialised databases and are accessible against payment of a fee. This data is useful to apply the methodology of event studies (see Annex B for a discussion of the quantitative methodologies).

- **Accounting information** – Firms that are quoted on the stock exchange must publish accounting information. This data is usually aggregated following accounting categories, rather than economic ones, but it may still be useful in some assessments.
- **Press releases and articles** – Press releases issued by the parties originally investigated and by their competitors, as well as specialised press articles, may be useful sources of qualitative information on the evolution of the market, or on the economic performance of specific firms.
- **Information from other investigations and cases** – the CA may have collected information on the same market as part of other more recent, or ongoing, investigations and sectoral enquiries/market studies. In some cases a new merger may have been recently assessed in the same industry. Unfortunately, there may be legal and confidentiality issues that do not permit to use the information collected for one investigation to be used for purposes other than those that led to its collection.

Not all of these sources are available in all markets. In addition, many sources may provide the same information, sometimes with different levels of precision, disaggregation and reliability.

It should be always borne in mind that collecting data is an extremely important step of the evaluation process. Without good data it is difficult to perform a solid and reliable analysis. Further, the quality of the data constrains the choice of the methodology that can be used, as well as of the robustness checks that can be performed. The lack of data is often quoted as the main obstacle in performing ex-post evaluations by both academics and CAs.

Indeed most agencies do not have the power to compel information from market participants to perform ex-post evaluations; hence they have to rely on available information from public and commercial sources and on the willingness of market players to voluntarily provide data.

For some agencies an option that might improve data could be to identify decisions as candidates for ex-post review at the time when these are issued, so as to continue monitoring the relevant markets. Some jurisdictions may have a framework where an obligation to provide continuing information on the evolution of the market might serve the role of a remedy.[51] Where that is possible, the option may be worth exploring. Such a framework would need to avoid even the appearance of offering to clear problematic transactions in order to obtain the benefit of free data for the agency.

6.1 The timing of the data collection exercise

We have discussed in section 1.5 how much time should elapse between the moment when the decision is made and the one when the ex-post review is undertaken. However, time can also matter for the collection of the data for the analysis because it affects the robustness of the results and it may have implications for the availability of the data, as well as for confidentiality concerns.

Usually ex-post evaluations need:

1. data for a period of time that goes from "some time" before up to the moment when the decision was taken to help build the counterfactual,[52] and
2. data for a period that goes from when the decision was taken to "some time" after to determine the effects it has caused.

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51 See Duso and Ormosi (2015) for a discussion.

52 Considerable information on the market up to the time of the decision is usually collected during the investigation and kept in the case file. If stored in a user-friendly manner this information could be of great use for subsequent ex-post evaluations. However it should be borne in mind that in some jurisdictions, e.g. the US, the information contained in the case file cannot be used for other purposes.

The length of these two periods depends on the type of decision being examined, the nature of the market affected and the methodology used. For example, for event studies the period after the decision was made – or whichever event is used – is usually not very long, it can be just a few days. For the other methodologies it has to be longer, often spanning two years. No precise indication can be provided on the appropriate length of these two time periods, but one can say that the time before the decision should be long enough to capture the market in a condition of equilibrium, and the time after must be long enough for the effects of the decision to manifest themselves and to avoid the evaluation capturing only a temporary change in the variables (e.g. due to a short term shock). Further, if a quantitative approach is used, the time periods before and after the decision have to be sufficiently long to support statistically robust results. The analysis could be repeated considering different time windows as a robustness check.

Time also matters because the collection of very recent market data on prices and quantities can be rendered difficult by the fact that this information is considered commercially sensitive. Firms may, thus, be unwilling to share the data with the researcher. This problem can be addressed by ensuring maximum confidentiality in the storage of the data and in their publication. An additional option to further reduce concerns about the disclosure of information, and, thus, to make information collection more successful – as in many jurisdictions there is no obligation to provide information for ex-post reviews to the CA – is to let some time elapse after the period that will be covered by the assessment before collecting the data. Using older data (e.g. data 1 to 2 years older) lessens their sensitivity[53].

6.1.1 Assessing efficiency effects: does this affect the time frame?

Efficiency claims can play a major role in CAs' decisions, in particular in the case of mergers. Often the parties claim that a concentration should be cleared on the ground that it will produce efficiencies that will translate into benefits for consumers and outweigh any anticompetitive effects. These efficiencies could take a number of forms – for example a merger may help firms to reduce shipping and distribution costs, to enjoy greater economies of scale and scope, to increase the quality of management, and to improve the use of information and expertise.

It can take time for these efficiencies to be achieved, as merging physical operations can be a difficult and lengthy business, and then have to be translated into better offers for consumers, such as lower prices, greater variety or higher quality. Effects due to greater market power can show rather quickly, but exploiting the opportunity for greater efficiency can even take a few years. Hence, if one wants to determine all the effects of a merger decision in which efficiency claims played a big part, the time horizon of the ex-post assessment should be carefully gauged[54]. The type of efficiency expected can provide some guidance on how long it could take for them to be realised – e.g. if a merger between banks could lead to savings from the reduction of overlapping branches, this cost reduction will take time to show on the balance sheet because closing offices and transferring or laying off staff is a complex process.

Box 10 below discusses one of the first studies that tried to isolate and assess the efficiency effects of a merger.

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53 Buccirossi et al (2006) advise to allow two years between the date of the request of confidential and sensitive information and the latest date for which information is requested, when the CA has no powers to compel market players to provide information for an ex-post evaluation.

54 This can also apply to abuse cases, though usually in those cases efficiency should be achieved faster. But when these concern innovation and R&D again the timeframe can be longer.

Box 10. Assessing the short and long terms effects of a merger

The paper by Focarelli and Panetta (2003) provides a good example of a study that considers the timeframe over which the various effects of mergers can manifest themselves and tries to assess them. The authors start from the assumption that a merger can have two types of effects:

1. an anticompetitive effect, as it can increase the merged entity's market power and, hence, allows it to charge higher prices, and
2. an efficiency effect, as it can reduce the merged entity's costs and, possibly, its prices.

The anticompetitive effect happens soon after the merger is completed, because the firm can immediately exercise its market power, while it can take much longer for the efficiencies to be exploited and transferred into lower prices.

The paper investigates the pricing effect of a set of mergers in the retail deposit market in Italy in the 1990s. Since this market in Italy is fragmented into numerous local markets and its characteristics are highly homogeneous over time and across banks, the authors exploit these conditions to perform a DiD estimation.

Since efficiency claims were often considered in the relevant merger decisions, the authors try not just to consider whether these claims were valid but they also attempt to estimate separately the market-power and the efficiency effects. To achieve this they examine two post-merger periods: the transition period, which goes from year 0 – the year of the merger - to year 2, and the completion period, which goes from year 3 to year 5.

They find that in general prices increase in the transition period, but decrease in the completion period, completely outweighing the initial negative impact on consumer welfare. They also find that there are no short term price effects for those mergers that do not lead to greater market power - because there was no geographical overlap between the merging banks, and no longer term efficiency effect for those merging banks that are not successful in reducing costs. These results, the authors argue, show that a merger can have (negative) short and (positive) long term effects and that it is possible to determine its overall impact on consumers only by letting enough time pass.

Table 2 below shows some examples of the timeframe adopted to assess merger decisions in which efficiency considerations played a big role.[55]

Table 2. Some examples of length of time needed to assess the impact of efficiencies in mergers

Authors	Sector	Methodology	Number of years after merger considered
Ashenfelter et al. (2013)	Brewing industry	DiD and Event Study	Examines one merger and considers a period of 3,5 years after the merger Finds that: The market power effect on prices was felt immediately, while it took 2 years for the efficiency effect to be fully incorporated into pricing
Brito et al. (2013)	Non-life insurance	Merger Simulation	Examines a number of mergers and considers various periods ranging from 2 to 5 years after each merger Finds no evidence of changes in cost efficiency levels, but the firms that took part in the four most relevant mergers were, at the outset, among the most efficient in the industry
Dranove and Lindrooth (2003)	Hospitals	DiD	Examines a number of mergers and considers a period of 4 years after each merger Where efficiencies are found these took either 2, 3, or 4 years to be transferred into prices

[55] Most studies do not explain why they have adopted a specific timeframe for the analysis of the efficiencies.

Authors	Sector	Methodology	Number of years after merger considered
Focarelli and Panetta (2003)	Retail banking	DiD	Examines a number of mergers and considers for each one a period of: 2 years to determine if there has been any market power effect 5 years to determine if there has been any longer term efficiency effect
Gayle and Lee (2013)	Airlines	DiD and Merger Simulation	Examines two mergers and considers a period of: 3 years for the Delta/Northwest merger 1 year for the United/Continental merger
Groff et al. (2007)	Hospitals	DiD	Examines a number of mergers over a period of 2 years. Finds no detectible improvements in efficiency in the first year after the merger, but significant improvement in the second year after the merger
Harrison (2011)	Hospitals	Non parametric estimation of potential cost savings and comparison to realized cost savings	Examines one merger and considers a period of 3 years after the merger It finds that economies of scale are realized immediately after the merger, but their effects decline as time goes by.
Sung and Gort (2006)	Telecoms	DiD	Examines a number of mergers and considers a period of 3 years after each approval Finds no evidence of cost efficiencies

7. Perform the analysis

The next step consists in the actual assessment of the effects caused by the decision and, hence, in the determination of how key market variables have changed relative to the counterfactual(s).

How to assess the effects depends on the variables on which the analysis intends to focus and on the methodology chosen, but it always involves:

- determining how the key variables have evolved following the decision,
- ascertaining how the same variables would have evolved in the counterfactual(s), and
- concluding whether the decision led to a better outcome than the one that would have emerged in the counterfactual.

Some CAs integrate the assessment of the effects of a decision with an assessment of the validity of analysis on which the decision was made. For example, the UK CA has listed the following as the purpose of its analysis in an ex-post study of 8 merger decisions (see Deloitte, 2009):

- whether the authority had reached sound decisions, given the information available to it at the time;
- whether the reasoning behind these decisions was clear and consistent; and
- whether the authority's views were borne out by subsequent market developments, and if not, what it could learn from this.

Buccirossi et al (2006) in their Guidance on the ex-post review of merger control decisions suggest integrating an evaluation of the actual effect of a decision with an assessment of the analysis, and devote a part of their report to explain how this can be carried out. The case study therein contained provides a detailed example of such an approach.

8. Verify the robustness of the results

Once the results are obtained, it is always important to verify their validity. A study's reliability should be informed by the degree to which its results can be tested or cross-checked.

A number of standard approaches, usually statistical tests, exist to check the reliability of quantitative results. When an econometric approach is used, one could perform the analysis with different specifications of the equations that is being estimated, or using different estimators or alternative control variables. This allows the researcher to test the sensitivity of the results to the specific structure of the analysis.

In addition to these more standard robustness checks, a researcher could use another methodology as a cross-check. As in the analysis that supported the decision, also in the ex-post assessment there should be some attempt to reconcile evidence that may not all point in the same direction. Surveys and interviews of market players are always a good tool for this purpose, since they can be applied in all cases and, as discussed previously they help ensure that no other factor affecting the market has been overlooked. Buccirossi et al (2006) suggest that "whenever feasible, a survey should always be carried out to add insights and help the interpretation of the results obtained through other techniques, as well as to obtain data to analyse with these other techniques".

For example Aguzzoni et al. (2013) employ a difference-in-differences methodology to assess the effect of a merger between two large chains of book retailers in the UK. Since the CA claimed in their decision that retail book prices were set nationally, but the authors found variation in prices also at local level, the analysis is done using two different market definitions - national and local. They also use various control groups to test the robustness of their conclusions. Further they conduct a survey of all major market players to verify their results on prices, as well as to try to determine if the decision had had any impact on quality or variety.[56]

When a more qualitative approach is used, the reliability of the conclusions can be checked by using a variety of sources of information and by ensuring that all the evidence supports the results.

When presenting the results, it is good practice to be very clear and transparent about how these should be interpreted, and to state openly the degree of certainty that one can have on the existence of a clear causal link between the decision and specific changes in the market. For example if some results are very sensitive to specific assumptions and may change considerably if these are altered, this should be clearly highlighted. Similarly, if only a limited number of robustness tests have been performed, due to a lack of data or time, this should be clearly said and any source of uncertainty that may persist indicated. Only by being very honest about the strengths and limitations of the analysis one can derive useful lessons from an ex-post evaluation.

[56] However, all solid ex-post studies include tests and checks and researchers can find a wealth of suggestions and examples when browsing through the papers listed in Annex C.

8.1 Ensuring the existence of a causal link between the decision and the effects identified

To determine the actual effects of a decision, it is not enough to evaluate how the key variables have evolved after the decision was made, as these variations may have been caused by other events. It is also necessary to understand what other changes have happened in the market and how these may have affected the key variables to make sure that they are accounted for and that only the effects caused by the decision are picked up by the assessment.

When multivariate regression analysis is used, this permits to control for other potential explanatory factors that may explain (all or part of) the effects observed following the decision. However to determine what these other potential explanatory factors are it is important to understand how the market has evolved and if specific events have happened at the same time.

The decision can provide some guidance on the factors one should consider, but it can also be that unexpected phenomena or changes have happened, which could not have been predicted in the original analysis, but that have had an effect on the key market variables. Surveys and interviews of market players can be a very good source for this kind of information, as they may help to understand to what extent these other factors may have played a role in changing consumer welfare.

Factors that should be considered are:

- if there has been entry or exit – not just in the affected market but also in the upstream and downstream one;
- if there have been changes in the regulatory and legal environment;
- if there have been other important enforcement decisions over the period examined;
- if production and distribution costs have varied, how and why;
- if technology has evolved and how;
- if new products or business models have emerged - e.g. there has been entry by low cost no frill providers, or online providers;
- if there have been variations in consumption patterns - e.g. because of a shift in preferences, or a sudden drop or increase in income; and
- if changes in transportation costs or import/export conditions have shifted geographic market boundaries.

More items could be added to the list depending on the characteristics of the market and on the reasoning that led to the original decision.

9. Identify key lessons

The last step in an ex-post evaluation consists in deriving conclusions that can be incorporated into the agency's future work. Useful lessons can be drawn both from evaluations that show that a decision was appropriate, as well as from evaluations that show that a decision was not the most appropriate one. However, it is very important, when deriving general conclusions from the outcome of an evaluation, to consider the specific circumstances of the case and to determine to what extent these may have driven the results. Markets evolve and the conditions under which a specific decision led to certain effects may no longer be present.

Usually, it is harder to obtain general lessons from a small number of case studies, whereas if a CA regularly engages in the ex-post reviews of its decision, it might more easily observe patterns that can aid its future decision making. The UK CC, for example, undertook in 2009 an evaluation of eight merger decisions reached between 2004 and 2006. [57] The selection of the cases to assess was made so as to include: a mixture of clearances, conditional clearances and prohibitions, a variety of industries and a range of analytical issues (e.g. coordinated and unilateral effects, price and quality competition, national and local markets). The ex-post review suggested a number of improvements to the authority's merger guidelines, which were under revision at the time, related to: i) the criteria used to define local markets, ii) the circumstances under which to use a fascia filter rather than one based on market shares or concentration indexes, and iii) how to approach self-supply when defining market boundaries.

Another example of a series of assessment of cases, this time all in the same sector, is provided in **Box 11** below.

Box 11. Lessons learnt from the ex-post assessment of mergers in the US hospital sector

In the late 1990s in the US the Department of Justice and the Federal Trade Commission lost seven consecutive attempts to stop mergers between hospitals they considered to be anticompetitive. Their inability to convince the courts of the expected negative impact on competition of these hospital mergers effectively stopped the agencies from attempting further challenges.

In 2002, the then FTC Chairman Timothy Muris announced that the agency was going to conduct a series of ex-post evaluations of consummated hospital mergers. The studies were designed to "obtain useful real-world information, allowing the Commission to update its prior assumptions about the consequences of particular transactions and the nature of competitive forces in health care."[58] At the time the studies were announced Muris noted that, "to the extent ex-post data reveal a real problem in some of these mergers, that data may bolster the Commission's position the next time it seeks a preliminary injunction against a proposed merger in federal district court."[59]

The studies were a massive exercise that involved a large collection of data and significant investment of agency resources. But they led to a number of important lessons such as:

- The Elzinga-Hogarty test[60], often employed to define relevant markets, frequently generated markets that were too large.
- The presence of large hospitals located relatively far from the merging hospitals, which were assumed by courts to constrain post-merger pricing frequently, did not in fact do so.
- Not-for-profits hospitals, like for-profit ones, frequently exercised the market power obtained through mergers.

These lessons were immediately applied and led to the successful challenge of a consummated merger: FTC vs. Evanston/Northwestern/Highland Park.

Currently, the FTC has a very active merger enforcement program: six hospital mergers have been either blocked or abandoned since 2008.[6162] In addition, the methodologies used to analyse the competitive significance of hospital mergers have changed as a result of the conclusion of these exercise.

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57 Deloitte (2009).

58 Timothy Muris (2002), "Everything Old is New Again: Health Care and Competition in the 21st Century" available at: https://www.ftc.gov/news-events/press-releases/2002/08/federal-trade-commission-announces-formation-merger-litigation

59 Muris (2002).

60 For a definition of the Elzinga-Hogarty see note 9 above.

61 These ex-post studies and other hospital merger related papers have been published in a special volume of International Journal of the Economics of Business (2011).

ANNEX A. EX-POST ASSESSMENTS OF THE EFFECTIVENESS OF MERGER REMEDIES

This Annex discusses a specific subset of ex-post assessments: the studies of the ex-post effectiveness of merger remedies. These studies: 1) examine only merger decisions where the transaction was cleared and remedies were imposed and 2) assess only at a specific element of the decision, the remedies, to determine whether these have been effective.

This Annex is not meant to provide a methodology that a researcher should adopt to assess the effectiveness of merger remedies, rather it aims to explain what these studies want to achieve and how they differ from other types of ex-post evaluations. It also provides a brief overview of the type of information sources that are usually employed and of the techniques that are generally used to analyse this information. Any researcher who wants to undertake such an assessment should refer to the bibliography herein discussed to obtain a better understanding of how these studies are done.

1. Merger remedies

Competition authorities can deal with mergers that pose a threat to competition in two ways: they can prohibit them or, where possible, they can impose remedies that address this threat and thus maintain competition in the affected market(s) at pre-merger levels. The choice to prohibit a merger or impose remedies is a forward-looking decision based on predictions made from the best available information at the time of review.

These remedies can be structural or behavioural. Structural remedies lead to a permanent change in the market structure. They consist of the divestiture of one (or more) stand-alone business and related assets (or a subset of it). Behavioural remedies, instead, temporarily modify, or constrain, the behaviour of the merging firms. Examples of behavioural remedies are: the imposition of a supply contract at pre-specified conditions, or the imposition of an obligation to licence specific IPRs. Structural and behavioural remedies can be supplemented with a number of interim measures to support their implementation, for example a trustee can be nominated to monitor the implementation of the remedies or the sale of the divested assets.

2. Assessing the effectiveness of remedies

Those ex-post studies that assess the effectiveness of merger remedies aim to determine whether these remedies have reached the objectives expected by the CA when it imposed them, what has determined their success, and if a different remedy could have been more effective in reaching these objectives[63]. These studies only look at the remedies and do not try to determine whether the clearance of the merger had been appropriate or not. Hence, they do not evaluate how

62 For a discussion of the FTC's recent hospital merger enforcement program see Deborah Feinstein (2014), Antitrust Enforcement in Health Care: Proscription, not Prescription," available at: https://www.ftc.gov/public-statements/2014/06/antitrust-enforcement-health-care-proscription-not-prescription .

63 The answer to this question should not disregard the fact that in some jurisdictions the authorities can only consider remedies proposed by the parties.

competition in the market has been affected by the merger, but they simply consider what specific impact each remedy has had.

The kind of questions these studies try to answer are rather specific and limited in nature, compared to those answered by ex-post evaluations of whole decisions that have been discussed in the rest of this Guide.

Examples of the questions answered by these studies are:

- If a divestiture was required: Has anyone acquired the divested business? Has the acquirer become a viable competitor in the market? How has the divested business' market share evolved compared to the retained business' one? If the acquirer has exited the market, what has caused his failure?
- If a licencing agreement was imposed: Was the price of the licence appropriate? Did the firm who got the licence manage to operate in the market? If not, what were the reasons?
- If a maximum price for a product was introduced: Was the price control respected? Did the price constraint allow entry? Did it bite?
- If a monitoring trustee was nominated: Was she able to fully supervise the implementation of the remedy? If not why?

The outcome of these assessments can be:

i. The remedies have been successful, because they removed the competition concerns they were aimed to address.

   In this case the study tries to determine some best practices and/or useful lessons for future use.

ii. The remedies have been partially successful, because design and/or implementation problems have partially undermined their expected effects.

iii. The remedies have been completely unsuccessful, because these have not had at all the expected effect.

   In these two cases the study tries to identify the factors that have limited or undermined their effectiveness. These factors may be related to the design and implementation of the remedies, in which case the agency can derive lessons on how improve future design of remedies, or to exogenous changes in the market, in which case much less can be learnt because these changes are usually outside of the agency's control and often could not even be forecast.

iv. No judgement on the effectiveness of the remedies can be reached – because it has been impossible to disentangle the influence of exogenous changes in the market from the effects of the remedies.

In this case no conclusions can be derived.

Box A.1 underneath provides an example of remedies that have been judged successful or partially successful.

Box A.1 Examples of the ex-post assessment of remedies

Successful remedy: the Johnson & Johnson's -Pfizer transaction (Tenn and Yun, 2011)

In June 2006, Pfizer and Johnson & Johnson's (J&J) reached an agreement on a transaction consisting in the sale of Pfizer's consumer health division to J&J for USD 16.6 billion.

On December 12, 2006, the FTC announced that it was challenging the acquisition because the transaction would reduce competition in the US markets for over-the-counter H2-blockers, hydrocortisone anti-itch products, night-time sleep aid and diaper rash treatment. In order to appease the FTC's concerns the parties agreed to divest a brand in each of these categories: one brand was sold to Boehringer-Ingelheim and three to Zantac. J&J and Pfizer also agreed to sell two more brands to Zantac, one in the diarrhoea remedies category and the other in the oral rinses category.

The authors use for their analysis retail scanner data collected by ACNielsen. The data cover a period of 69 weeks before the divestiture and 87 weeks after the divestiture for all the six categories of products in which a divestiture occurred.

The effect of the divestiture on prices is first assessed using a before-and-after methodology, which estimates the post-divestiture change for each brand. The analysis is then performed using a DiD methodology[64]: the post-divestiture change of each divested brand is compared to the change in a control group. Such control group consists of all brands in the same category whose sales share is at least 5%.

The results of the before-and-after estimation indicate that the price of every brand declined after divestiture. Moreover, three of the divested brands performed as well or slightly better in terms of sales after being sold. The remaining three brands experienced significant sales changes (an increase in two cases, a reduction in the third) but they do not appear to be divestiture-related. The DiD results are mostly statistically not significant.

Overall, the results are consistent with the view that the divestitures were successful in maintaining the pre-transaction level of competition in the market.

The results of the before-and-after estimation indicate that the price of every brand declined after divestiture. Moreover, three of the divested brands performed as well or slightly better in terms of sales after the merger. The remaining three brands experienced significant sales changes (an increase in two cases, a reduction in the third) but they do not appear to be divestiture-related. Most of the results of the DiD estimation are not statistically significant.

Overall, the results are consistent with the view that the divestitures were successful in maintaining the pre-transaction level of competition in the market.

Partially successful remedy: the Hoffmann-La Roche - Boehringer Mannheim transaction (Davies and Lyons, 2008)

On September 1, 1997, Hoffmann-La Roche (Roche) notified to the European Commission its intention to acquire the Boehringer Mannheim group (BM). Limited overlaps existed between Roche and BM pharmaceutical portfolios of products. The transaction instead raised competition concerns in two areas: clinical chemistry in vitro diagnostics (CCVD) and DNA probe products.

In the market for CCVD, the Commission found that the merging firms would have a dominant position in Austria, Germany, Italy, Portugal and all the Scandinavian countries. These conclusions were based not only on the high combined market shares (between 40- 80% in the different markets), but also on other factors, such as the weakness of existing competitors and the absence of countervailing purchasing power. Roche proposed to divest the majority of its CCVD business in all the eight States mentioned above, and sold the greater part of it to ABX – a subsidiary of a Japanese firm.

As for DNA probe products, Roche had built a dominant position in all Member States of the EEA thanks to the patent relating to the technology of polymerase chain reaction, at the time the most advanced technology in the market. The European Commission believed that the merger would have reinforced this dominant position, so Roche committed to grant worldwide licenses to its key-technology to all interested market participants.

Davies and Lyons (2008) conducted an ex-ante analysis of the effects of the merger in the CCVD market in Germany and Austria. The results obtained through a merger simulation show that, if remedies had not been required, the transaction would have had little effect in Germany: the percentage price change for the merged firms would have varied between -0.1% and +2% depending on the own and industry elasticities and on the cost efficiencies. The Austrian market would have suffered more, with a price variation ranging from +3.8% to +9.2%.

64 See Annex B for an illustration of all the methodologies mentioned in this box.

The authors also performed an ex-post qualitative analysis based on interview records supplied by DG Competition and responses to a questionnaire administered to the merging parties.

In the CCVD market, the evidence showed that the divested business lost market share: its sales fell from EUR 16 million in 1999 to EUR 14 million in 2000 to EUR 11 million in 2001. Problems arose because some parts of what could have formed a coherent business were not included in the divestiture, but also because there were obstacles in transferring staff and the acquirer was provided inaccurate information. At the same time, the market share of the Roche/BM's retained business increased both in Germany and in Austria (+2.3% and +3% respectively), while the prices fell by 3% in both countries. Overall, the authors concluded that the divestiture remedy had probably had a useful short-term effect in preventing higher price rises in Austria, but only a marginal effect on long-term competition level in the CCVD market.

In the market for DNA probes, an insufficient number of licences were sold: six years after the merger, 15 targeted and three broad licences had been sold. According to the authors, this might have been due to the licensing terms agreed in the remedy package: for example, the royalty rate and the front fee to be paid the licensees were both very high.

3. How are these studies undertaken

These studies are typically based on surveys and interviews of key markets players, industry associations, market experts and other stakeholders. They are usually performed a few years after the decision imposing the remedies was issued.[65] The surveys and interviews allow the researcher to collect factual information and quantitative data on the effects of the remedies in the market(s) after their imposition, as well as the views of these informed parties on what they consider to have been the effects of these remedies and the reasons for their success/lack of success. This information is then analysed to determine if the remedies have been effective or not and for what reasons, and to derive some lessons for the design and implementation of future remedies. Usually, but not always, these studies do not involve econometric based assessments of quantitative data, but are based on analysis of factual information, plus some before and after examination of quantitative data (e.g. on market shares or prices).

Since these studies are mostly based on factual information, market players' views and simple analysis of quantitative data over time, no statistical tests or sensitivity analyses can be conducted to verify the validity of their conclusions. Hence, as it can be seen by looking at some of these studies, numerous cross-checks and verification of the information and views are made before reaching firm conclusions, and considerable care is taken before deriving general conclusions. Researchers should examine existing studies to better understand the types of checks that can and should be made before reaching any conclusions that could be extended to future remedies.

Many agencies do not have information gathering powers with respect to these studies, hence they have to rely on the voluntary participation to these surveys and interviews. This may sometimes limit their ability to perform the analysis.

The US FTC, the DG Competition of the European Commission and the UK Competition Commission and OFT (now CMA) have so far been the agencies most active in performing this kind of studies[66].

Box A.2 underneath completes this Annex by providing some examples of lessons learnt from the ex-post assessment of remedies.

65 The majority of the existing studies consider decisions that had been issued 5 to 10 years before.

66 See CC (2011), CMA(2015), FTC (1999), EU (2005), Canada Competition Bureau (2011).

Box A.2 Examples of lessons learnt from the ex-post assessment of remedies

The Alanod case (UK CMA, 2015)

The acquisition of Metalloxyd Ano-Coil Ltd (Ano-Coil) by Alanod Aluminium-Veredlung GmbH & Co (Alanod), both processing sheet aluminium used in commercial lighting units, raised some competition concerns and was thus referred by the OFT to the Competition Commission in July 1999 for a more detailed assessment. The merger had already been consummated when the Competition Commission examined it and it had led to an increase in Alanod's share in the UK market for anodized aluminium coil used in lighting from about 35 per cent to about 75 per cent.

After conducting a detailed investigation, the UK CC concluded that the merged entity would have the ability and the incentive to raise prices for anodized aluminium in the UK. It also noted that the merged entity could tie sales of the high quality 'MIRO' product, of which it now was the sole supplier, to sales of more basic anodized aluminium products.

To address these concerns, the UK CC recommended a package of seven behavioural remedies. These remedies were considered to be a second-best solution: a divesture would be more effective in addressing the competition concern, but since the merger had already been consummated no viable stand-alone divestiture packages were possible.

The recommended remedies were:

(a) the imposition of maximum prices (to be reviewed after five years);

(b) the continuation of the supply of existing grades of specular anodized aluminium;

(c) the prohibition to link the sales of MIRO products to the sales of lower-grade anodized aluminium products;

(d) the obligation to supply MIRO products to competitors;

(e) the cancellation of the merged entity's exclusive distribution agreement with Von Ardenne Anlagentechnik GmbH;

(f) the prohibition to give retrospective rebates; and

(g) the obligation to maintain an arm's length relationship with Jordan Reflectors Ltd (linked to Alanod), which was the largest supplier of louvres for ceiling light fittings in the UK.

The assessment of these remedies, conducted by the UK CC[67] some years, later showed that Alanod's customers sold their products in an aggressively competitive market. This forced them to keep input costs to a minimum, which in turn resulted in pressure on Alanod to reduce prices. Alanod had declared that this pressure had made it unable to raise prices even up to the level permitted by the price control (remedy a above). In addition, the downstream market had been characterized by consolidation and exit, rather than entry, which had given more bargaining power to Alanod's customers and had ensured the price control's effectiveness.

According to the UK CC's report, several key learning points could be derived from this assessment. Among them, the fact that it can be difficult to control prices in industries where input costs are subject to major changes and that price controls, by holding down a firm's prices, can increase its market share and may even help it to expand its sales in other markets (or market segments). They thus concluded that these possible effects of price controls should be taken into account before imposing similar remedies in the future.

The lessons learned from these and subsequent evaluations played an important role in the UK authorities taking a more robust approach to interim measures than previously, including greater use of monitoring trustees and hold separate managers. This was reflected in the UK authorities' guidance and practice in merger investigations and also subsequently in new provisions in the Enterprise and Regulatory Reform Act 2013, giving the CMA the powers to impose an Interim Enforcement Order to prevent parties from integrating their businesses, to prevent further integration taking place or to require existing integration to be unwound[68].

67 See UK CMA(2015).

68 This information have been provide by the UK CMA.

ANNEX B. METHODOLOGIES FOR THE EX-POST QUANTIFICATION OF THE EFFECT OF AN ENFORCEMENT DECISION

1. Introduction

This Annex provides a brief description of the techniques that are currently[69] most used for the ex-post assessment of enforcement decisions. Hence, we will not cover all the existing methodologies, though we shall provide some references for those who are interested in them in the footnotes.

As discussed in Part I of this Reference Guide, an ex-post assessment of a CA's enforcement decision is an examination that:

- is performed to determine what has been the impact of the decision on the affected market(s), relative to the developments that would have emerged in alternative scenario(s), i.e. if alternative decision(s) had been taken, and
- is done sometime after the decision has been taken, to benefit from the availability of information on how the affected market has evolved following the decision.

There are also studies that try to determine what has been the impact of enforcement decisions, but rely only on information available at the time of the decisions, or immediately after - i.e. that fulfil i) above, but not ii). Since this Guide focuses on ex-post evaluations, i.e. those that fulfil both criteria i) and ii), in this Annex we will focus on the methodologies that can be used to perform them. Nevertheless, we shall also briefly cover the most common methodologies that are used for the evaluation of enforcement decisions, but that do not rely on information on how markets have effectively evolved.

It is also important to stress that this Annex is only intended as an introduction to the main available methodologies. It explains the intuition behind each one, outlines their main pros and cons, and provides examples of their use and methodological papers to refer to. It is not meant to be a textbook that discusses in details all the technical aspects of the methodologies and explains how to use them, and it is not meant to suggest the most appropriate methodological approach for undertaking ex-post evaluations. This Annex only wants to illustrate the range of tools and techniques currently in use, as a foundation for researchers to build upon in determining their own approach to ex-post assessment. The available methodologies have each their advantages and limitations, and any researcher who wants to undertake an ex-post evaluation should explore these methodologies in-depth and should evaluate the facts and circumstances of her specific case before deciding which one to adopt.

[69] This Annex reflects what is currently state of the art in this area, but as time passes methodologies may evolve and new ones may be introduced.

Annex C and the Bibliography completes this overview by providing an extensive list of studies based on these methodologies and methodological papers to which researchers for further examples and guidance. Annex C specifically contains an exhaustive tough not complete list of ex-post studies performed by competition authorities, consultants, and academics, which are classified according to:

- the nature of decision assessed,
- the specific methodology employed,
- the variables studied, and
- the sector or sectors examined.

2. Methodologies for ex-post evaluations

The methodologies that are most often used for the ex-post evaluation of enforcement decisions are:

- Comparator-based methods (before-and-after, cross sections, and difference-in-differences);
- Market-structure-based methods (simulations) – based on ex-post data; and
- Surveys and interviews.

We shall examine each of them in the following sections. Subsequently, we shall briefly refer to other methodologies that do not rely on data on how markets have effectively evolved after the decision, and hence cannot strictly be considered as ex-post methodologies.

3. Comparator-based methods

Comparator-based methods use data from actual transactions in markets or time periods that have not been affected by the decision under examination to construct the counterfactual and to compare it with actual developments in the market affected by the decision. These methods can involve:

- Comparisons of changes in the affected market before and after the decision - usually referred to as the *before-and-after* approach;
- Comparisons of the changes in the affected market after the decision with the changes that took place in a comparable geographic or product market not influenced by the decision - usually referred to as the *cross-sectional* approach; or
- Comparisons of the changes in the affected market before and after the decision with the changes that took place over the same time period in a comparable market not influenced by the decision - usually referred to as the *difference-in-differences* approach.

These comparisons can be done through simple graphical analyses, or, in a more sophisticated way, through the use of regression techniques.

Graphical comparisons do not allow the researcher to control for other concurrent factors that may have contributed to determine the changes identified. Regression techniques, instead, identify with more precision the causal effect of a decision, because they allow the researcher to control for additional potential explanatory factors. Clearly the reliability of their results hinges on the inclusion of all the potential explanatory factors: if some factors are left out of the analysis then the estimates

can no longer be trusted. Hence, regressions can be a very powerful tool, but they have to be properly applied. Similarly, graphical comparisons do not permit to estimate with accuracy the magnitude of the effects, while regression techniques can provide more precise results. Again this precision depends on the quality of the analysis performed.

Hence any analysis based on these methodologies, whether graphical or quantitative, should better be accompanied by other qualitative analyses that help to identify all the possible explanatory factors that should be included in the analysis and to confirm that the decision is the main event that has driven these changes.

2.1 *Before-and-after[70] and cross-sectional approaches[71]*

The before-and-after methodology consists in comparing one or more variables in the affected market before and after an event – in this case the enforcement decision - has occurred. The key underlying assumption is that there has been no simultaneous macro-shock, hence, if the event had not occurred, the situation in the affected market would have stayed the same across the two time periods.

Similarly a cross-sectional approach compares variables after the event across two geographic or product markets, assuming that any shock – apart from the event, i.e. the enforcement decision - that may have affected one market, would have also affected the other and in the same manner.

The assumptions just mentioned – no other macro-shock in the market or that the comparator market is indeed comparable - are very restrictive. This implies that, as far as possible, other drivers of the variable of interest should be controlled for to ensure that the estimated impact is not biased by other factors concurrent to the decision.

As mentioned above, these approaches can be implemented by simply comparing the average value of the relevant variables between the two time periods or across the two markets. Alternatively the change in the relevant variables can be estimated using multivariate regression analysis. The latter approach permits to control for other potential explanatory factors that may explain (all or part of) the change. Hence, the multivariate regression analysis renders more reliable the estimate of the effects, provided the equation is correctly specified and all the relevant explanatory factors of the demand and the supply side are included.

The before-and-after methodology is extensively used to assess the impact of cartels on prices and in this context it is often referred to as the dummy variable approach[72]. The time period employed can either be:

- the one during which the cartel took place and the one before (basically “before and during”), or
- the one during and the one after (basically “during and after”), or
- all the three periods (“before, during and after”).

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70 For a general discussion on the use of this approach in the ex-post assessments of merger decisions refer to Buccirossi et al. (2006), and Davies and Ormosi (2012). Lafontaine and Slade (2008) discuss the use of this methodology for the assessment of the effect of decisions on vertical restraints and agreements. For its use in the context of cartels refer to Oxera (2009) and Van Dijk and Verboven (2208).

71 This approach is more rarely discussed, but, as Box 10 shows, it has been used.

72 See White and al (2006) for a simple and clear explanation of the problems one may encounter when using the before-and-after approach to estimate the price effect of a cartel.

The method most likely to generate reliable results depends on data and resource availability and on which time period provides a better approximation of the competitive long run market equilibrium[73]. Different period of times – in terms of start and end date- often have to be used as it can be difficult to establish with precision when the cartel began and when it stopped[74]. The end date can be particularly problematic because, even when the cartel is discovered and fined, the firms may continue to tacitly collude either because they want to maintain prices close to the cartel level to constrain damage claim, or because the cartel has made it easier for them to coordinate their pricing behaviour, or in some cases a price war may ensue. Hence, for an accurate estimate of the effect of a cartel on price, it is important to use as reference period during which the price can be assumed to be at an equilibrium level, and clearly a competitive one.

Box B.1 provides some examples of uses of these methodologies.

Box B.1 Examples based on the use of simple comparator based methods

Evaluating the impact of the OFT's 2001 abuse of dominance case against Napp (OFT, 2011)

This ex-post study is a good example of the use of the before-and-after approach in the context of an abuse of dominance case. In this study the approach has been applied through a simple comparison of the evolution over time of data, on prices and markets shares. The results have then been verified through some additional quantitative analyses and the collection of information on the evolution of the market obtained from market players (rival firms, doctors, hospital pharmacists) and market experts (academics and policy analysts).

Napp Pharmaceutical supplied sustained released morphine tablets to hospitals and to the community segment in the UK. The CA found that Napp had used heavy discounting, often in excess of 90% of list prices, when bidding for hospital contracts. This type of exclusionary behaviour enabled Napp to charge excessive prices in the community segment and retain a very significant share of the market (well over 90%). Even though a smaller proportion of tablets were sold in the hospital segment than in the community segment, a firm had to establish itself in the hospital segment before it could penetrate the much more profitable community segment, as doctors preferred patients to remain under the same drug regime once out of the hospital. Hence Napp managed, via its policy of heavy discounts, to get most hospital contracts and thus to lock in patients. It could then recoup its losses through the exploitation of these customers, once they moved to the community segment.

In its decision, published in March 2001, the CA found that Napp had abused its dominant position and required it, inter alia, to reduce prices in the community segment by at least 15% and to sell to hospitals at a price of no less than 20% of the community segment price.

Ten years later the CA assessed the impact of its decision by examining the movements of prices and market shares in the sustained released morphine tablets market between 1990 and 2009. This large time span permitted to ensure that any effect generated by the decision had not just been temporary. They found that, following the CA's 2001 intervention, the discounts offered by Napp to the hospital segment had fallen from approximately 90% to 40% of list prices, going beyond the obligations imposed by the CA. They also found a clear downward trend in Napp's list prices in the community segment, which fell by more than the 15% indicated in the decision. The analysis of the market share data showed that, at the same time, there had been a substantial fall in Napp's position in both the hospital segment (from 95% to 50%) and the community segment (from 95% to 65%), while Napp's main competitors had seen a substantial increase in their market share.

The OFT also used the data to investigate the relationship between Napp's prices and its market shares in the community segment through an econometric analysis. The model was too simplified to enable the CA to make inferences about causality, but they found that high market shares tended to be correlated with high prices, after controlling for dosage and time effects. This econometric analysis confirmed the results obtained through the graphic analysis of prices and market shares.

An evaluation of the impact upon productivity of ending resale price maintenance on books (OFT, 2008)

This study shows how limited quantitative data can be employed to perform an ex-post analysis through the use of two simplified comparator-based approaches: a before and after comparison and cross-country comparison.

[73] For a discussion of this and the impact on the before-and-after estimates see Hüschelrath et al. (2013).

[74] There are methods that allow researchers to statistically determine the beginning and end of a cartel period. For a discussion of these approaches see Harrington (2008).

The study assesses the impact on productivity in the UK book industry of the abolition of the Net Book Agreement (NBA), which imposed Resale Price Maintenance (RPM) on books.

The authors start by comparing data on the industry's performance prior to the abolition and after it. The RPM was formally ended by a decision of the Restrictive Practises Court in 1997, but it had already started breaking-down in the mid-1990s due to significant changes occurring in the industry. Hence, the authors consider the period 1990 to 2005. Unfortunately their results are limited by the relative paucity of firm-specific data pre-1997, and the fact that so the industry changed over that, rather long, period of time not only as a consequence of the NBA abolition. They perform a number of graphical comparisons and conclude that the evidence suggests that at the time of the abolition of the NBA there was a surge in the productivity of the traditional retailers. However, their nominal turnover soon dropped sharply and then declined steadily thereafter - despite the fact that the aggregate volumes of books sold and prices were both increasing. The authors argue that this was the result of entry from internet sellers and supermarkets, on which they could not collect no data.

The authors then move on to compare the UK market post-RPM abolition with the German one, where RPM existed and was strongly enforced even when the UK repelled it. They claim that Germany is a good control market because its book industry, at the time, presented considerable similarities with the UK one, and that the main difference between the two markets consisted in the change in policy on the book RPM.

The comparisons focus mainly on traditional retailers, due to the lack of data on internet sellers and supermarkets. They conclude that the analysis suggests that the substantial decline in productivity experienced by the UK retail sector over the period under exam had not occurred in Germany, where real labour productivity had remained fairly constant.

On the basis of these analyses the authors reach the tentative conclusion that productivity growth would have been lower in the UK during this period if the NBA had not been abolished, because the move to a free price system has facilitated the entry by more efficient retailers (i.e. internet-based retailers and supermarkets).[75]

Estimating consumer damages in cartel cases: the detergent cartel (Laitenberger and Smuda, 2013)

This study assesses the damage suffered by German consumers due to a detergent cartel that was active between 2002 and 2005 in eight European countries. The agreement involved three firms (Procter & Gamble, Unilever and Henkel), which jointly accounted for around two thirds of the sales a in Germany, and was aimed at stabilizing market positions and coordinating prices.

In 2011, the European Commission imposed a fine of EUR 315.2 ml on Procter & Gamble and Unilever. Henkel received full immunity because it had been the first to apply for leniency in 2008.

The ex-post evaluation is based on a consumer panel dataset for the detergent category, which the authors purchased from a commercial provider. This data is highly disaggregated and quite extensive; the observation units are single purchase acts of observed consumers and the number of observed transactions amounts to 35.000. Brands are classified into three groups: cartel brands (i.e. the detergents produced by Procter & Gamble, Henkel and Unilever), competitive private brands of major retailers (e.g. Tandil from Aldi) and competitive manufacturer brands. The database covers the period that goes from July 2004 until June 2006. Since the cartel is assumed to have ended in March 2005 following the decision of the European Commission, the database includes 9 months during the cartel period and 14 months after it.

The damage is firstly estimated using a before-and-after methodology: the authors assume that no other change happened in the market over the period examined apart from the presence of the agreement in the first nine months. The overcharged is therefore calculated as difference between the observed cartel price and the corresponding but-for price, and this is multiplied by the quantity sold in the cartel period to obtain the damage suffered by German consumers.

The before-and-after analysis finds a statistically significant positive overcharge during the cartel period both for cartel brands (6.72% higher than during the period after the cartel breakdown) and for retailer brands (2.63%). This suggests that retailers reacted to price changes by the cartel firms (umbrella effect). No significant price increase is found for the competitive manufacturer brands.

The analysis is repeated using a difference-in-differences methodology. Given the results above, competitive manufacturer brands are chosen as a control group since their prices do not seem to have increased in response to the collusive behaviour of the cartel firms. The estimate reveals a statistically significant positive overcharge of 6.93% for cartel brands, which is not far from the 6.72% overcharge estimate obtained with the Before-and-After methodology.

[75] The cautious language used in this description is modelled on that used in the study. The authors repeatedly affirm that the limited data set and the crudeness of the analytical method could not allow them to reach firmer conclusions.

2.2 *Difference-in-differences*[76]

The difference-in-differences (DiD) method determines the effect of an enforcement decision by comparing how key market variable(s) have changed in the market affected by the decision (the "treated" market) relative to the same variable(s) in a market not affected by the decision (the "control" market).

The effect of the decision is given by the difference between:

- the average difference between the behaviour of the treated market, before and after the treatment, and
- the average difference between the behaviour of the control market, before and after the decision.

The DiD approach, hence, entails a cross-sectional dimension (treated market vs. control market) and a time-variation dimension (before the decision vs. after). The presence of these two dimensions leads to a double-differencing that permits to identify only the changes due to the treatment – i.e. to the decision - provided the control market has been appropriately selected.

The idea behind the DiD approach is described in **Figure 3** below.

Figure 3. The DiD estimator

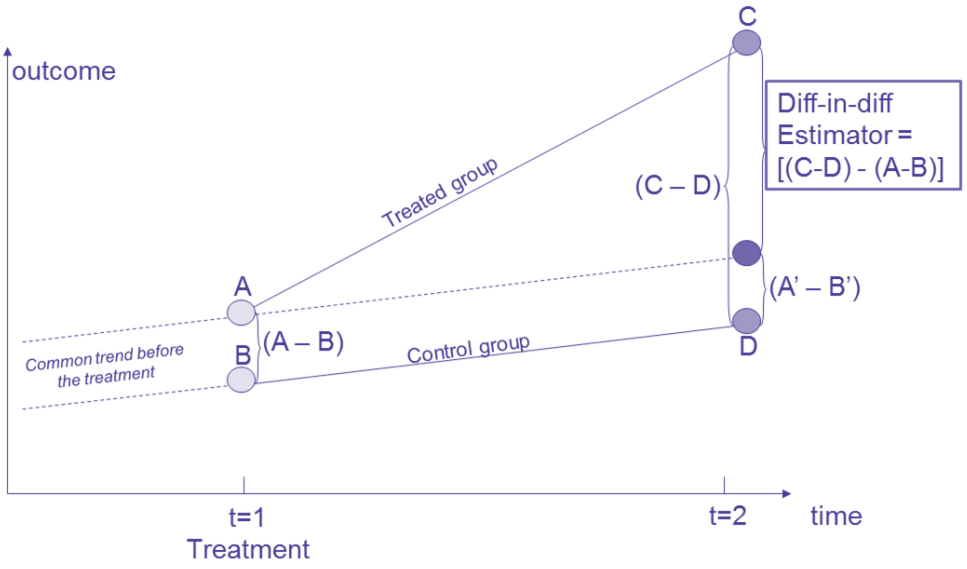

Figure 3 above shows that the DiD methodology compares the difference between the behaviour of the treated group (A in the figure) and the control group before the treatment (B in the figure), with the difference between the same two groups after the treatment (C-D). This difference can then be split to determine the effect of the treatment, which is given by the Diff-in-Diff estimator (in the figure [(C – D) – (A – B)]). This result rests on the key assumption that, absent the treatment, the difference would have stayed constant over time (A'- B' = A- B in the figure).

[76] For a general explanation of the DiD approach see Angrist and Pischke (2010). For an explanation more linked to its use in ex-post evaluations see "A Guide to Merger Analysis using DiD" by D. Greenfield in Kwoka (2015). For its use in the context of cartels refer to Oxera (2009) and Van Dijk and Verboven (2008).

The DiD approach permits to measure the effect of a decision with more certainty than does an approach based only on a before-and-after or cross-sectional analysis, as the double differencing helps to remove individual effects. Indeed by comparing the evolution of the variables for the treated and the control markets before and after the merger, the method allows to identify the effects that can be attributed only to the decision, isolating them from the effects induced by changes in other variables that may have affected simultaneously both the affected and the control markets. Again one must warn that such a result can be obtained only if the methodology is correctly applied, in particular only if the control market has been carefully selected.

The key condition for the use of the DiD approach is the existence of an appropriate control market. This condition is satisfied when:

- the differences between the treated market and the control market are stable over time,
- both markets are affected by the same supply and demand shocks identically (i.e. not just by the same shocks, but in the same measure) – the so called "common trend assumption", and
- the control market has not been influenced by the treatment – i.e. the enforcement decision.

In other words, the DiD approach to be reliable requires that, if the decision had not occurred, the pre-existing trends would have remained the same over the two periods, and, hence, that the observed differences can be fully attributed to the decision.

Such a condition is not easy to meet. Units may not be randomly assigned to the treated and an untreated group because they may differ in some aspects that determine whether or not they received the treatment. In these circumstances it may not be possible to obtain a correct estimate of a treatment by simply comparing outcomes among units that received the treatment versus those that did not, because the apparent difference in outcome may depend on these characteristics rather than on the treatment per se, i.e. the assignment to treatment is endogenous.

Also, external shocks could have affected key variables in both markets in a different manner, in which case the double differencing would also capture this differential impact and would not isolate just the effect of the treatment. Similarly, determining which products or geographic areas have not been influenced by the enforcement decision has to be carefully done to avoid including in the control market products or geographic areas that have been affected, which would lead to an underestimation of the treatment effect[77].

One way to verify if a control market satisfies the common trend assumption is to verify how the two markets were behaving – i.e. what were the trends – one or even two periods before the one used in the analysis.

There are also quantitative techniques that can help to select an appropriate control market. These are data-driven procedures that reduce discretion in the choice of the control units by requiring researchers to identify the affinities between the treated and untreated units using observed quantifiable characteristics.

A widely used one is Propensity Score Matching (PSM). PSM constructs a control group based on a model of the probability of participating in the treatment, using observed characteristics of treated and non-treated units (usually on demand and supply). Participants are then matched on the basis of this probability, or propensity score, to the control group. PMS thus attempts to create a sample of units that received the treatment that is comparable on all observed covariates to a

[77] See Choné and Linnemer (2012) for a discussion of this problem and a methodology to overcome it.

sample of units that did not receive the treatment[78]. One the control group has been created, the methodology works like a DiD one. [79]

Another one is the Synthetic Control Group. With this methodology the control market is artificially generated as a weighted average of the available control units, with weights chosen so that the resulting synthetic control group best reproduces the values of a set of predictors in the treated market before the treatment. The idea behind the Synthetic Control Group is that a combination of untreated units often provides a better comparison for the treated one than any specific untreated unit. [80]

Box B.2 below provides examples of control markets that have been used in existing studies of ex-post evaluations.

Box B.2. Examples of control markets

When using a DiD approach, the first and foremost decision that has to be taken is on the control market to use. A number of options can be considered. Below we discuss the three most used ones: different geographic markets, different product markets, or competitors. Annex C provides more examples for each of these types of control markets.

Different geographic markets

When the relevant geographic markets are local it is possible to use the local markets not affected by the decision as controls. The difference between the before-and-after change in prices in the affected markets and the before-and-after change in the non-affected markets provides an estimate of the effect.

When the geographic market is national, sometimes it is possible to find another national market of the same product that can be used as a control; but difference in consumers' tastes and buying habits, as well as dissimilarities in the regulatory environments, render this option unlikely in most cases.

Examples:

Aguzzoni et al. (2013) assess the effect of a merger between two large chains of book retailers in the UK. The merger had been cleared unconditionally by the UK CA . The CA claimed in their decision that retail book prices were set nationally by the merging parties, with some flexibility at shop level, but that competition on title ranges and service quality was local because consumers tended to shop locally. The authors, however, found variation in prices also at local level. Hence, they exploit this finding and divide the national territory into overlap areas - areas where both merging retailers were present - and non-overlap areas - where only one of two chains was present. They then use the PSM technique (see above) to select two groups of areas with homogeneous observable demand and supply characteristics.

For these local markets they build a dataset of monthly prices for 200 books sold in 60 stores over a period of four years around the merger date. They then employ a panel-data approach to estimate the difference in the change in average prices between the two sets of areas.

Taylor and Hosken (2007) study the impact on wholesale and retail gasoline prices of a joint venture between two major petroleum companies. The JV affected 4 cities in two regions of the US. The authors use a DiD estimator to determine the effects of the concentration and for each city under exam they employ as a control a number of cities. These control cities are selected so that they are close enough to the affected city to experience similar demand and cost shocks, but not close enough to be in the same geographic market and possibly affected by the transaction. Various cities are used as control for each affected city to test the robustness of the results.

Huschelrath et al. (2013) study the impact on prices of a cartel in the German cement market. They employ a DiD methodology and use Spain, France, the UK and Poland as control markets However they admit, when commenting the results, that they cannot rule out that cement cartels where also operating in some of these comparator countries and

78 For example Aguzzoni et al. (2013) choose the local markets to use as control groups in their DiD analysis through the PSM methodology. This allows them to select areas in which only one of the merging firms had a shop that closely match in terms of observable demand and supply characteristics areas in which both firms were present.

79 For a more detailed explanation of PSM see Rosenbaum and Rubin (1983) - the seminal paper that first proposed this approach - or Khandker et al (2010).

80 For more details refer to Abadie A., Diamond A. and Hainmueller J. (2010).

hence cannot exclude that the control markets have been affected by the treatment . This shows the difficulties inherent in using other national markets as controls.

One of the two case studies discussed in ICF and DIW report for DG Comp on the energy market (ICF and DIW, 2015), the GdF-Suez merger, also uses a separate national geographic market as the control market. In 2006 the Commission examined this merger and concluded that, given the horizontal and vertical overlaps between the two companies' activities, the proposed transaction raised significant competition concerns at all levels of the Belgian gas market. In response to these concerns, GDF and Suez offered extensive remedies, mostly in the wholesale market. These remedies were intended to facilitate the entry of new competitors and foster competition. Among other aims, they were intended to increase the access to the Dutch ZEE hub, which should then lead to higher liquidity and volumes traded, and to lower prices in the hub.

To determine the impact of these remedies the authors compare prices at the ZEE hub with prices of a different hub – the control market - unaffected by the event and as similar as possible, in terms of characteristics, to the ZEE one. The choice of this control was difficult as all European hubs are, to some extent, interconnected. Therefore the possibility that a major event affecting one hub did not impact on another hub could not be ruled out. Despite these challenges, the TTF hub in the Netherlands was identified as the most suitable hub and used as the control. The results of the DiD suggest that there was a price decline at the Belgian hub relative to the control hub after the effective implementation of the merger and associated remedies.

Different product market

A possible alternative to a different local or national geographic market is to use a different product market as the control market. This should not be a market in which both merging firms are active to avoid it being affected by the merger.

Examples:

Ashenfelter et al. (2013a) study the price effect of Whirlpool's purchase of Maytag by estimating how markets for different types of appliances were impacted by the acquisition. They exploit the fact that before the merger, Whirlpool and Maytag were both large manufacturers of clothes washers, clothes dryers, dishwashers and refrigerators, while both firms had essentially no presence in the market for freezers and Maytag was a relatively less important producer of cooktops and ovens. Hence, they compare the evolution of the prices of dryers, washers, refrigerators, and dishwashers to that of the prices of appliance markets that experienced no or small changes in concentration after the merger. As a further check they also estimate the effects of the merger on market share and on a simple measure of product variety.

Competitors

Another option is to use competitors as the control group. The main advantage of this option is that it enables one to separate the effects of the merger from any factors influencing demand or costs, since these affect in the same way all the firms in the market. But competitors are not sheltered from the impact of the merger: if the merging parties raise their prices after the merger and prices are strategic complements, their rivals will react by increasing their own prices in the post-merger equilibrium - the so-called spillover effect. This effect takes place under a variety of market conditions and, in particular, in the differentiated product Bertrand model. However, for a large class of demand systems, Deneckere and Davidson (1985) show that the merging firms change their prices after the merger by a greater amount than their rivals. This difference permits to identify the merger effect, though not the full effect, but rather a lower bound estimate.

Examples:

Ashenfelter and Hosken (2010) study the price effect of five mergers in highly concentrated markets for consumer products. They base their analysis on a comparison of changes in the prices of the products sold by the merging firms with those of competing producers. For robustness they use two different control groups: private-label products (i.e. products sold under the retailer's name) and branded products sold by rival firms. Private label products are their preferred control, because they are considered as distant substitutes for the higher quality branded products sold by the merging parties - they could be considered akin to a different product market.

De los Santos and Wildenbeest (2014) analyze how the use of vertical price restraints has impacted retail prices in the market for e-books. In 2010 five of the six largest publishers of trade books in the US switched from the "wholesale model" of selling e-books, in which the publisher sells the e-book to retailers at a wholesale price and the retailers then choose its retail price, to the "agency model", in which publishers set the retail prices and retailer gets a fixed percentage of it. After the DOJ sued Apple and the five publishers for conspiring to raise e-book prices, all the publishers decided to settle and return to the old pricing model, but did so at different points in time between September 2012 and September 2013. The authors use this variation in the timing of the return to the wholesale model to estimate the effect on retail prices in a difference-in-differences framework. Hence for each of the publishers they compare prices for other publishing companies before and after the publisher's switch back from the agency to the wholesale model. This means that the control group at the time of the switch includes: i) publishers that were still selling under the agency model, ii) publishers that had already switched, and iii) publishers who were not part of the suit because they had always adopted the wholesale model.

2.3 Pros and Cons of comparator-based methods

So far these methods, in particular DiD, are the most widely used approaches for the ex-post quantification of the effects of enforcement decisions, especially merger control ones[81].

Their widespread use is probably justified by the fact that:

- They do not require the specification of a structural competition model. The analysis can therefore remain agnostic about the precise mode of the firms conduct (e.g. the strategic dimensions of competition) and, in general, it does not rest on untestable theoretical assumptions. This also avoids any analysis of potential multiplicity of equilibria and the ensuing (lack of) identification questions, which arises when structural methods are employed (see next section).
- The econometric techniques involved are not very complex and do not entail any numerical or computational complexities. This makes their results easy to reproduce and scrutinize.
- They have very limited data requirements. For example the data can be firm-level aggregates and need not be at transaction level.

Its critics, however, argue that these are drawbacks rather than advantages. For example these methods lack a strong theoretical foundation, as they are not linked to a structural economic model. This implies that the analysis does not offer any insights regarding the structural causes of any ex-post effect that is detected and that no welfare effects can be econometrically identified.

Another limitation relates to the omitted variables bias[82]. The before-and-after and cross-sectional approaches are vulnerable to such concerns; while the DiD approach can handle them, but only when the omitted variables do not vary over time.

Furthermore, to the extent that a merger does not only have downstream effects, but also upstream effects (e.g. due to enhanced buyer power), the analysis may under-estimate the true ex-post effect.[83]

The main obstacle to be overcome when using comparator-based models is the need to find an appropriate control group, as the reliability of the results depends on this having been correctly selected. In the case of the before-and-after approach, the control group is represented by the affected market before the enforcement decision. This choice is valid if it can be reasonably assumed that, in the absence of the decision, the market conditions would have stayed the same. For the cross-sectional approach and the DiD methodology, one needs to identify a comparable geographic or product market not influenced by the decision. Specifically for the DiD approach, the common-trends assumption has to be postulated and, as far as possible, tested for[84].

These approaches can only be used to assess those enforcement decisions that determine a change in market conditions: without a change no comparison is possible and no assessment can be

81 Kwoka (2015) goes further and argues that the DiD approach is the only valid methodology for performing ex-post evaluations of merger decisions.

82 Nevo and Whinston (2010).

83 This point was first raised by H. White (2006) and White, Marshall and Kennedy (2006) in the context of damages estimation in antitrust civil litigation.

84 See par. 25-27 of Annex B for a comprehensive discussion on the choice of the control group.

made. Hence, they can be used to evaluate: merger clearances (with and without remedies), cartels, and decisions to stop abusive practices or anticompetitive agreements.

Annex C contains references to a large number of studies based on these approaches to which researchers interested in these methodologies can refer to, in order to get better acquainted with the technical aspects, the requirements and the limitations (as well as suggestions on how to test the robustness of the results) of these approaches.

3. Market-structure-based methods: simulations[85][86]

Market-structure-based methods build on a full model of market competition, which structurally specifies both the demand and supply sides of the market as well as an equilibrium concept, i.e. the kind of competitive conditions governing the interested markets. Once the structural parameters of the model – generally the price elasticities of demand on the demand side and cost/technology parameters on the supply side – are identified and measured, they can be used to simulate alternative market scenarios.

The three key elements of a simulation are:

- the definition and specification of the relevant economic model: demand, supply, and equilibrium condition;
- the estimation of the key structural parameters: demand elasticities and cost parameters; and
- the calculation of the counterfactual equilibrium constellation based on the chosen economic model and estimated structural parameters.

These steps might entail different level of complexity. The economic model can vary from a very simple and stylized structure – for instance a simple static model with a homogenous good and linear demand where firms compete à la Cournot– to a more complex and sophisticated model that allows goods to be differentiated and incorporates dynamic considerations. For instance, while most existing literature looks at static models, dynamic aspects can also be included, such as consumer inertia/addiction or switching costs on the demand side as well as, on the supply side, firms' dynamic investment and innovation decisions or learning. The equilibrium concept can also vary. Standard models with Cournot or Bertrand-Nash behaviour, where firms choose quantities or prices, are generally assumed (e.g., Berry, 1994). Yet, the researcher can also set up more complex models where firms also choose other strategic variables such as the degree of differentiation, product positioning, or the quality of the goods (e.g., Mazzeo et al., 2014), to even richer (and less standard) bargaining games where the different players in the market bargain over the division of the rents created in the market (e.g., Gowrisankaran et al., 2015).

85 This section has been prepared by Tomaso Duso, professor of empirical industrial economics at the Dusseldorf Institute for Competition Economics (DICE) and Head of Department at the Deutsches Institut für Wirtschaftsforschung (DIW Berlin).

86 The classic reference for structural models and simulations is Berry, Levinsohn and Pakes (1995). For a general discussion on the use of simulations in the ex-post assessments of merger decisions refer to Buccirossi et al. (2007), and Davies and Ormosi (2012). Lafontaine and Slade (2008) discuss the use of this methodology for the assessment of the effect of decisions on vertical restraints and agreements. For their use in the context of cartels refer to Oxera (2009) and Van Dijk and Verboven (2008).

The estimation of the key relevant parameters for these theoretical models can be accomplished through different methods: from surveys and interviews of the key market players, to calibrations based on other studies analysing similar markets, to richer and more precise econometric estimations of a full structural economic model of demand and supply based on market-specific micro-data. Most of this section addresses the latter approach.

The last step consists of simulating counterfactual scenarios. Here, the researcher has to clearly identify what alternative decision might have been taken. For instance for a merger that was unconditionally cleared, the counterfactual situation of a prohibition could be simulated by calculating the hypothetical equilibrium one would observe had the two merging firms separately maximised their profits. The precision of this last step strongly depends on the quality and complexity of the first two steps. Only a rich economic model allows the simulation of complex counterfactual scenarios. Specifically thinking about merger control, even quite flexible and technically advanced models might be unable to cleanly incorporate the subtleties of complex behavioural remedies – such as licensing agreements or conduct obligations – as well as some very specific structural remedies – as for instance the selling of some specific firms' assets that do not correspond to a specific product. The difficulty of incorporating complex aspects of firms behaviour in the theoretical model and, hence, perform simulations on policy changes in this environment is one possible reason why these methods have not been intensively used to evaluate decisions other than merger control ones.

The data requirements for the use of simulation methods vary and depend, in particular, on the specific choice in the estimation stage. If the key parameters of the economic model are estimated, the minimum data requirement is a cross-section of market-aggregated data on price, quantities, cost drivers and/or product characteristics. This kind of data, especially quantity data, is not always easily available for all kinds of markets. Hence, data availability can be a major constraint for the application of this methodology.

3.1 Demand side: the economic model and the estimation of elasticities

The majority of the existing studies using – mostly merger – simulations assume that products sold in the relevant market(s) are differentiated. Under this assumption, the literature frequently implements two main approaches in order to give a micro-economic foundation to the demand side of the market: 1) random utility discrete choice models; or 2) representative consumer models.

The first approach positions goods in the space of characteristics. Hence, one good – say one car – is assumed to be considered by the consumers as a bundle of characteristics – say an engine size, a length, a width, a fuel efficiency parameter, whether the car has particular options such AC, Electronic Stability Control (ESC), Bluetooth. Heterogeneous consumers might differently value these characteristics and derive a specific utility from consuming each of them. The parameters that weight how each consumer evaluates each characteristic are the key parameters of the model that determine how consumers substitute among goods, that is the own and cross-elasticities of demand.

In most models that follow this approach, each consumer chooses the good that yields for her the greatest utility by consuming bundles of different characteristics and, therefore, these models are generally called discrete choice random utility models[87]. The econometric discrete choice approach can be implemented both with micro-level (consumer level) and aggregate (market share) data. Especially the latter makes it popular among empirical IO researchers[88]. Depending on the

87 For an overview see Train (2009); Berry (1994); and Reiss and Wolak (2007).

88 See Berry (1994), and Berry, Levinshon and Pakes (1995).

assumed functional forms for the utility function and the assumptions on the degree of heterogeneity among consumers, different versions of a random utility model such as the logit model[89], the nested logit model[90], or the random coefficients model[91] have been used to model consumer choices.

A second approach is based on models of a representative consumer who has preferences for variety. These are more traditional neoclassical models of demand. The demand curve, which is derived from a well-specified utility function that is maximised by the representative consumer and the marginal utility from the consumption of each good, is assumed to be decreasing. Therefore, the representative consumer has an incentive to spread consumption across a variety of goods. The reason that goods are differentiated is typically buried in the parameters of the utility function, which again are the key element to determine the own and cross-elasticities of demand. The most topical of these models of demand is the Almost Ideal Demand System developed by Deaton and Muellbauer (1980).

Typically, these assumptions about the consumer's utility function are coupled within a model of multi-budgeting utility maximization, where consumers care about the sub-utility from various groups of goods (e.g., food and clothing) and use a (justified) price index for the groups to make their within group choices. Products are then divided into small groups and a flexible functional form within each group is allowed. In order to apply this kind of models, the utility must be separable across groups. At the lowest level (generally the market under consideration), demand for a good depends on the prices of within group goods, conditional on total group expenditure. Applications of this approach are more limited[92], but are a valid alternative to discrete choice models of demand.

3.2 Supply side: marginal cost estimation

The structural demand estimation is crucial also for the calibration or estimation of the supply side, since own- and cross-price elasticities are key ingredients of every model of imperfect competition. Indeed in a market with differentiated goods, the mark-ups chosen by the firms for each of their brands — which can be seen as a direct measure of the extent of their market power — crucially depend on the substitution possibilities the consumer has. Hence, the effect of a change in market structure, such as a merger or a merger remedy, can best be measured by understanding these substitution patterns.

Typically, in many empirical models, the supply side is represented through static models of oligopolistic competition, where multiproduct firms compete à la Bertrand-Nash in prices. The logic of these models is as follows: when the price of a product increases, the demand for all other brands increases as consumers substitute out the now more expensive product with alternatives. A multiproduct firm only considers the pricing externality that a change in price for one of its brands exerts on the demand of the other brands it owns, as it does not care of the change in profits for the products held by competitors. Hence, the effect of a marginal change in price will be jointly determined by the cross-price elasticity (the price externality) as well as on whether a brand belongs to the same firm or not. This latter element is often referred to as the ownership matrix, i.e. a matrix containing the information of what products are produced by what firm. This is one of the key elements for performing merger simulations, as we will discuss below.

89 For example Werden and Froeb (1994).

90 For example Berry (1994); Goldberg and Verboven (2001); Ivaldi and Verboven (2005a).

91 Berry, Levinshon and Pakes (1995) and Nevo (2000).

92 For example Hausman, Leonard, and Zona (1998).

Under these assumptions about the equilibrium concept and based on a set of price elasticities —for instance, as estimated by means of the aforementioned demand models— as well as a ownership matrix, it is then possible to recover marginal costs from the equilibrium price-cost margins. Specifically in simple static models of differentiated products and Bertrand-Nash price competition, marginal costs are estimated to be equal to the observed price minus the (estimated) mark-up. The latter is equal to the inverse of the price elasticity of residual demand in models with single product firms. In models with multiproduct firms, mark-ups are more complex and also depend on the cross-price elasticities among all goods produced by the multi-product firm.

3.3 Simulations

Using the estimated demand- and supply-side parameters together with the assumed economic model, the researcher can now simulate the new equilibrium prices, market shares, change in consumers' welfare and producers' profit that would result from a change in the market structure or from any other policy change that can be accommodated within the adopted framework, for example one caused by a competition enforcement decisions. The economic model provides the demand equations and the first order conditions for each of the goods, as well as the equilibrium concept. The estimation stage provides values for the key parameters of the economic model. The simulation consists of *ad hoc* changing of one (or a few) parameter in the model.

Most of the existing literature applying this method to competition policy is limited to the *ex-ante* simulations of horizontal mergers, i.e. the simulation of a counterfactual ownership structure undertaken before deciding whether this particular merger is authorised to determine its likely impact on the market. One typical example would be to consider the effect of a change brought about by the acquisition of some brands by one firm from another. The simulation consists of assuming that some products that were produced by firm *A* will be now produced by another firm *B*, which might be the acquiring firm or the merged entity. The researcher can then calculate the equilibrium in this modified economic model[93] taking the structural parameters as given. In a market with *J* products, the new equilibrium is determined by the price and quantities that solve a simultaneous system of *J* first order conditions and *J* demand equations. In this step the estimated structural parameters are taken as constant, i.e. it is assumed that preferences and technology do not change in the counterfactual scenario.

In the case of an *ex ante* merger simulation in the new equilibrium, the acquiring firm internalises the price externality that a change of the price of its old products will have in the demand of the old products as well as the new acquired products; whereas the selling firm will stop internalising the price externality on the demand of the sold brands. This leads to different equilibrium prices and, accordingly, different market shares. Once the new equilibrium prices and quantities have been simulated the consequent change in consumer welfare and firms profits can also be calculated by comparing these measures in the *status quo* scenario to those generated in the simulated world.

Overall, this methodology has proven to be a very useful and powerful instrument to assess *ex ante* counterfactual situations. Notwithstanding the legitimate critique to this approach spelled out by Angrist and Pischke (2010), [94] it may be the most precise and state-of-the-art way to predict the

93 For example Nevo (2000); and Ivaldi and Verboven, (2005a).

94 While discussing Nevo's (2000) structural approach to estimate the effect of mergers on the price of ready-to-eat breakfast cereals, Angrist and Pischke (2010, p. 21) note its limitations, "The postulated demand system implicitly imposes restrictions on substitution patterns and other aspects of consumer behaviour about which we have little reason to feel strongly. The validity of the instrumental variables used to identify demand equations—prices in other markets—turns on independence assumptions across markets that seem arbitrary.

effect of a competition enforcement decision (or a policy intervention) in complex markets characterized by strategic behaviours[95] where quasi-natural experiments are more difficult to implement.[96]

Simulations are also being used to perform *ex-post* assessments of the effects of enforcement decisions (mostly merger decisions), but the number of papers using this approach are still limited.[97] In this case actual *ex-post* data can be used to populate the model, and if the model correctly portrays how the market works, simulations can provide a precise estimate of the impact of the decisions on all key market variables (e.g. prices, costs, profits), as well as on welfare.

An important aspect that has to be kept in mind when using this methodology in an *ex-post* rather than in an *ex ante* assessment of merger decisions is what data should be used to estimate demand and supply parameters. While demand parameters should theoretically not be affected by the policy decision, as consumers' preferences are taken to be exogenous, the marginal costs could – and actually in case of mergers should–be affected by the policy change. This would call for the use of *ex-post* data in the estimation of post-merger marginal costs[98]. The researcher could then potentially compare the pre-merger costs estimates to post-merger ones to verify if the merger led to efficiency gains[99]. Clearly, this simple before-and-after comparison might, however, be criticized as the change in marginal cost that is eventually observed might also be due to factors other than the merger. Hence, a causal interpretation of the comparison might be difficult.

Box B.3 below provides an example of an ex-post study based on the use of this methodology.

Box B.3 Example of use of simulations and structural models: the case of the Portuguese non-life insurance industry

Brito et al. (2013) conduct an *ex-post* evaluation of a series of mergers in the Portuguese non-life insurance industry that took place between 1999 and 2007.

The authors analyse three types of non-life insurance: "Motor Vehicle Insurance," "Employers' Liability" and "Fire and Other Damage to Property." Their analysis includes data for 13 firms whose combined average market share between 1999 and 2007 varies between 77% and 86%, depending on the type of insurance. Five of these 13 firms were involved in at least one concentration operation in the considered period.

The panel firm-level data were drawn mainly from regulatory annual financial statements, but some information was also provided by the industry association. The collected data include the number of policies, the price per policy and the claims ratio (i.e. number of claims over the number of policies). In addition, some firms' characteristics such as total costs, total assets and the age of the firm were also included in the model.

The simulation step typically focuses on a single channel by which mergers affect prices—the reduction in the number of competitors—when at least in theory a merger can lead to other effects like cost reductions that make competition tougher between remaining producers. In this framework, it's hard to see precisely which features of the data drive the ultimate results."

95 For example Nevo and Whinston (2010), and Einav and Levin (2010).

96 The applicability of this methods have been facilitated by the existence of several academic papers, as well as statistical programs, that have become standard tools taught in advance economic programs and are readily available to all researchers. For instance, a recent methodological paper by Björnerstedt and Verboven (2014) describes a Stata program that the authors develop to perform merger simulations based on nested logit models of demand and Bertrand-Nash pricing behaviour in the supply side.

97 See Pinkse and Slade (2004); Brito et al. (2013); Nilsson and Strand (2005); Ohashi and Toyama (2013); Jeziorski (2014).

98 Some authors, however, include ex-post merger data also when estimating the demand equation. See for example Gayle and Le (2013) and Ohashi and Toyama (2013).

99 This is for example the approach used by Ohashi and Toyama (2013), who use observed data in both the pre- and post-merger periods to estimate the marginal costs.

The analysis is based on a structural model. Consistent with the discussion above, the approach of the study consists of specifying and separately estimating each of the three blocks of the structural model: (i) preferences, (ii) technology, and (iii) the equilibrium condition. More precisely, the authors estimate the demand and cost parameters (i-ii) and then insert the obtained estimates into the equilibrium condition (iii). A peculiar characteristic of their model is to allow for the possibility of intermediate degrees of competition among firms, going from the case of Nash equilibrium (perfect competition) to the case of joint profit maximization (coordinated effects). By allowing the conduct or intensity of competition to change over time, the authors are able to evaluate the extent of market power through coordinated effects before and after the mergers.

After estimating the model, the authors analyse the impact of the mergers. The first result is that between 1999 and 2007 there was a decrease in the level of coordination between the firms in all of the markets. This does not prove, though, that the mergers were the cause of the decrease. The study also finds that cost efficiency levels did not change significantly over time. This may be due to the fact that firms were, on average, already close to the industry's efficiency frontier: this left little room for further improvements.

Finally, the study shows that the mergers had a positive effect on welfare: both consumer surplus and firm's profits increased. These changes were driven by lower prices (in two of the three markets), improvements in the product characteristics, as well as a large increase in the number of consumers.

3.4 Pros and Cons of market-structure-based methods

Market-structure-based methods have the advantage that they permit to analyse the effect of prohibitions — both what would have happened if a prohibited mergers was cleared or if a cleared merger was prohibited — as they allow for the simulation of a theoretical counterfactual situation that is not observable. Moreover, one of the most useful developments for the application of such methodology is that it can be potentially used to study the impact of alternative divestitures. Specifically, the researcher can simulate what would be the effect of divesting some brands (assets) to rivals or potential entrants when the merger was unconditionally cleared. Alternatively if a specific divestiture indeed took place, alternative remedies could be simulated[100]. As mentioned above, however, this is only possible if the economic model chosen in the first step is flexible enough.

An additional advantage of market-structure-based methods is that they allow the researcher to estimate the full welfare effect of a particular change in market structure or of a particular policy intervention, such as an enforcement decision. Indeed, since a full economic model is specified and the underlying preference and cost structure can be estimated, inferences on welfare can be done. Imagine, for instance that, following a merger approval, some prices increase and others decrease. Whether this situation is welfare increasing or not is not immediately clear, but with a full economic model it is possible to know how consumers and firms react to these changes in prices and, thus, to determine who gains and who loses from this new situation. This then permits to measure the change in welfare compared to the status quo before the change in prices was observed.

Market-structure-based methods have mostly been used for the *ex-post* evaluation of mergers, for the most part cleared mergers, and have only occasionally been used to evaluate enforcement decisions on anticompetitive conducts, such as abuses of dominant position or cartels. Specifically, some studies have used the same framework to disentangle the margins due to differentiation and market structure from those due to coordination or joint dominance[101]. These can be effectively seen as studies that try to estimate the effect of collusive agreements. Also in this case, by modifying the extent of the ownership matrix, the researcher can simulate the effect of a cartel, which is

100 See Friberg and Romahn (2014).

101 For example Nevo (2001); and Pinske and Slade (2004).

modelled as the joint profit maximisation decisions of all firms participating in the agreement. In this respect, these applications can be seen as a specific case of merger simulations. However to cleanly identify the conduct, i.e. the margins due to coordination/collusion, the researchers usually need to have quite precise data on the marginal costs[102]. This is generally not very likely, especially in industries where the production technology is quite complex.

These methods have also their limitations. A first caveat on the applicability of these methods relate to the kind of markets that can be analysed. Most of the existing papers look at markets for end-consumer products (cars, cereals, soft drinks, grocery products, telecommunication services, etc.). Therefore, most of these studies limit themselves to simple model of horizontal markets and estimate one level – generally the last, retail, level – of the vertical chain. Yet, there are an increasing number of studies that specifically look at vertical relationships and enrich the economic models to encompass supplier and retailer interactions[103]. Some papers also use these more complex models of vertical relations to simulate the effect of various policies on vertical conduct such as vertical restraints[104]. A good example of work on vertical restraints is Nurski and Verboven (2014), who look at an industry characterized by vertical relations – the Belgian car industry — where manufacturers set retail prices to maximise total upstream and downstream profits over all their products by means of exclusive dealing. They then perform counterfactual simulations to assess the effects of a ban of exclusive dealing that leads to multi-branding agreements.

While some advances have been made, the modelling of more complex intermediate markets and the evaluation of policy intervention in those markets that do not directly affect final consumers is an area where little guidance from the literature exists. Moreover, quite complex markets characterised by composite firms' strategic decision (for instance simultaneous quality, innovation, and price decisions), non-standard pricing behaviour (for instance when prices are the outcome of a bargaining process rather than determined in the market), or several layers of regulation are more difficult to model and, hence, to be applied in *ex-post* evaluation. Finally, it might be difficult to have a well-structured model that can encompass the specificity of peculiar conducts, such as predatory pricing, loyalty rebates, tying and bundling, refusals to deal, margin squeeze, and excessive pricing. This is surely one of the most likely reasons for the limited applicability and application of these methods to all areas of competition policy, in particular for performing *ex-post* retrospective analyses. Yet, potentially, simulation methods could be used in these cases as well.

In sum, one of the key trade-offs that researchers face when using market-structure-based methods and simulations is between the richness of the model and its complexity. The richer the model, the more likely it is that researchers can cleanly encompass the specificities of an industry, calculate the specific counterfactual situation and, hence, address the exact policy questions they are interested in. However, this comes at the cost of increasingly difficult estimation and simulation steps, as well as the generalisation and, in some cases, the robustness of the obtained results.

The sensitivity of simulations to modelling assumptions, that makes this methodology very precise and sophisticated, can therefore be a weakness when there are no sound theoretical motivations to choose, for example, a specific form of competition or a functional form of the demand curve. Besides, rich and complex models need staff with very strong econometric skills and a great amount of data.

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102 See also Genesove and Mullin (1997).

103 See Bresnahan (1985); Villas Boas (2007); Brenkers and Verboven (2006); Bonnet and Dubois (2010).

104 See Lafontaine and Slade (2007) and (2008) for reviews.

4. Surveys and interviews[105]

Surveys and interviews can be a means to elicit data from market players and industry experts on how the market has actually evolved following an enforcement decision that can then be used to apply one of the methodologies just discussed.

Surveys and interviews can also be employed to collect factual and anecdotal information about the development of the market, as well as the views of informed parties on the impact of the decision under exam. These views can then be cross-checked, analysed and confronted, combined with the available factual information, and used to determine the effects of a decision.

Hence, surveys and interviews can be just used as a source of data or can lead, on their own, to a quantification of the impact of the decision, though they cannot provide certainty about the causation of the effects identified, nor about the precise quantitative dimension of these effects.

However, surveys and interviews have the advantage that they allow to determine the impact of the decision on some market variables, which are usually difficult to derive from hard data and the application of quantitative methodologies. For instance they help to determine if the decision has had an impact on quality, or variety, or the level of innovation.

A survey, as a set of interviews, involves the collection of data from players and informed parties in the relevant market. These may include:

- the merging or the offending firms;
- the buyers of the goods or services exchanged in the market affected by the decision;
- the competitors of the merging or the offending firms;
- the suppliers of the merging or the offending firms;
- the distributors of the merging or the offending firms; as well as
- industry experts.

The choice of which of these groups to include in the survey/interviews can only be determined on a case-by-case basis, depending on the information and data one wishes to obtain, the nature of the decision, the characteristics of the market, as well as many other factors. Often different information can and should be asked from each group.

Surveys and interviews generate rather than require data, but some preliminary information on the market is needed to design and administer a survey/interviews. The most important information needed refers to size, composition and main characteristics (e.g. geographical distribution) of the target population. This is necessary to determine if the whole population can be covered by the survey, or whether one has to select a representative sample. In the latter case, it is necessary to select such a sample. It is also necessary to have a good understanding of the market and how it has evolved over time and of the decision, in order to develop a meaningful and useful set of questions.

105 For a general discussion on their use in ex-post assessments refer to Buccirossi et al (2006), and Davies and Ormosi (2012). For a more technical discussion see: Groves et al (2011) and Mellenbergh, G. J. (2008).

Once this information is available the researcher has to:

- determine whether she needs to select a sample, and if so select it;
- design the questionnaire and test it;
- decide how to administer the questionnaire; and
- interpret the results.

In some cases, the target population is sufficiently small, and the researcher can include the entire population in the study. However, the target population(s) can be too large to attempt to survey all of its members (e.g. if customers are individuals). In that case a representative sample has to be drawn from it (i.e. a sample that reflects accurately the characteristics of the population it is selected from).[106]

Usually, a survey consists of a number of questions that respondents have to answer in a set format. In designing these questions the researcher needs to balance the desire to obtain a rich set of information with the risk of discouraging the respondents. However, the design of the questionnaire is much more than asking the right questions to obtain the data and information one is after, how the questions are asked is also extremely important. The clarity of the language and intelligibility of what is being asked have a major impact on the quality of the responses, as well as on the response rate. The questionnaire should also clearly explain how the information obtained will be used and how confidential information will be treated. Fear that confidential information may be revealed can reduce the response rate. Guaranteeing anonymity can also be a useful strategy to ensure a good response rate when the survey covers a limited number of major market players.

It is worth remembering that there is usually no obligation on the market participants to answer to questionnaires linked to ex-post evaluations, and many market players may not have any special interest in supporting the project. Hence, the length and complexity of the questionnaire should take this factor into account.

In general a pilot test is conducted to make sure that respondents understand correctly the questions, that the questionnaire is complete and exhaustive, and that the format chosen (i.e. open-ended vs closed-ended[107]) is the appropriate one.

106 The methods to select a sample can be classified as probability or non-probability ones. Probability samples are selected on the basis of a process that assures that different units in the population have equal probabilities of being chosen. Non-probability samples are formed by selecting some members of the population in a non-random manner. The advantage of probability sampling is that the sampling error, i.e. the degree to which a sample might differ from the target population can be calculated. In non-probability sampling, instead, the degree to which the sample differs from the population remains unknown.

107 Open-ended questions ask the respondent to formulate his or her own answer, while closed-ended question, ask the respondent to choose one or more answers from a given number of options. Closed-ended questions facilitate the respondents and may lead to a higher rate of response; open-ended questions are more flexible and may be useful to obtain information that was not originally anticipated in the design of the questionnaire. Open questions are especially useful in small sample studies in which respondents are particularly qualified (i.e. surveys and interviews of small groups of firms, rather than of large groups of individual consumers).

A choice also needs to be made with respect to the way of administering the questions. The most common ones are:

- By telephone interviews;
- By face-to-face interviews;
- By mail or online; or
- A combination of the above.

The choice between the modes of administration is usually based on the time available, the resources that can be dedicated to it, the length of questionnaire, the size of the sample/target population, the degree of flexibility required (e.g. whether one may want to elicit further information depending on the response), the respondents' willingness to participate, and the accuracy required (e.g. precise and reliable quantitative data is difficult to provide in an interview).

The data and the information obtained through surveys and interviews should always be checked for internal consistency and their accuracy corroborated by collecting publicly available information. Survey responses are inevitably not as accurate as actual behaviours. The most typical biases happen because:

The respondents may wish to please the researcher by providing the kind of response that he believes the researcher is looking for, or to impress the researcher by providing the "right" response - this generates a "response error or bias".

The interviewer can (inadvertently) influence the response elicited through the phraseology of the questions - this is known as the interviewer error or bias.

The interviewees may have an interest in manipulating the results of the ex-post assessment, and thus may respond strategically to the questions.

Responses may be distorted by the passage of time.

When the questions are hypothetical (e.g. of the kind "what would have happened if the merger had been allowed rather than blocked") responses tend to be less reliable. Nevertheless, if the group of interviewees is sufficiently large and varied – i.e. composed of different types of market players - it is possible to cross-checks the answers and gain more certainty.

Surveys may also involve mistery shopping exercises, where "fake consumers" perform specific tasks, such as purchasing a product or a service, collecting information on their prices, testing their quality or the quality of consumer service, and then provide detailed reports about their experiences. These exercises can be very useful when dealing with retail markets.

Box B.4 below provides some examples of ex-post studies that are based on surveys and interviews.

Box B.4 Examples of ex-post studies based on survey

Example: Evaluation of the impact of the OFT's investigation into bid rigging in the construction industry (OFT, 2010)

In September 2009, the OFT announced its decision to fine 103 construction companies a total of £129.2 million for engaging in bid rigging activities. Soon after the OFT decided to evaluate the impact of this decision and compare it with the impact of earlier interventions still related to bid-rigging in the construction sector. The methodology consisted in surveying construction companies and procurers of construction projects. All the contractors and procurers included in a major construction database were contacted and asked to undertake a telephone interview and complete an online survey. The questions concerned the perceived prevalence of bid rigging in the construction sector, knowledge of and compliance with competition law and the impact of OFT's recent decision on bid rigging in the construction sector.

The answers to the survey were compared to those obtained in an equivalent survey conducted two years before. The results showed that the majority of contractors perceive bid rigging practices occurring in the UK to be rare. It appeared as well that the 2009 OFT decision had had a greater impact in increasing awareness about the illegality of a range of bid rigging practices, than earlier OFT decisions.

Example: Ex-post Merger Review: An Evaluation of Three (Canada) Competition Bureau Merger Assessments (CRA, 2007)

In 2007 the Canadian Competition Bureau commissioned an independent review of three merger cases that had raised important competition issues. The first transaction occurred in 2000 in the commercial radio broadcasting sector. Corus Media acquired the assets of WIC Broadcasting. The second case involved a merger in 2003 of a number of coal companies based in western Canada, collectively referred to as the Fording group. The third case is a joint venture created in 1999 between Carmeuse and Lafarge, both large suppliers of concrete and other building materials. All three mergers were not challenged by the Competition Bureau.

The analysis in all three cases was mainly based on phone interviews to market participants, competitors and in some cases also customers. The questions concerned the evolution of prices and whether there had been any changes in the market conditions unrelated to the merger decision (costs of input, entry, and the like). The questions also asked what the interviewee considered had been the effect of the decision. The information and views thus collected were complemented with information about post-merger market conditions derived from other studies and from public sources.

From the interviews, the authors obtained some anecdotal information on price changes, but not the kind of data that could allow conducting a rigorous statistical analysis. In particular most respondents refused to provide pricing data on the ground that it was commercially confidential. Hence, the analysis had to be mostly based on anecdotal and qualitative evidence.

Only for the Corus Media-WIC Broadcasting case, they managed to obtain a large amount of data from the Bureau of Broadcast Measurement (BBM), a Canadian audience measurement organization. The conclusions derived from the interviews were thus complemented with a before-and–after regression analysis to test how the merger affected listening levels, ratio station revenues and format variety in the radio sector.

Example: Ex-post evaluation of mergers (CC and OFT, 2005)

In 2005 the UK Competition Commission commissioned an evaluation of 10 out of the 29 mergers that it cleared between 1992 and 2002[108]. The research methodology consisted of a series of in-depth interviews with different market participants, such as buyers, competitors, the merged parties, and new entrants. The respondents were a large and varied group, but the sample was not statistically designed. Most of the interviews were conducted by telephone, along with some face-to-face interviews.

The interviews asked questions about what had happened in the markets in the years after the decisions had been taken. The questions concerned prices, quality, market structure (including new entry), buyers' behavior, technology and market definition. The information collected through the interviews was integrated, where possible, with publicly available information.

The results suggested that the UK competition authority had been generally good at predicting where entry was likely to act as a significant competitive constraint. On the contrary, it had proved less effective in predicting the circumstances where buyer power would be a valid restraint for the merging entities' market power.

108 See also Deloitte (2009, this review examines eight merger decisions from the period 2004 to 2006: three were resolved at the OFT stage and five were referred to the CC.

Example: Ex-post evaluation of abuse of dominance (Bundeskartellamt, 2010)

In 2010 the Bundeskartellamt published a report on the evaluation of some recent decisions concerning long-term gas supply contracts.

Between 2006 and 2008 the Bundeskartellamt initiated proceedings against 15 national and regional gas transmission companies for foreclosing the market for the supply of gas to regional and local distributors by concluding long-term gas supply contracts. In the decisions the agency imposed limitations on the duration as well as on the quotas of gas supply contracts, initially to be complied with until September 2010.

In order to decide whether to extend the provisions on quotas and contract periods beyond September 2010, the Bundeskartellamt examined the legal and factual market developments after the decisions. Over 100 market participants were asked about their contract practice and their experience in this area. With very few exceptions, purchasers of gas positively assessed the development of competition on the demand side of the market.

The evaluation showed that the intervention of the Bundeskartellamt was successful. The market was now characterized by different types of contracts, product diversity, a wider selection of suppliers and greater bargaining power on the demand side. Due to the positive changes observed in the market, the agency decided not to initiate new proceedings.

5. Other methodologies

The methodologies discussed above help to quantify what has been the actual impact of enforcement decisions on prices, and sometimes on other key market variables, by relying on information on how the affected markets have evolved following the decisions. There are also methodologies that try to determine what has been the impact of enforcement decisions, but that rely on information available at the time of the decisions and not on how markets have actually evolved as a result of these decisions. These methodologies are not ex-post methodologies, but they are still used in assessments of enforcement decisions and hence merit some attention.

The most well-known of these methodologies is the event studies one. We shall discuss it briefly in section 5.1.

As for cartel decisions, their assessment is sometimes based on the use of other methodologies that do not rely on ex-post information. This Guide will not cover these methodologies, and will just provide references for the interested reader.[109]

5.1 Stock market event studies[110]

Event studies use share prices to determine which firms have benefited or suffered from a CA's decision and from this information derive conclusions on the effects of enforcement decisions. Hence, this methodology does not rely on actual information on how market variables have evolved sometime after the decision was issued, but rather use information on stock market reactions at the time when the decision was issued to reconstruct its likely impact on firms' profitability and, hence,

109 For a review of methodologies that are employed in the assessment of the effects of cartels, see ABA Section of Antitrust Law (2014, pp. 301-340), Davis, P.J., & Garcés, E. (2010, pp.347-368), OECD (2011b), Oxera (2009) and Van Dijk, T., & Verboven, F. (2008). Connor (2007) and Connor (2014) provide broad compilations of reported harm estimates. For examples of peer-reviewed studies of harm from particular cartels, see Bolotova et al (2008), Froeb et al (1993), Gupta (2001), Lanzillotti (1996), Lee (1999), Pesendorfer (2000) and Porter and Zona (1999).

110 For a general discussion of event studies, their use, their advantages and limitations refer to MacKinlay (1997), and Cicchello and Lamdin (2006) – the latter focuses on their use in antitrust. For a discussion on the use of event studies in ex-post assessments of merger decisions refer to Buccirossi et al (2006), and Davies and Ormosi (2012). For their use in the context of cartels refer to Oxera (2009).

prices. At the same time, it cannot be considered an ex-ante methodology, since it uses data that were not available to the CA at the moment of taking the decision (i.e. it is based on the share prices after the enforcement decision is announced).

The event study methodology relies on the assumption that financial markets are perfectly efficient and the expectations of the agents that operate in them are rational. If these assumptions are true, a firm's stock price should represent the discounted value of its expected flow of profits. Hence, when news about an event that is expected to affect a firm's profits reaches the stock market, the stock price of that firm should immediately adapt to reflect this change in expectations. This implies that by assessing the stock market's reactions to an event, it is possible to derive a view on the likely effect of this event on the profitability of firms, and thus on their sales and prices. The event can be the announcement of a merger, the news of a dawn raid to collect information on a cartel, or the publication of a decision imposing remedies on a firm accused of an exclusionary behaviour.

Clearly such a methodology can be adopted only if the firms directly affected by decision and other market players are quoted on the stock market.

Methodologically, an event study requires that the following steps are performed:

- estimate the "normal returns" of the affected firm(s) on the day of the event - the change in stock price that would have happened if the event had not taken place, using a financial market model;[111]
- obtain data on the "actual returns" observed on the stock market on that same day; and
- deduct the former from the latter to obtain the "abnormal returns" – the change in stock price that can be attributed to the event.

Sometimes "cumulative abnormal returns" are used, which consist of the abnormal returns calculated for each of a number of days surrounding the event - the event window - summed over time[112]. The event window is the time period where one anticipates that there may be a stock price reaction to what the analyst has identified as the unanticipated information that may influence the investors' valuation of the profitability of a firm. The window should be large enough to capture the exact moment when the "news" first reaches the market, but not too large to include other events that may influence the results. Hence, it is important to be aware of any other important event that may have happened around the event window – e.g. a change in management in a major firm, a tax investigation, the announcement of an important investment or the launch of a new product.

The abnormal returns of the firms directly involved in the decision are not enough in themselves to determine the likely impact of the decision on their sales and prices, as they simply reveal if each firm is benefitting or suffering from the decision, but not for what reason. For example, the share prices of two firms may increase after their merger is announced: this information tells us that financial markets expect the firms to benefit from this merger, but not whether this due to an - anticompetitive - increase in their market power or through a - procompetitive - efficiency effect.

To interpret this information and determine if the abnormal returns were due to anti-competitive merger or behaviour or to a procompetitive one, analysts usually employ the sign and

111 Different models can be used to determine the normal returns. See McKinlay (1997) for an overview.

112 This approach has been developed by Fama et al (1969).

size of the abnormal returns of other market participants (which is only possible to do if these are quoted on the stock market):

- In the case of a merger decision, one could look at the how the share prices of competitors behave. If the competitors' share prices increased, one could assume that the merger is market-power enhancing because these firms would benefit from the merging firms' ability to raise prices; instead, if the competitors' share prices decreased one could assume that the merger is going to generate efficiencies because competitors would suffer from the merging parties' ability to increase the quality of their products or reduce their prices.

- In the case of an abuse of dominance or an anticompetitive vertical/horizontal agreement, analysts use information on the sign and magnitude of the abnormal returns of distributors, customers, suppliers, and competitors to determine the expected impact on consumer welfare of the incriminated behaviour. For example, one would expect customers to suffer from a behaviour that led to a price increase, but not from a behaviour that could generate efficiencies and a price reduction.

Box B.5 below describes two examples of ex-post evaluations based on event studies.

Box B.5 Examples of event studies

Example of an event study applied to a merger decision - the Pirelli/BICC merger

The merger between "Pirelli Cavi e Sistemi" and "BICC General", two producers of power cables systems, was cleared by the European Commission in 2000. Buccirossi et al (2006), in a report for the European Commission, performed an ex-post assessment of the effects of this decision.

The authors decided to perform the analysis through an event study, because they could not employ a DiD methodology, nor perform a merger simulation. The DiD methodology had to be ruled out because of the difficulties in identifying an appropriate control group, as the affected markets were going through numerous changes on the demand and on the supply side around the time of the decision. And they could not find a model appropriate for simulating this merger, because the main form of competitive interaction in the markets under consideration were auctions.

The first step of their analysis consisted of identifying the firms that were affected by the mergers, i.e. the competitors and the customers of the merging parties. The next step involved the identification of the relevant event dates and the authors decided to consider the date in which the merger was announced and the dates of the major steps in the merger control procedure - i.e. the notification, the Phase I decision and the Phase II decision[113].

They then collected the stock-market data on the merging parties and all the other affected firms that were quoted on the stock market. This data was used to estimate the relationship between the firms' stock prices and the value of a market portfolio in the month before each event. Using the estimated parameters, they then computed what would have been each firm's stock value if the event had not occurred – i.e. the counterfactual - and compared it with the observed stock prices. They thus obtained the daily abnormal returns for each firm.

The results showed that the abnormal returns for the competitors around the various dates were mainly negative and not statistically significant, while they were positive for the customers. Hence, the authors concluded that the investors expected the merger to bring about efficiencies.

As a robustness check, the authors repeated the analysis considering two larger event windows around the relevant dates, which permitted to control for any information leaks. They also collected the views of all major players on how the market had evolved since the merger had been allowed and what role the decision had had in shaping the market. This information was consistent with the result of the event study.

The overall conclusion was that the merger had been pro-competitive and that the Commission's decision had been appropriate.

[113] Phase I refers to the preliminary assessment of a merger, whereas Phase II refers to the more in-depth investigation of mergers that raised competition concerns when examined in Phase I.

Example of an event study applied to an abuse decision: Microsoft's abuse

Bittlingmayer and Hazlett (2000) use the event study methodology to examine share price reactions for both Microsoft and 159 other computer firms around 54 antitrust enforcement announcements involving Microsoft's alleged abuses over the period 1991-1997 in the US.

Opinions vary on whether Microsoft's aggressive marketing practices, given its large market share, constituted an abusive strategy, or whether it was a successful company winning clients through innovation and low prices. The abnormal returns of Microsoft alone do not permit to distinguish between these two views: they will always be negative when there are enforcement actions and positive when these actions are stopped. Hence, the authors try to shed light upon the expected effects on competition of these enforcement interventions by calculating the abnormal returns of other firms in the industry.

Their argument is that, if the interventions were enhancing competition, the abnormal returns of non-Microsoft computer companies should be positive because they should benefit from them: firms that buy Microsoft's products should expect lower prices, firms that produce complementary products should expect an outer shift in demand for their products, and Microsoft's rivals should expect lower barriers to entry and expansion. If, instead, the interventions were not competition enhancing, antitrust enforcement against Microsoft should damage other computer companies, as these would be deterred from undertaking efficiency-enhancing behaviours, and would face increased uncertainty (which would discourage investments).

The results of the event studies show that enforcement actions are accompanied by declines in the share value both of Microsoft and of the other computer companies, while the opposite happens in case of setbacks in enforcement. In the authors' opinion, these findings provide arguments to reject the hypothesis that Microsoft's conduct was anticompetitive and that antitrust policy was beneficial to competition and consumers.

5.1.1 Pros and Cons of Event Studies

Event studies do not require actual data on how the market has evolved, but only data on the stock market's reactions at the time of the decision; hence they can be used to assess any kind of decisions provided firms are quoted in the stock market. Indeed they can and have been used to assess decisions to clear and block mergers, as well as decisions on cartels, abuses and other types of competition enforcement decisions.

In addition event studies require relatively little data – mostly time series of share prices for the firms directly affected by the decisions and other market players - which can be easily acquired. The approach can be applied soon after the event, avoiding a long wait, and the econometric skills required are not very sophisticated.

All these advantages make this methodology look rather attractive. However one should be well aware of its numerous limitations.

First, the conclusions that can be derived when using this methodology are indirect, in that they are not based on the analysis of how markets have actually evolved following a decision, but on how financial analysts expects these market to evolve. As a consequence this implies that one must believe that financial markets are efficient and that share price movements in reaction to announcements from CAs represent the rational expectations of investors and analysts about the likely impact of the decision on the future profitability of the firms – which implies that financial markets are better at predicting outcomes than the CA. If one believes, as many economists do, that this assumption is not always satisfied, then the whole methodology loses credibility. The method also assumes that the news about rivals' future profitability conveyed by the authority's decision necessarily relates to an increase in the merged entity's market power. However, it need not. For example, a merger clearance might result in positive share price movements because of what it conveys about the authority's attitude to mergers in that sector, or about the market itself.

Many commentators, like Budzinski (2011) and Werden (2008), are very sceptical about the use of event studies, because they consider the efficient financial market hypothesis to be of questionable validity.

In addition, even if one believed that financial markets can predict the likely effects of a CA's decision, an important condition for the success of this methodology is that the event really represents *unanticipated information* for the investors and that the event window captures precisely the time when this information first reaches the stock market. If it is not possible to determine the precise day or a limited number of days over which the information first hit the stock market, it is unlikely that its effects on stock prices can be calculated.

Further it is necessary that a large share of the firms operating in the affected market, and in particular the firm(s) to whom the decision is addressed, are quoted on the stock market. In addition, a large share of the revenues of these firms must originate from the affected market, if such a condition is not satisfied it is unlikely that event will affect the firms' share prices. As an increasing number of quoted firms are now large conglomerate or multinationals that operate in a variety of product and geographic markets, this condition is becoming harder and harder to satisfy[114].

6. How to choose the methodology to use

This Guide does not aim to provide guidance on how to choose the methodology to use among those just discussed. The choice has to be made by the researcher on a case-by-case basis.

A number of factors will play a role in this choice, in particular:

- the nature, the quality, the level of disaggregation and the quantity of the available data, or of the data that could be obtained through a survey – each methodology (apart from surveys and interviews) has specific data requirements;
- the researcher's view on the accuracy of the various available methodologies, where by accuracy we mean the potential of a methodology to deliver unbiased and precise estimates of the true effect[115] – as discussed above, each methodology is based on some hypotheses and assumptions, when the researcher does not consider that these are satisfied she should discard that approach;
- the researcher's and her team's skills - some methodologies require a sophisticated knowledge of econometric techniques and software;
- the time available – as some methodologies can be more time-consuming than others; and
- the type of decision that has to be assessed - for example the price effect of a cleared merger can be assessed with any of the techniques just discussed, while that price effect of a blocked merges cannot be assessed with comparator-based approaches, because actual market developments do not provide any help; and

114 See McAfee and Williams (1988) for a discussion of this problem, and Beverley (2007) for a discussion of the difficulties of implementing event studies.

115 This definition is taken from Freidriszich and Roller (2010), who discuss in depth the issue of accuracy and of practicality in the choice of the methodology.

Table B.3 below summarises the methodologies that can be used for each type of decision – it is important to highlight that, as techniques evolve, this table may change. The table focuses on the three main quantitative ex-post methodologies discussed here and on the event study one, which is widely sued despite not being based on ex-post information.

Table B.3. Methodologies that can be applied to different types of decisions

Type of Decision	Structural Methods and Simulations	Before-and-after/ cross-section	Difference-in-Differences	Surveys and interviews	Stock market event studies [116]
Merger Unconditional Clearance	Yes	Yes	Yes	Yes	Yes
Merger Clearance with Structural Remedies	Yes	Yes	Yes	Yes	Yes
Merger Clearance with Behavioural Remedies	May be possible (depending on complexity of remedies)	Yes	Yes	Yes	Yes
Merger Prohibition	Yes	No	No	Yes	Yes
Vertical Mergers	Yes	Yes	Yes	Yes	Yes
Abuse of dominance	Yes	May be possible (if behaviour is stopped)	May be possible (if behaviour is stopped)	Yes	Yes
Cartel	Yes	Yes	Yes	Yes	Yes
Vertical Agreement	Yes	May be possible (if behaviour is stopped)	May be possible (if behaviour is stopped)	Yes	Yes

6.1 A recapitulation

Table B.4 below lists the major pros and cons of the methodologies discussed in this Annex:

116 Remember that this is not an ex-post methodology as it does not employ data on how the affected market has developed following the decision.

Table B.4. Pros and Cons of the various methodologies

Methodology	Cons	Pros
Before-and-after/ Cross-section	• Relies on the assumption that the only major change that has affected the market is the decision or else the research must be aware of all other shocks that may be affecting the market and be able to completely control for their effects. • Requires information on key variables in the affected market for some time before and after the event (or for the control market over the same period of time).	• Requires a limited amount of data (but this has to cover a sufficiently large window of time before and after the event). • It is relatively easy to implement. • Does not require strong assumptions on demand and supply curves. • Does not require assumptions on the type of competition prevailing in the market.
Difference-in-Differences	• Relies on the ability to find a valid control market/group. • Can only be used to assess decisions that have led to a change in the treated market, hence they are not appropriate for merger prohibitions • Requires information on key variables in both the control and affected markets for some time before and after the event • Does not permit to calculate the welfare effect of a decision.	• Requires data on key variables in both the control and affected markets for some time before and after the event, which is extensive but not as much as the data required by a simulation. • It is relatively easy to implement • Does not require strong assumptions on demand and supply curves. • Does not require assumptions on the type of competition prevailing in the market.
Simulations	• Requires making assumptions on both the demand and supply curve and on how firms compete in the market, and results are very sensitive to changes in these assumptions • Can only be used to assess markets where the prevailing form of competition matches an existing model of oligopoly. • Requires a considerable amount of data (such as cross-sections of price and quantity data, as well as demand and cost exogenous). • Requires very good econometric skills.	• Provided the appropriate model can be found, they can be used to assess any type of decision, including merger prohibitions. • Permits to calculate the welfare effects of a decision.
Surveys and interviews	• Can only arrive to an approximate assessment of the sign and magnitude of the effects. • Rely on the correct selection of the sample, on the appropriate design of the questionnaire and on appropriate checks on the reliability of the information collected. • Relies on the willingness of the surveyed parties to answer.	• Can be used to assess all types of decisions and all types of variables • Only requires information about the market and the characteristics of the target population • Generates data • Useful cross-check for other methodologies • Permits to identify effects on the market, especially non-price effects, that may not be derived from the quantitative analysis of data
Stock market event studies	• It is not an ex-post methodology, in that it does not use information on how the market has actually evolved - it only tries to predict the impact of the decision. • It can be used to determine only indirectly the impact of the decision on prices • Rely on the key assumption that financial markets are efficient. • Rely on the assumption that there was no leak of information before the enforcement decision was announced. • Can only be employed to study markets where firms are quoted on the stock market. • Are reliable when used to study the impact of decisions on firms that are not heavily diversified, so that most of their revenues come from the market affected by the decision.	• Can be used to assess all types of decisions • Only requires data on share prices for a short window of time before and after the event

ANNEX C
LIST OF EX-POST STUDIES

This annex includes an extensive, though totally non-exhaustive, list of ex-post studies done by authorities and academics. It is meant as a tool that researchers can use to identify those studies that could best satisfy their interest and provide them with ideas and suggestions for their own work. This list also exists in excel format and can be downloaded at: www.oecd.org/daf/competition/reference-guide-on-ex-post-evaluation-of-enforcement-decisions.htm. All publications are cited in full in the bibliography.

The results gathered have been classified according to: i) the type of publication studied (peer reviewed journal or other); ii) the type of decision assessed; iii) the sector; iv) the methodology employed, and v) the variables studied.

Title	Author, year	Type of publication*	Type of decision	Sector	Methodology **	Variables examined
Ex post evaluation in the UK retail market for books	Aguzzoni et al., 2013	WP	Cleared horizontal merger	Retail Sale of Books	Difference-in-Differences, Survey/Interviews	Price
A Retrospective merger analysis in videogames	Aguzzoni et al., 2014	PRJ	Cleared horizontal merger	Videogames	Difference-in-Differences, Survey/Interviews	Price
The short-term effects of merger on hospital operations	Alexander, Halpern and Lee, 1996	PRJ	Cleared horizontal merger	Hospitals	Difference-in-Differences	Scale, Staffing, Operating efficiency
The impact of retail mergers on food prices: evidence from France	Allain et al., 2013	WP	Cleared horizontal merger with remedies	Food Products	Difference-in-Differences, Survey/Interviews	Price
The Effect of Mergers in Search Markets: Evidence from the Canadian Mortgage Industry	Allen et al., 2013	PRJ	Cleared horizontal merger	Mortgages	Difference-in-Differences	Price
The impact of mergers and acquisitions on the efficiency of the US banking industry: further evidence	Al-Sharkas, Hassan and Lawrence, 2008	PRJ	Cleared horizontal merger	Banks	Difference-in-Differences	Cost, Profit
The effect of mergers on consumer prices: evidence from five mergers on the enforcement margin	Ashenfelter and Hosken, 2010	PRJ	Cleared horizontal merger, Cleared horizontal merger with remedies	Food Products, Motor Oil, Liquors, Feminine Hygiene Products	Difference-in-Differences	Price
Empirical methods in merger analysis: econometric analysis of pricing in FTC v. Staples	Ashenfelter et al., 2006	PRJ	Blocked horizontal merger	Office supply retailers	Other (Regressions)	Price
The price effects of a large merger of manifacturers: a case study of Maytag-Whirpool	Ashenfelter et al., 2013a	PRJ	Cleared horizontal merger	Domestic appliances	Difference-in-Differences	Price, Market shares, Variety (number of distinct appliance products offered for sale)
Efficiencies brewed: pricing and consolidation in the US beer industry	Ashenfelter et al., 2013b	WP	Cleared horizontal merger	Beer	Other (OLS regression)	Price, Market concentration, Quantity sold, Efficiency (reduction in distance between the retailer and the nearest brewery)
Are mega-mergers anticompetitive? Evidence from the first great merger wave	Banerjee and Eckard, 1998	PRJ	Cleared horizontal merger	Industrial and mining industry	Event study	Share prices

* CAR = Competition Agency Report; CH = Chapter in book; PRJ = Peer-reviewed journal; RP = Report; WP = Working Paper.

** Options: Difference-in-Differences, Before-and-After, Simulation, Event Study, Survey, Forecasting, Cost-based, Other.

Title	Author, year	Type of publication*	Type of decision	Sector	Methodology **	Variables examined
The price and profit effects of horizontal merger: a case study	Barton and Sherman, 1984	PRJ	Cleared horizontal merger with remedies	Duplicationg microfilms	Difference-in-Differences	Price, Profits
Do mergers increase product variety? Evidence from radio broadcasting	Berry and Waldfogel, 2001	PRJ	Various types of mergers	Radio broadcasting	Other (OLS regression, IV regression)	Entry, Quality (variety measured by the number of formats available relative to the number of stations)
Stock Market Event Studies and Competition Commission Inquiries	Beverley, 2007	WP	Various types of mergers	Media, Books, Brick Manufacturing, Water supply	Event study	Share prices
DOS Kapital: Has antitrust action against Microsoft created value in the coumputer industry?	Bittlingmayer and Hazlett, 2000	PRJ	Abuse of dominance	Softwares and Hardwares	Event study	Share prices
Does simulation Work? Evidence from the Swedish Analgesics Market	Bjornerstedt and Verboven, 2013	WP	Cleared horizontal merger	Pharmaceuticals	Simulation	Price
The impact of collusion on price behavior: Empirical results from two recent cases	Bolotova et al, 2008	PRJ	Cartel	Chemicals	Other (ARCH and GARCH models)	Price (overcharge)
Airline mergers, airport dominance, and market power	Borenstein, 1990	PRJ	Cleared horizontal mergers [(1)]	Airlines	Difference-in-Differences	Price
Illegal Cartel Overcharges in Markets with a Legal Cartel History: Bitumen Prices in South Africa	Boshoff, 2015	PRJ	Cartel	Bitumen	Forecasting, Difference-in-Differences	Price
Post-entry competition in the plain paper copier market	Bresnahan, 1985	PRJ	Abuse of dominance	Plain Paper Copiers	Other (Qualitative Analysis)	Price, Market shares
Mergers, coordinated effects and efficiency in the Portuguese non-life insurance industry	Brito et al., 2013	PRJ	Cleared horizontal mergers	Non-life Insurance	Simulation	Price, Efficiency (costs), Quantities, Profits
Fare determination in airline hub-and-spoke networks	Brueckner et al., 1992	PRJ	Cleared horizontal mergers	Airlines	Simulation	Price
Ex-post review of merger control decisions	Buccirossi et al., 2006	REP	Various types of mergers	Power Cables	Event study, Survey/Interviews	Share prices, Price, Quantity, Efficiency (total production costs per unit)
Report on the evaluation of the decisions on long-term gas supply contracts	Bundeskartellamt, 2010	CAR	Abuse of dominance	Gas supply	Survey	Delivery costs, N. of suppliers, Duration of contracts, Range of products, Other
Monopoly-creating bank consolidation? The merger of Fleet and BankBoston	Calomiris and Pornrojnangkool, 2005	WP	Cleared horizontal mergers	Banking	Difference-in-Differences	Price (interest rates)
Evaluating Market Consolidation in Mobile Communications	CERRE, 2015	REP	Cleared horizontal mergers	Telecommunications	Difference-in-Differences	Price, investment
Mergers in Two-Sided Markets: An Application to the Canadian Newspaper Industry	Chandra and Collard-Wexler, 2009	PRJ	Cleared horizontal mergers	Newspapers	Difference-in-Differences	Price
Targeted Ex Post Evaluations in a Data Poor World.	Chitale and Csorgo, 2015	CAR	Cleared horizontal mergers	Various industries	Survey/Interviews	Entry and other qualitative variables
A treatment effect method for Merger Analysis with an application to Parking Prices in Paris	Chone and Linnemer, 2012	PRJ	Cleared horizontal mergers	Parking Lots	Difference-in-Differences	Price
Deterrent Effects of National Anticartel Laws: Evidence from International Vitamins Cartel	Clarke and Evenett, 2003	PRJ	Cartel	Vitamins	Before-and-after, Other (regressions)	Price (overcharge), Imports

[(1)] These mergers are also assessed in Werden et al (1991), Morrison (1996) and Peters (2006).

Title	Author, year	Type of publication*	Type of decision	Sector	Methodology **	Variables examined
Evaluation of CCM case: IBL consumer goods sales contracts with retail store	Competition Commission of Mauritius, 2011	CAR	Abuse of dominance	Food Products	Before-and-After	Price, HHI, Market share
Ex Post Merger Review: An evaluation of three Competition Bureau merger assessments	CRA, 2007	REP	Cleared horizontal merger	Radio Broadcasting, Coal, Building Materials	Other (Qualitative analysis, Regressions)	Price, Entry, Profits, Variety (change in the number of formats)
Separating the ex post effects of mergers: an analysis of structural changes on the Hungarian retail gasoline market	Csorba, Koitay and Farkas, 2011	OTHER	Cleared horizontal merger	Wholesale and Retail Gasoline	Difference-in-Differences	Price
Paying a premium on your premium? Consolidation in the US health insurance industry	Dafny et al., 2012	PRJ	Cleared horizontal merger with remedies	Health Insurance	Before-and-After	Price (premium), HHI
Mergers and acquisitions in the pharmaceutical and biotech industries	Danzon, Epstein and Nicholson, 2007	PRJ	Cleared horizontal merger	Pharmaceutical and biotech industry	Difference-in-Differences	Profit, R&D Investment
The impact of antitrust fines on firm valuation in South Africa: the case of Pioneer foods, Tiger brands and Sasol Chemical Industries	Darji et al., 2011	WP	Cartel	Food, Chemicals	Event study	Share prices
Assessment of the long steel cartel	Das Nair, Mondliwa and Sylbvester, 2014	OTHER	Cartel	Long steel bars	Difference-in-Differences	Price, Damages
E-book pricing and vertical restraints	De Los Santos and Wildenbeest, 2014	WP	Cartel, Vertical restraints	E-books	Difference-in-Differences	Price
Review of mergers decisions under the Enterprise Act 2002	Deloitte, 2009	REP	Cleared horizontal merger, Cleared horizontal merger with remedies, Blocked horizontal merger	Cans, Healthcare Products, Licensed Betting, Processed Food, Soft Drinks, Rail Freight Maintenance Services, Insulation Materials, Corrugated Cardboard Packaging	Simulation, Survey/Interviews	Price, Entry
Merger impacts on investor expectations: an event study for Australia	Diepold et al., 2008	PRJ	Cleared horizontal mergers, Cleared vertical merger	Various	Event study	Share prices
The Impact of Mergers on Fares Structure: Evidence from European Low-Cost Airlines	Dobson and Piga, 2013	PRJ	Cleared horizontal merger	Airlines	Difference-in-Differences	Price
Hospital consolidation and costs: another look at the evidence	Dranove and Lindrooth, 2003	PRJ	Cleared horizontal mergers	Hospitals	Difference-in-Differences	Costs
Is the event study methodology useful for merger analysis? A comparison of stock market and accounting data	Duso et al., 2010	PRJ	Cleared horizontal merger	Various	Event study, Other (analysis of accounting data)	Share prices, Profits
How effective is European merger control?	Duso et al., 2011	PRJ	Various types of mergers	Various	Event study, Other (regression analysis)	Share prices

Title	Author, year	Type of publication*	Type of decision	Sector	Methodology **	Variables examined
Horizontal mergers, collusion, and stockholder wealth	Eckbo, 1981	PRJ	Horizontal and Vertical mergers	Mining, Manufacturing	Event study	Share prices
Ex-post analysis of two mobile telecom mergers: T-Mobile/tele.ring in Austria and T-Mobile/Orange in the Netherlands	European Commission, DG Competition, 2015	CAR	Cleared horizontal merger, Cleared horizontal merger with remedies	Telecommunications	Difference-in-Differences, Other (Synthetic control method)	Price
Do mergers improve hospital productivity?	Ferrier and Valdmanis, 2004	PRJ	Cleared horizontal merger	Hospitals	Difference-in-Differences	Cost efficiency, Productivity
Are Mergers beneficial to consumers? Evidence from the market for bank deposits	Focarelli and Panetta, 2003	PRJ	Cleared horizontal merger	Banking	Difference-in-Differences	Price
What is the Effect of Bid-rigging on Prices?	Froeb et al, 1993	PRJ	Cartel (bid-rigging)	Frozen seafood	Other (forecasting and backcasting estimate)	Price (overcharge)
Measuring Merger Cost Effects: Evidence from a Dynamic Structural Econometric Model	Gayle and Le, 2013	WP	Cleared horizontal merger	Airlines	Difference-in-Differences, Simulation	Price, Costs
Assessing the case for in-country mobile consolidation	GSMA, 2015	REP	Cleared horizontal merger with remedies	Mobile operators	Before-and-After	Price
On measuring the economic impact: savings to the consumer post cement cartel burst	Govinda et al., 2014	OTHER	Cartel	Cement	Before-and-After	Price, Savings to consumers
Mergers When Prices Are Negotiated: Evidence from the Hospital Industry	Gowrisankaran et al., 2015	PRJ	Cleared horizontal merger with remedies, Blocked horizontal merger	Hospitals	Simulation	Price
Measuring efficiency gains from hospital mergers	Groff, Lien and Su, 2007	PRJ	Cleared horizontal merger	Hospitals	Difference-in-Differences	Efficiency (estimation of the production frontier)
The effects of mergers: an international comparison	Gugler et al., 2003	PRJ	Horizontal merger, Vertical merger, Conglomerate merger	Manufacturing, Services	Difference-in-Differences	Profits, Sales
Hospital Mergers and Competitive Effects: Two Retrospective Analyses	Haas-Wilson and Garmon, 2011	PRJ	Cleared horizontal mergers, Blocked horizontal merger	Hospitals	Difference-in-Differences	Price
Do mergers really reduce costs? Evidence from hospitals	Harrison, 2011	PRJ	Cleared horizontal merger	Hospitals	Other (Non parametric estimation of potential cost savings)	Costs
Do mergers and acquisitions create shareholder wealth in the pharmaceutical industry?	Hassan et al., 2007	PRJ	Cleared horizontal merger	Pharmaceuticals	Event study	Share prices
Market Power, Vertical Integration and the Wholesale Price of Gasoline	Hastings and Gilbert, 2005	PRJ	Vertical merger	Wholesale and Retail Gasoline	Difference-in-Differences	Price
Hospital mergers and acquisitions: does market consolidation harm patients?	Ho and Hamilton, 2000	PRJ	Cleared horizontal merger	Hospitals	Difference-in-Differences	Quality (inpatient mortality for heart attack and stroke patients and other measures)
Cementing Relationships: Vertical Integration, ForeclosureProductivity and Prices	Hortaçsu and Syverson, 2007	PRJ	Vertical merger	Cement, concrete	Other (Regression of the dependent variables on indicators of vertical integration)	Price, Quantity, Productivity (TFP)
Do Retail Mergers Affect Competition? Evidence from Grocery Retailing	Hosken et al., 2012	WP	Cleared horizontal merger	Supermarkets	Difference-in-Differences	Price

Title	Author, year	Type of publication*	Type of decision	Sector	Methodology **	Variables examined
Does concentration matter? Measurement of petroleum merger price effects	Hosken, Silvia and Taylor, 2011	PRJ	Cleared horizontal merger [2]	Wholesale and Retail Gasoline	Difference-in-Differences	Price
Spatial differentiation and vertical mergers in retail markets for gasoline.	Houde, 2012	PRJ	Cleared vertical merger	Gasoline	Difference-in-Differences, Simulation	Price
Assessing the effects of a roadsurfacing cartel in Switzerland	Hüschelrath et al., 2009	PRJ	Cartel	Road Construction	Other (Descriptive statistics)	Price
Effect of the German cement cartel on market prices	Hüschelrath et al., 2013	PRJ	Cartel	Cement	Difference-in-Differences; Before-and -After	Price
Study of the economic impact of enforcement of competition policies on the functioning of energy markets	ICF and DIW, 2015	REP	Cleared horizontal merger with remedies, Abuse of dominance	Energy	Difference-in-Differences, Other (qualitative Analysis)	Price
Resale price maintenance: An economic assessment of the Federal Trade Commission's case against the corning glass works	Ippolito and Overstreet, 1996	PRJ	Vertical restraints	Cookware products	Event study, Other (Qualitative analysis)	Price, Market shares
Quantifying the effects from horizontal mergers in European competition policy	Ivaldi and Verboven, 2005	PRJ	Blocked horizontal merger	Motor Vehicles	Simulation	Price
Bank Consolidation and the Dynamics of Consumer Loan Interest Rates	Kahn, Pennacchi and Sopranzetti, 2005	PRJ	Cleared horizontal merger	Banks	Difference-in-Differences	Price (personal loan interest rates and automobile loan interest rates)
The impact of mergers in US petroleum industry on wholesale gasoline prices	Karikari et al., 2007	PRJ	Cleared horizontal mergers [3]	Railroads, Wholesale Gasoline	Difference-in-Differences	Price
The Union Pacific/Southern Pacific railroads merger: Effect of trackage rights on rates	Karikari, Brown and Nadji, 2002	PRJ	Cleared horizontal merger with remedies	Wholesale gasoline	Difference-in-Differences	Price
Price effects of Dutch hospital mergers: an ex-post assessment of hip surgery	Kemp et al., 2012	PRJ	Cleared horizontal merger	Healthcare	Difference-in-Differences	Price, Quality (average travelling time of patients)
Harm and overcharge in the South African precast concrete products cartel	Khumalo et al., 2014	PRJ	Cartel	Precast Concrete Products	Difference-in-Differences	Price, Entry
Mergers and market power: Evidence from the airline industry	Kim and Singal, 1993	PRJ	Cleared horizontal merger	Airlines	Difference-in-Differences	Price, Efficiency
Evaluating the German bank merger wave	Koetter, 2005	OTHER	Various types of mergers	Banking	Other (Estimation a stochastic cost frontier)	Costs
Estimating the Impact of Competition in Text Message Service to Consumer Welfare	Institute for Economic and Social Research (Indonesia), 2011	CAR	Horizontal agreement	Telecommunications	Other (Compensating Variation method)	Price, Entry, Welfare
Effects of hospital mergers and acquisitions on prices	Krishnan and Krishnan, 2003	PRJ	Various types of mergers	Hospitals	Difference-in-Differences	Revenue per patient, Operating cost per patient, Operating margins
Market restructuring and pricing in the hospital industry	Krishnan, 2001	PRJ	Cleared horizontal merger	Hospitals	Difference-in-Differences	Price
The influence of mergers on firms' product-mix strategies	Krishnan, Joshi and Krishnan, 2004	PRJ	Cleared horizontal merger	Hospitals	Difference-in-Differences	Quality (product mix)

[2] This merger was also assessed by Karikari et al., (2007).

[3] This merger was also assessed by Hosken, Silvia and Taylor (2011).

Title	Author, year	Type of publication*	Type of decision	Sector	Methodology **	Variables examined
Do mergers improve efficiency? Evidence from restructuring the US electric power sector	Kwoka and Pollitt, 2010	PRJ	Cleared horizontal merger	Electricity distribution	Difference-in-Differences	Efficiency (efficiency scores)
Estimating consumer damages in cartel cases	Laitenberger and Smuda, 2013	WP	Cartel	Laundry detergents	Difference-in-Differences, Before-and-After	Price, Consumer damages
Ex-post assessment of merger effects: the case of Pfizer and Pharmacia (2003)	Leheyda et al., 2011	WP	Cleared horizontal merger with remedies	Pharmaceuticals	Before-and-After	Price, Market share
Horizontal Mergers in the Iron Ore Industry	Lundmark and Warell, 2007	PRJ	Cleared horizontal merger	Iron Ores	Event Study	Price
Is the efficiency doctrine valid? An evaluation of US local exchange telecommunications company mergers	Majumdar et al, 2010	OTHER	Cleared horizontal mergers	Telecommuni-cations	Before-and-After	Efficiency (operational performance measures, e.g. ratio of total plant specific operations expenses to total communications plants in service)
Damage claims in the Spanish Sugar Cartel case	Marcus, 2014	WP	Cartel	Sugar	Coast-based approach	Price
Journal pricing and mergers: a portfolio approach	McCabe, 2002	PRJ	Cleared horizontal mergers (some with remedies)	Academic Biomedical Journals, Legal Publications, Professional Books	Difference-in-Differences	Price
The South African Wheat Flour Cartel	Mncube, 2014	PRJ	Cartel	Wheat Flour	Before-and-After	Price
Bank mergers and lending relationships	Motoriol-Garriga, 2008	WP	Cleared horizontal merger	Banking	Difference-in-Differences	Price
Airline mergers: A longer view	Morrison, 1996	PRJ	Cleared horizontal mergers [(4)]	Airlines	Difference-in-Differences	Price
Assessment of damages in the district heating pipe cartel	Møllgaard, 2006	WP	Cartel	District Heating Pipes	Before-and-After, Cost-based	Price
The effects of US hospital consolidations on hospital quality	Mutter et al, 2011	PRJ	Cleared horizontal merger	Hospitals	Difference-in-Differences	Quality (patient outcomes)
Mergers with differentiated products: The case of the ready-to-eat cereal industry	Nevo, 2000	PRJ	Cleared horizontal merger	Cereals	Simulation	Price, Welfare
On Simulation and Reality: a Swedish example	Nilsson and Strand, 2005	CH	Cleared horizontal merger	Bread	Simulation	Price
Methods for Quantifying Antitrust Damages: The Pasta Cartel in Italy	Notaro, 2014	PRJ	Cartel	Pasta	Before-and-After, Forecasting	Price (overcharge)
An evaluation of the impact upon productivity of ending resale price maintenance on books	OFT, 2008	CAR	Vertical restraints	Books	Difference-in-Differences	Productivity (labour productivity), Price, Entry, Market shares
Effects of Domestic Merger on Exports: The Case Study of the 1998 Korean Automobiles	Ohashi and Toyama, 2014	WP	Cleared horizontal merger	Automakers	Simulation	Price, Efficiency (marginal cost), Export
Mergers and innovation in big pharma	Ornaghi, 2009	PRJ	Cleared horizontal merger	Pharmaceutical	Difference-in-Differences	Innovation (R&D input, output and productivity)
Mergers and DiD estimators: Why do firms do not increase prices?	Jiménez and Perdigero, 2012	WP	Cleared horizontal merger	Retail Gasoline	Difference-in-Differences	Price
Do mergers improve the X-efficiency and scale efficiency of US banks? Evidence from the 1980s	Peristiani, 1997	PRJ	Cleared horizontal merger	Banks	Difference-in-Differences, Other (regressions)	Efficiency (cost function based distribution-free approach)

[(4)] These mergers are also assessed in Borenstein (1990), Werden et al (1991) and Peters (2006).

Title	Author, year	Type of publication*	Type of decision	Sector	Methodology **	Variables examined
Evaluating the performance of simulation: evidence from the US airline industry	Peters, 2006	PRJ	Cleared horizontal mergers[5]	Airlines	Simulations; Difference-in-Differences	Price
Mergers, brand competition, and the price of a pint	Pinkse and Slade, 2004	PRJ	Cleared horizontal mergers	Breweries	Simulation	Price
Ohio School Milk Markets: An Analysis of Bidding	Porter and Zona, 1999	PRJ	Cartel (bid-rigging)	Milk	Difference-in-Differences	Price (overcharge)
Do substantial horizontal mergers generate significant price effects? Evidence from the banking industry	Prager and Hannan, 1998	PRJ	Cleared horizontal mergers	Banking industry	Difference-in-Differences	Price
The effects of horizontal mergers on competition: the case of the Northern Securities Company	Prager, 1992	PRJ	Blocked horizontal merger	Railroads	Event study	Share prices
Divestiture requirements as a tool for competition policy: a case from the Swedish beer market	Friberg and Romahn, 2014	WP	Cleared horizontal merger with remedies	Beer	Difference-in-Differences, Simulation	Prices
A retrospective analysis of the clinical quality effects of the acquisition of highland park hospital by Evanston Northwestern Healthcare	Romano and Balan, 2010	PRJ	Cleared horizontal merger	Hospitals	Difference-in-Differences	Quality (patient outcomes: risk-adjusted mortality and complication rates for a number of clinical conditions)
Assessing the impact of antitrust intervention by the Italian Competition Authority	Sabbatini, 2010	PRJ	Cleared horizontal merger with remedies	Milk	Other (Descriptive statistics)	Price, Consumer welfare
Transformation and Continuity: The US Carbonated Soft Drink Bottling Industry and Antitrust Policy Since 1980	Saltzman et al., 1999	CAR	Cleared horizontal merger, vertical merger	Carbonated Soft Drinks	Other (Reduced-form equations)	Price, Sales
Case studies of the price effects of horizontal mergers	Schumann, Rogers and Reitzes, 1992	CAR	Cleared horizontal merger	Corrugating Medium for boxes, Titanium Dioxide, Cement	Before-and-After	Price
Petroleum mergers and competition in the northeast United States	Silvia and Taylor, 2013	PRJ	Cleared horizontal merger, Cleared horizontal merger with remedies	Gasoline and Diesel	Difference-in-Differences	Price
Are retailing mergers anticompetitive? An event study analysis	Simpson and Hosken, 1998	WP	Cleared horizontal mergers	Retail (department stores and supermarkets)	Event study	Share prices
Michigan gasoline pricing and the Marathon-Ashland and Ultramar Diamond Shamrock transaction	Simpson and Taylor, 2005	CAR	Cleared horizontal merger	Petroleum industry	Difference-in-Differences	Price
The Geography of Grocery Demand in the UK: An Evaluation of the 2003 Morrisons-Safeway Merger	Skrainka, 2012	WP	Cleared horizontal merger	Groceries	Simulation	Price, Profits, Consumer welfare
Beer and the Tie: Did Divestiture of Brewer-owned Public Houses Lead to Higher Beer Prices?	Slade, 1998	PRJ	Vertical restraints	Breweries	Other (Reduced-form price and profit equations, test for structural break)	Price, Profits
Merger simulations of unilateral effects: what can we learn from the UK brewing industry?	Slade, 2009	WP	Cleared horizontal merger with remedies, Blocked horizontal merger	Breweries	Simulation	Price, Margins

[5] Some of these mergers are also assessed in Werden et al (1991), Morrison (1996) and Borenstein (1990).

Title	Author, year	Type of publication*	Type of decision	Sector	Methodology **	Variables examined
The effect of non-rural hospital mergers and acquisitions: An examination of cost and price outcomes	Spang, Arnould and Bazzoli, 2009	PRJ	Cleared horizontal merger	Hospitals	Difference-in-Differences	Price, Cost
Hospital mergers and savings for consumers: exploring new evidence	Spang, Bazzoli and Arnould, 2001	PRJ	Cleared horizontal merger	Hospitals	Difference-in-Differences	Price, Cost
Examining antitrust policy towards horizontal mergers	Stillman, 1983	PRJ	Cleared horizontal mergers	Heavy trucks, Liquor distilling, Candies Coal, Health and Beauty Products, Filters, Natural Gas engines, Oil Refining, Batteries, Ethical Drugs Roofing Materials	Event study	Share prices
Mergers, capital gains, and productivity: Evidence from US telecommunications mergers	Sung and Gort, 2006	PRJ	Cleared horizontal merger	Telecommunications	Difference-in-Differences	Productivity (TFP), Costs, Shareholder returns
The Economic Effects of the Marathon-Ashland Joint Venture: The Importance of Industry Supply Shocks and Vertical Market Structure	Taylor and Hosken, 2007	PRJ	Cleared horizontal merger	Petroleum	Difference-in-Differences	Price
The success of divestitures in merger enforcement: Evidence from the J&J-Pfizer transaction	Tenn and Yun, 2011	PRJ	Cleared horizontal merger with remedies	Health Products	Before-and-after, Difference-in-Differences	Prices, Sales
The price effects of hospital mergers: a case study of the Sutter–Summit transaction	Tenn, 2011	PRJ	Cleared horizontal merger	Hospitals	Difference-in-Differences	Price
The effect of hospital mergers on inpatient prices: a case study of the New Hanover–Cape Fear transaction	Thompson, 2011	PRJ	Cleared horizontal merger	Hospitals	Difference-in-Differences	Price
Evaluation of the OFT's decision in 2011 on abuse of a dominant position by Reckitt Benckiser Healthcare (UK) Limited and Reckitt Benckiser Group	UK CMA, 2015	CAR	Abuse of dominance	Pharmaceuticals	Before-and-After, Difference-in-Differences, Other (Qualitative Analysis)	Price, Number of suppliers of competing products, Market share of the incumbent supplier and competitors
Ex post evaluation of mergers	UK OFT and CC, 2005	REP	Cleared horizontal merger	Various	Survey/Interviews	Changes to the market since the merger (e.g. prices, profits, entry/exit, new products, new technology, and changes in customer tastes and buying strategies)
Evaluating the impact of the OFT's 2001 abuse of dominance case against Napp Pharmaceuticals	UK OFT, 2011	CAR	Abuse of dominance	Pharmaceuticals	Before-and-After, Other (Qualitative analysis)	Price, Market share
Shell - Rontec. An evaluation of the OFT's conditional clearence of the merger	UK OFT, 2014	WP	Cleared horizontal merger with remedies	Petroleum	Difference-in-Differences	Price

Title	Author, year	Type of publication*	Type of decision	Sector	Methodology **	Variables examined
The Petroleum Industry: Mergers, Structural Change, and Antritrust Enforcement	US FTC, 2004	CAR	Cleared horizontal merger	Petroleum	Other (Descriptive statistics)	Prices
Using retail data for upstream merger analysis	Villas-Boas, 2007	PRJ	Cleared horizontal merger	Coffee	Simulation	Price, Welfare
The competitive effects of not-for-profit hospital mergers: a case study	Vita and Sacher, 2001	PRJ	Cleared horizontal merger	Hospitals	Before-and-After, Other (Reduced Form Price Equations)	Price, Quality (per-admission expenses)
Evidence on the accuracy of merger simulations	Weinberg and Hosken, 2013	PRJ	Cleared horizontal merger	Car motor oil, Breakfast Syrup	Simulation	Price
More evidence on the performance of simulations	Weinberg, 2011	PRJ	Cleared horizontal merger	Feminine Hygiene products	Simulation, Difference-in-Differences, Before-and-After	Price
The effects of mergers on price and output: Two case studies from the airline industry	Werden, Joskow and Johnson, 1991	PRJ	Cleared horizontal merger [(6)]	Airlines	Difference-in-Differences	Price
Long-run effects of mergers: The case of US western railroads	Winston, Maheshri and Dennis, 2011	PRJ	Cleared horizontal merger with remedies	Railroads	Difference-in-Differences	Price

[(6)] Same mergers are also assessed in Borenstein (1990), Morrison (1996) and Peters (2006).

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