Statistical inference in competition policy: how to improve market definition by thinking like a statistician

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Abstract

The delineation of the relevant product and geographic market is an important first step in competition inquiries in the EU, US and also developing countries such as South Africa. Market definition, however, is frequently criticized for being arbitrary and, more recently, for being less useful given the availability of econometric models capable of directly predicting competitive effects. Despite these criticisms, practical constraints (such as limited data for sophisticated modelling) and legal considerations (such as case law precedence and preferences for legal certainty) continue to support the formal definition of the relevant market. This paper aims to improve current practice by using statistical decision theory to explain the key features of a rational market definition decision. Specifically, the paper derives a Bayesian decision rule to show that, under uncertainty, an optimal market definition decision balances (1) the weight of case evidence in favour and against substitutability, (2) "prior probabilities" determined by previous cases and existing research, and (3) the loss function of the decision-maker. These features have implications for market definition practice: market definition should eschew an "in or out" approach in favour of a ranking approach, rely on the current scientific record where case evidence is inconclusive, and employ a variety of tools rather than a single econometric model. The recently concluded Primedia/Kaya partial merger case, in which radio market definition was highly contentious, is used to discuss the extent to which the market definition conforms to the decision rule.

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1. Introduction

In a competition case, the court or authority judges the welfare effects of a business practice or a proposed merger. The judgment by the court is an inference under uncertainty and statistical decision theory can help to unpack the factors that influence such an inference. Cooper, Froeb, O'Brien and Vita (2005) use statistical decision theory to show that the rational judgment of a vertical restraint involves a careful weighing of pro- and anti-competitive evidence rather than a binary decision[2]. But the weighing of evidence is only one determinant of a court's judgment. Cooper et al. (2005) also show that judgment does not occur in a historical vacuum and that existing case law and economic research generate 'prior' probabilities that raise the standard of proof in any given case. In addition, the preferences of the decision-maker (the loss function) also matter: the decision-maker can assign different costs to the risk of disallowing a pro-competitive practice and of allowing an anti-competitive practice. Empirical evidence in a particular vertical restraints case can therefore be outweighed by case law, economic theory, and asymmetric loss functions – and still constitute a rational judgment.

Cooper et al. (2005) deals with the judgment of vertical restraints, but statistical decision theory can also be applied to market definition, which is subject to notable uncertainty. Statistical decision theory can help to unpack the roles of weighing of evidence, prior probabilities and loss functions in market definition. Prior probabilities matter for market definition, as previous research or case law findings on substitutability raise the standard of proof in market definition. Loss functions may also be important, as the relevant market is defined by economists working for opposing parties and they could weigh the evidence differently as a result of their side's perspective. When the weight of evidence is not strongly in favour or against substitutability, prior probabilities and loss functions can determine whether the particular product is included in the relevant market. As shown below, an outcome dictated by prior probabilities or loss functions is consistent with a rational decision rule.

This paper studies market definition as a problem of statistical inference under uncertainty and is structured as follows. First, the paper considers the need for an explicit treatment of uncertainty in market definition, focusing on conceptual ambiguity and model uncertainty. Second, the paper introduces a Bayesian decision rule for market definition. Third, the paper interprets the major elements of the Bayesian decision rule, emphasizing the roles of prior probabilities, loss functions and weight of

[2] In the United States, since the 1977 Sylvania ruling, complainants must link consumer harm to the vertical restraint; in the European Union, Article 81 and the 2010 vertical restraint guidelines emphasize an analysis of a particular vertical practice; section 5(1) of the South African Competition Act requires weighing of pro- and anti-competitive effects of a vertical restraint.

evidence. Fourth, the paper discusses the problems of relying on a specific model for market definition. Finally, the paper evaluates the extent to which market definition in a recently concluded South African merger case employ the decision rule principles developed in the paper.

2. Uncertainty in market definition

The translation of economics into legal practice is a challenging task. Market definition is not exempt from this problem and is conducted under conditions of notable uncertainty due to conceptual ambiguity and model uncertainty.

2.1 Conceptual ambiguity

Competition policy involves a combination of law and economics, with economics providing a conceptual framework for competition law (Neven 2006). For example, the price elasticity of demand, monopoly and oligopoly are key concepts in competition policy derived from economics (Baker and Bresnahan 2008: 2). The application of rich economic concepts within the legal setting of competition policy poses challenges to practitioners and policymakers, as law requires codifiable concepts and unambiguous conditions in the interest of procedural efficiency and legal clarity. This need for legal clarity has led competition authorities in the US and EU to issue guidelines or directives to standardize economic analysis by providing definitions of key economic concepts (see, for example, European Commission (2008) and United States Department of Justice and Federal Trade Commission (2010)).

Translating economic concepts into law is particularly challenging in the context of market definition. Substitutability is the central economic concept in market definition, but it is remarkably difficult to codify. US competition authorities implicitly define substitutability in merger investigations by reference to a thought experiment, the so-called hypothetical monopolist (HM) test (United States Department of Justice and Federal Trade Commission 1992: 3):

> "A market is defined as a product or group of products and a geographic area in which it is produced or sold such that a hypothetical profit-maximising firm, not subject to price regulation, that was the only present and future producer or seller of those products in that area likely would impose at least a 'small but significant non-transitory' increase in price, assuming the terms of sale of all other products are held constant. A relevant market is a group of products and a geographic area that is no bigger than necessary to satisfy this test"

The HM test defines substitutability of two products implicitly as the degree to which one firm is constrained by the product of the other firm in adjusting its price upward. This is a broad definition, but is

intended to emphasize the price constraint as the measure of substitutability. In its definition of product markets, the European Commission defines substitutability by reference to price characteristics, price relationships and use (European Commission 1997):

> "A relevant product market comprises all those products and/or services which are regarded as interchangeable or substitutable by the consumer, by reason of the products' characteristics, their prices and their intended use"

In other jurisdictions, including the UK and developing countries such as South Africa, practitioners tend to rely on similarly broad definitions of substitutability (Theron 2001; Davis and Garcés 2010). The broad definitions adopted in the various jurisdictions reflect the complexity of the substitutability concept. However, broad definitions also reflect a trade-off: competition authorities weigh the need for legal clarity against the need for an informed analysis, which may require case-specific empirical analysis. This renders conceptual ambiguities, and the accompanying uncertainty, inevitable in market definition. Case law and economic research can identify market features that influence substitutability, which could partially address the problem of conceptual ambiguity. Despite these contributions it remains difficult to codify exactly which features of a particular product should matter for substitutability, especially in the case of a differentiated product.

2.2 Model uncertainty

Apart from conceptual ambiguities, market definition also faces model uncertainty, i.e. uncertainty about the level of potential knowledge that an analyst can have about the model used to measure substitutability. 'Model' in this context is broadly defined and covers fully-specified econometric IO models but also a range of other tools used for assessing substitutability (including, for example, price tests).

Model uncertainty is not limited to competition policy and is a common problem in applied economics. For example, model uncertainty is a "shared experience for applied econometrics" (du Plessis 2009: 428) and is closely associated with the debate surrounding the benefits and potential risks of data mining in econometrics (Hoover and Perez 2000; Spanos 2000; White 2000; du Plessis 2009). In the context of market definition, model uncertainty arises for two reasons: firstly, substitutability is unobservable and must be inferred from non-experimental data and, secondly, the model used for assessing substitutability relies on local rather than global information.

Substitutability is not directly observable and must be inferred from non-experimental data, which may be difficult to interpret. For example, the conditions assumed under the HM thought experiment is difficult to mimic in real-world markets: it is rare to find a natural experiment where the firm under investigation

unilaterally raises its prices without other market factors also changing. Instead, analysts defining markets are forced to deal with the problem of inferring substitutability from observed data (Baker and Bresnahan 2008). But such inferences can be misleading, as observed data can be consistent with a number of possible interpretations. This problem of multiple interpretation pervades the social sciences and is known as the identification problem (Manski 1995): it is difficult to 'identify' the correct model from the observed data. The identification problem forms the basis of Stigler and Sherwin's (1985) pessimistic label of the HM test as "completely nonoperational".

The identification problem in market definition is best explained by reference to a simple example. Suppose the analyst aims to study the price elasticity of demand for corn. It is usually not possible to directly estimate this demand elasticity, as the demand curve for corn is not observable. The analyst only observes the realized prices and quantities of corn traded and it is not possible to identify a demand function from the price-quantity relationship without additional data. However, if additional data on supply-shift variables is available, the analyst can label particular quantity movements as demand movements. For example, suppose information on the weather conditions for a particular year is available. A match of annual weather conditions with corresponding annual corn price and quantities would then help to isolate variation in quantities due to demand[3]. The weather variable is called an 'instrumental' variable. The identification problem therefore requires the analyst to search for a sufficient number of suitable instrumental variables.

The identification problem in market definition may be more complicated than suggested by the corn example, as market definition usually requires estimates on the cross-price elasticity of a variety of differentiated products. The identification problem is also not limited to cases where market definition relies on estimated econometric IO models for substitutability evidence: even when using predominantly anecdotal and qualitative evidence the problem of inferring substitutability from the observable evidence remains.

The uncertainty created by the identification problem in market definition is exacerbated by the nature of the empirical tools employed in competition policy. Empirical tools tend to rely on local rather than global information, which restricts results to a subset of the information universe (Baker and Bresnahan 2008). Practitioners often use qualitative evidence and simple quantitative tools with a limited information requirement (such as tests of price co-movement) when defining markets – especially given time and data requirements of more rigorous tools, such as econometric IO models. The local information problem is not limited to cases without rigorous econometric evidence: even if presented, the court may

[3] Geometrically, this happens because the weather variable splits the quantity-price data into two sets (each associated with a particular supply condition), which then helps to uncover the slope of the demand curve.

not accept the *interpretation* of econometric evidence or it may question the extent to which econometric evidence correlates with other pieces of evidence (Bishop and Walker 1998).

A consequence of the local information problem is that it incentivizes the non-disclosure of evidence: an economist working for a particular party could focus on and elevate a particular aspect of substitutability favourable to her party's market definition. For example, in the South African radio merger case mentioned earlier, opposing parties disagreed in their interpretation of the demographic profile of radio listeners for the purposes of market definition. The intervening party grouped listeners into a larger group including all of the merging stations, whereas the merging parties differentiated more finely among listeners' demographic profiles to accentuate the differences between the merging stations.

Conceptual ambiguities and model uncertainty pose significant challenges to competition policy investigations and, specifically, market definition. These uncertainties do not necessarily reflect poorly on courts' ability to analyze evidence. Courts may perform reasonably well, given time, data and cognitive constraints. Nevertheless, a statistical decision framework that engages with the risks of incorrect inferences can assist in improving market definition decisions.

3. Market definition as a Bayesian decision rule

3.1 Using statistics for analytical purposes

Conceptual ambiguities and model uncertainty create significant risks of incorrect inference in market definition. Statistics can help to describe and manage these risks. For example, suppose the analyst relies on an econometric model to obtain price elasticity estimates for market definition purposes. The analyst can assess the risks of false positives and false negatives regarding the extent of substitutability using the model output and statistical tests. But statistical tools can also offer analytical insights in settings with little quantitative data. Statistical decision theory represents one such a tool. For example, statistical decision theory played an important role in elucidating rational decision-making in the 1970s (Simon 1979; Heiner 1983). By emphasizing the role of decision errors, statistics helped to elucidate the concept of bounded rationality. Statistical decision theory has also been applied extensively in competition law since the seminal paper by Easterbrook (1984). Easterbrook introduced the concept of error costs in an effort to incorporate the social costs of under- and over-enforcement in the development of optimal legal rules for competition policy (Manne and Wright 2010). Since then, statistical decision theory have been used to derive optimal rules for a range of horizontal practices and mergers (see, for example, Hylton and Salinger (2001) and Beckner and Salop (1999)).

Statistical decision theory can also offer insights for market definition. A statistical decision rule for market definition can make critical decision factors explicit in terms of a rational framework. The development of a decision rule therefore requires an assumption of rationality.

3.2 Rationality

Market definition involves bounded rational decisions, in which the competition court or authority aims to use all available information optimally. In other words, the court weighs the available evidence and matches the evidence with current theory. Market definition as a bounded rational decision therefore requires neither perfect foresight nor full information – see Smith (2008) for a recent summary – as the court necessarily deals with limited evidence and limited knowledge. But how plausible is an assumption of bounded rationality for competition policy?

Competition policy decisions follow a process open to scrutiny and feedback, analogous to the process of scrutiny and feedback characterizing scientific research. In science, the research presented by an individual must pass critical examination before it is acknowledged as scientific knowledge (Popper 1963; Kuhn 1970; Lakatos 1977). Scrutiny and feedback takes place via the so-called peer review mechanism, where peers of the researcher highlight alternative interpretations of data and ensure that the research is free from the subjective preferences of the individual researcher (Longino 1998). Scientific research is therefore rational because of its social character, which encourages the critical assessment of research findings. It is from this perspective that one may argue competition court decisions to be rational: the critical feedback via the appeals process in competition policy introduces the kind of rationality obtained in a scientific process open to scrutiny and feedback. For example, in South African competition policy, the appeals process runs from the Competition Commission to the Competition Tribunal to the Competition Appeals Court (CAC), with further recourse to the Supreme Court and, ultimately, Constitutional Court of South Africa (Competition Commission 2000). This process involves a chain of decisions much less likely to fall short of rationality than any one legal decision.

The appeals process is directly relevant to market definition. The Kaya merger case involved significant disagreement on the product market and market definition was one of the central issues in the appeals that followed the Competition Tribunal's initial approval of the partial merger (Theron 2010). In its first review, the CAC referred the matter back to the Tribunal, noting that the Tribunal failed to define a market in its first judgment. Therefore, the Tribunal in its second judgment explicitly delineated several markets, but still found in favour of the merging parties. Opponents to the merger still held that the market in the second judgment was not correctly defined and appealed again to the CAC. In its second review, the CAC concurred with the Tribunal's market definition and allowed the merger to proceed. This

case offers one example of how the appeals process can influence competition policy decisions and, in particular, market definition.

Further support for an assumption of rationality comes from the requirement that any particular legal decision must be consistent with previous decisions. The consistency requirement is similar to the requirement for scientific research to be encompassing. A key criterion for a scientific contribution is that it incorporates previous results in addition to offering new insights, thus ensuring progress in science (Popper 1963). For example, econometric models should encompass previous econometric results (Hendry 1995). The encompassing criterion prevents *ad hoc* hypotheses without clear links to previous research from being accepted into the scientific body of knowledge. This criterion ensures the optimal use of available knowledge and thereby contributes to a rational outcome in scientific research. Analogous to scientific research, legal practice also promotes encompassing decisions: case law requires the consistency of a legal decision with previous decisions on the particular matter. The role of precedence in legal decisions therefore contributes towards a rational process in the adjudication of competition cases.

The rationality of court decisions has received extensive attention from legal scholars, as is witnessed in the academic debate between so-called rationalists and legal realists (Simon 2004). Despite this disagreement, developing a decision rule for market definition may yet be useful. If the rationality assumption is disputed, it is important from a social welfare perspective to render competition court decisions more rational. The decision rule developed below can assist with this, by making critical decision factors explicit in terms of a rational framework.

3.3 Bayesian decision rule

A rational market definition exercise is based on evidence, both quantitative and qualitative, which can be denoted as e. As noted above, e includes all evidence that the court has access to and may not represent the entire set of available evidence: some evidence may not be reported by the parties involved and some evidence may not be admissible for legal reasons[4].

The process of market definition can be described as the application of a rational decision rule, which classifies a candidate product as either in or out of the relevant market based on e. Put differently, market definition is a binary classification problem – a candidate product is classified as inside or outside of the relevant market. Inclusion depends on the extent of substitutability between the candidate product and the

[4] Incomplete evidence may be less of a problem in adversarial competition jurisdictions such as the US and South Africa. Nevertheless, all competition investigations are subject to the local information problem, as discussed earlier.

product under investigation. When a candidate product is a substitute close enough to constrain the market power of the firm(s) under investigation, it is labelled as C and included in the relevant market. Alternatively, when it is not a close enough substitute to constrain market power it is excluded and labelled as F.

The decision to include or exclude a candidate product depends on the relative odds that a candidate product is a close substitute C. The relative odds is expressed mathematically as $\frac{P(C|e)}{P(F|e)}$, where:

$P(C|e)$ is the conditional probability of a product being a close substitute, given the evidence

$P(F|e)$ is the conditional probability of a product being a distant substitute, given the evidence

The Bayes (1783) rule states that, for two events A and B it can be shown that $P(A|B) = \frac{P(B|A)P(A)}{P(B)}$. We can apply this rule to restate the conditional probabilities of being close and being distant substitutes:

$$P(C|e) = \frac{P(e|C)P(C)}{P(e)}$$

$$P(F|e) = \frac{P(e|F)P(F)}{P(e)}$$

The relative odds can then be rewritten as:

$$\frac{P(C|e)}{P(F|e)} = \frac{P(e|C)}{P(e|F)}\frac{P(C)}{P(F)}$$

The relative odds of the candidate product being included in the market are determined by the prior probability of being a close substitute, $\frac{P(C)}{P(F)}$, and the relative likelihood of the evidence being more consistent with what is expected of the evidence assuming the product is a close rather than a distant substitute, $\frac{P(e|C)}{P(e|F)}$.

These two terms explain the behaviour of different parties during market definition. Firstly, economists and legal practitioners will attempt to establish the prior[5] probabilities by relating extant IO research and

[5] "Prior" is an unfortunate term in this context, as it may be (incorrectly) interpreted as denoting preferences. In this framework, preferences are captured by the "loss function" (introduced later), while the prior probability refers to the scientific and legal record on the topic, i.e. information from the literature and case law developed "prior" to the

quoting similar cases from the same or other jurisdictions and the court will collate these arguments in forming its own prior beliefs about the merits of including a candidate product in the relevant market. Secondly, economists will attempt to uncover evidence for (or against) substitutability by means of quantitative or qualitative analyses and attempt to match the evidence with theoretical arguments concerning the size of the relevant market (Decker 2009). The court will collate the different pieces of evidence and attempt to test whether the evidence is consistent with close substitutability or not.

The Bayesian exposition suggests that courts may find the posterior probability (i.e. the relative odds) to be quite close to the prior probability of being included in the market when two conditions hold more or less simultaneously: inconclusive evidence *and* strong prior beliefs that the candidate product should be excluded. Put differently, when case evidence is inconclusive but previous research and case law strongly suggest that the product should be excluded, it is rational for the court to exclude it. This result questions the critique of market definition as an arbitrary exercise. This issue is considered later in the paper.

What happens if there are no strong prior beliefs regarding substitutability *and* the evidence is inconclusive? Then the costs of a particular decision to include or exclude a product become important. In fact, these costs are always present, but become salient under conditions of high uncertainty as the possibility of error is higher. Market definition can be interpreted as statistical inference, relying on the following hypotheses:

H_0: Product is C and should be included in the relevant market

H_a: Product is F and should be excluded from the relevant market

Market definition therefore faces type I error, excluding a substitute from the relevant market that would have constrained the market power of the firm(s) under investigation, and type II error, including a substitute in the relevant market that would not constrain the market power of the firm(s) under investigation. Let each error entail a specific loss: the loss associated with type I error is denoted L_1 and the loss associated with type II error is denoted L_2. Table 1 summarizes the loss matrix:

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case. See: Salmon, W. C. (1998). Confirmation and Relevance: Bayesian Approaches. Philosophy of Science: The Central Issues. M. Curd and J. A. Cover. New York, W.W. Norton & Company.

Table 1: Loss matrix for market definition

		Product's actual substitutability	
		Close substitute	Distant substitute
Market definition decision	Exclude	L_1	0
	Include	0	L_2

If each loss is likely to occur with a certain probability, the expected losses from type I and type II errors can be obtained by scaling the loss function with the probability of the respective losses:

$$E(Loss_1|e) = L_1 P(C|e)$$

$$E(Loss_2|e) = L_2 P(F|e)$$

The expected loss functions allow us to derive an optimal rule for market definition. An optimal rule requires the competition authority to exclude a candidate product from the relevant market if:

$$E(Loss_2|e) > E(Loss_1|e)$$

Is the optimality condition the relevant one for market definition? One may argue that the court is only interested in minimizing the probability of misclassification and is unbiased between the two classification errors. Alternative optimal rules, embodying different assumptions about the loss function, are easy to derive from the general rule, as the latter encompasses a number of special cases (Johnson and Wichern 2002).

In applications of actual classification techniques to quantitative data, the analyst usually specifies the form of the probability distribution up-front. As is the case for other quantitative tools, including most of econometrics, the assumption is frequently that of normality – producing a linear classification rule. In the context of market definition, that would imply linear market boundaries (i.e. the space of substitutes are effectively 'chopped' up). However, the optimal rule for market definition developed in this paper does not rely on such a normality assumption. The optimal rule therefore holds regardless of the shape of the market boundaries.

It is useful to restate the expected losses as follows:

$$E(Loss_1|e) = L_1 P(C|e) = \frac{L_1 P(e|C) P(C)}{P(e)}$$

$$E(Loss_2|e) = L_2 P(F|e) = \frac{L_2 P(e|F) P(F)}{P(e)}$$

Using these forms, the optimal rule can then be expressed as:

$$\frac{P(e|C)}{P(e|F)} < \left(\frac{L_2}{L_1}\right)\left(\frac{P(F)}{P(C)}\right)$$

The optimality condition suggests three conditions under which a product is excluded from the relevant market:

(i) $\frac{P(e|C)}{P(e|F)}$ is relatively small, i.e. the substitutability evidence is more likely to have been generated by a product not being a close substitute for the product(s) under investigation

(ii) $\frac{L_2}{L_1}$ is relatively large, i.e. the cost of including an irrelevant substitute in the market is high relative to the cost of excluding a relevant substitute

(iii) $\frac{P(F)}{P(C)}$ is relatively large, i.e. the decision-maker has strong prior beliefs that a product should be excluded.

The Bayesian decision rule suggests that the case-specific evidence is not the only factor determining a competition authority's ruling on the extent of the relevant market: loss functions, prior probabilities, and weighing of evidence all affect market definition decisions. The following section investigates each of these elements, highlighting what insights each offer for market definition.

4. Elements of the Bayesian decision rule and implications for market definition

Market definition is frequently contentious and the Bayesian decision rule can be a useful clarifying framework in practice. The rule highlights when market definition decisions are not rigorous, i.e. fail to account appropriately for the available theory and case evidence, prior probabilities, or appropriate loss function. This decomposition renders court decisions more explicit by providing a simple taxonomy of the main elements of a rigorous market definition decision. The following subsections explore the different elements, considering how the loss function, prior probabilities and the weighing of evidence affect a rational market definition decision.

4.1 The loss function

The classical approach to inference do not account for the role of subjective preferences in shaping rational decisions (Audi 1995). Under such an approach it is difficult to judge whether a market definition decision is consistent with case law and literature or with case evidence, as it is difficult to distinguish between a rational market definition decision shaped by particular preferences and an incorrect market definition decision. A Bayesian approach to inference clarifies the role of preferences in a rigorous decision, by including a loss function in the decision rule.

The loss function describes the losses incurred from incorrect classification – either incorrect inclusion or incorrect exclusion from the relevant market. Arguably, the court may not have a bias in either direction, as it adopts the loss function implied in the competition law. As far as market definition is concerned, competition policy does not usually compel courts to define narrow or broad markets. Therefore, one could assume $L_1 = L_2$ in the optimality condition. This implies that, for an economist working for the court, the loss function does not necessarily feature in the market definition decision: the economist is led by the weight of evidence in a particular case and the evidence or theory from other cases and literature (as embodied in the prior probabilities). However, the loss function may be an important driver of the proposed market definitions of opposing parties in a competition investigation. Opposing parties may arrive at relevant markets of quite different sizes even if substitutability evidence from neither is implausible. It may be that evidence supporting and evidence not supporting inclusion of a specific product in the market are fairly balanced. However, opposing parties may deal differently with uncertainty about substitutability due to diverging loss functions. For one party a loss-minimizing approach would require excluding a specific product, while for the other loss-minimization would require including it.

The loss function's role in a market definition decision serves to highlight the link between a specific market definition decision and the underlying competition policy regime. The divergence in loss functions between opposing parties may be particularly important under a form-based approach to competition policy. A form-based approach centres on establishing dominance and then proving conduct to take a particular prohibited form, rather than assessing economic effects of the conduct. Under a form-based approach, much more hinges on the market definition and the prosecuting authority will assign a heavier cost to defining a broad market, while the defendant will do the same for a narrow market. For example, where there is disagreement about substitutability, the prosecuting authority may favour excluding the substitute from the relevant market even if the evidence is slightly in favour of inclusion. Under an effects-based approach, dominance may be of lesser concern (Arezzo 2008). Arguments on the exact

extent of the relevant market become less important and the loss function bias towards larger or smaller markets is reduced. Market definition therefore becomes less contentious because the loss functions of the parties converge (at least partially) on that of the court. Arguably, this convergence has two benefits.

Firstly, market definition and dominance can function more effectively as a first screen. It is frequently argued that market definition should be retained under an effects-based approach as it still helps to identify problematic cases. The argument for the retention of market definition is based on the assumption that, although the form-based approach has not been entirely successful, there is still evidence that structure yields certain conduct (Carlton 2007). However, market share can be less useful as a screen for dominance when loss functions are asymmetric, leading the analyst to define a certain size market. The role of the loss function in market definition therefore highlights one of the familiar problems with using dominance as a first screen under a form-based approach: asymmetric loss functions may lead a prosecuting authority or another plaintiff to find that a firm holds significant market power and is capable of anti-competitive behaviour *because* the prosecuting authority may be inclined towards a narrow market definition.

Secondly, beyond ensuring a more effective first screen, the convergence of loss functions under an effects-based approach actually ensures that market definition reaches its true purpose, namely to identify and rank competitors. The market definition exercise should be seen as an information collection process, aimed at establishing and describing the space within which the firm's conduct or merger decision should be assessed. Converged loss functions ensure that prior probabilities and the weight of evidence dictate market definition.

4.2 Prior probabilities

Prior probabilities enjoy a prominent position in the philosophy of science, as scientists employ these probabilities in judging the plausibility of a new hypothesis (Salmon 1998: 558-564). However, prior probabilities have not received much attention in the market definition literature. The Bayesian rule suggests that market definition, as any part of a competition investigation, does not occur in a historical vacuum. Strong prior probabilities concerning substitutability should raise the standard of proof in market definition exercises. The higher standard of proof does not necessarily affect the closer substitutes, but sets a higher bar for less close substitutes to be included, as the weight of case evidence for and against substitutability must be compared to prior probabilities. Furthermore, under conditions where the evidence is inconclusive, the Bayesian decision rule suggests that a product should be included in the relevant market if the prior probability of a close substitute is higher than the prior probability of a distant substitute.

The use of prior probabilities does not imply a subjective view of probabilities. Prior probabilities are to be established from a frequentist perspective, where 'probability' is measured by the frequency of a particular substitutability finding. For example, a high prior probability of being a close substitute implies that the larger part of the scientific record indicates close substitutability with the product under investigation. Of course, the use of these prior probabilities does not require exact numerical calculations. One may see the probabilities as intervals rather than as point values. While this may still leave room for divergence in views on prior probabilities, Salmon (1998: 564) notes that because of "washing out of the priors" these divergences need not affect the analysis negatively: as case evidence accumulates, the relative weight of prior probabilities in determining posterior probabilities declines.

The preceding discussion suggests that market definition can be enhanced if one had sufficient evidence on prior probabilities. The market definition component in most competition reports usually contains selected references to the literature and it may be useful to develop administrative capacity to enhance the utilization of extant research. Baker and Bresnahan (2008) suggest that economists can contribute to competition policy by developing a body of empirical evidence by industry type. The emphasis on prior beliefs suggests that competition regimes may benefit by developing institutional capacity to collate available evidence on substitutability of particular products by industry type. The body of evidence should be updated frequently from new academic research and competition cases concluded elsewhere, and should be accessible to defendants. This need not involve interpretation in terms of market definition, but could focus mostly on conclusions regarding substitutability and the associated research methods.

4.3 Weighing of probabilities

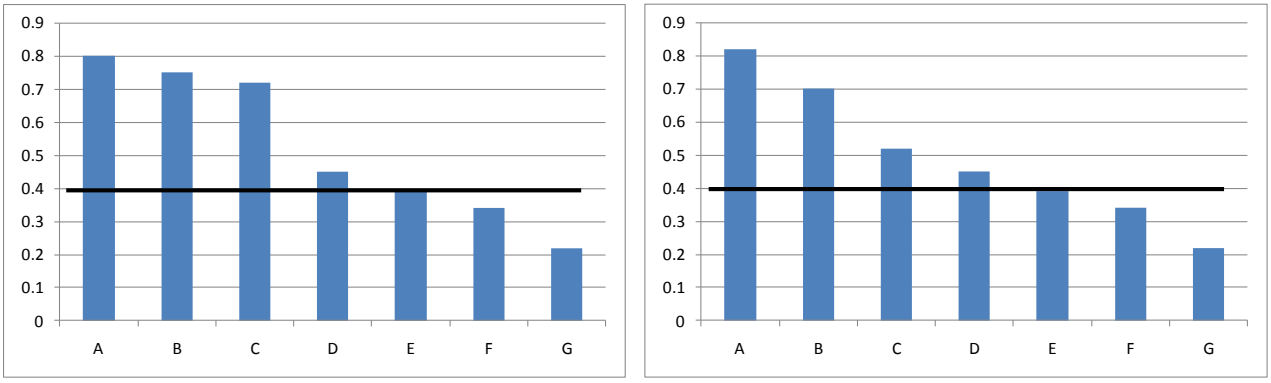
In the preceding discussions of the loss function and prior probabilities, the weighing of evidence received significant attention. In fact, the decision rule for market definition emphasises that a rigorous decision ultimately involves a weighing of probabilities for and against inclusion in the relevant market. Put differently, the strength of evidence must be explicitly considered during a market definition exercise. This is an important emphasis, as market definition is frequently applied in a binary sense, with substitutes being labelled either 'in' or 'out' of the market. However, some substitutes may be classified as 'in' on a much weaker basis than others. These substitutes may belong in the market, as they constrain market power, even though they represent a different level of substitutability relative to those products included on the basis of much stronger evidence.

The fact that the relevant market includes products with varying degrees of support (in terms of weight of probability) suggests that the rigorous drawing of market boundaries involves first the ranking of products and *then* the delineation of the market boundary. Such a perspective implies that the frequent calls for a

less rigid approach to market definition need not involve loose market boundaries. A less rigid approach to market definition can be seen as one where there is a nuanced understanding of what lies *within* the explicit market boundaries. Such an interpretation balances the need for legal clarity and the need for minimum loss of information.

Figure 1 shows the information loss when defining the market on the basis of a comparison of the cross-price elasticity estimates with a pre-specified threshold level of, say, 0.4. On the left-hand side graph, three close substitutes and a distant substitute is included in the same market. On the right-hand side graph the products are much more differentiated. An 'in or out' approach would treat these two scenarios as equal. The nuanced approach emphasised by the decision rule acknowledges that both markets include four products, but that the left-hand side market is more competitive (i.e. exercise more constraints on the hypothetical monopolist) than the right-hand side.

Figure 1: Cross-price elasticity estimates for close and far substitutes (left) and slowly decaying levels of substitution (right)



As argued earlier, a view of market definition as involving a weighing of probabilities does not necessarily involve quantitative calculations. The point is not that an optimal rule requires the decision-maker to weigh mathematically a set of de-linked pieces of evidence. For example, the implication is not that the decision-maker finds 'eight' pieces of evidence in favour of including the product in the relevant market and 'five' against. Decker (2009) discusses the way in which applied economists in competition cases weave evidence together. It is rarely the case that economists rely on a single table of cross-price elasticity estimates, which settles the market definition inquiry. Economists rely on a range of evidence weaved together to make the claim for (or against) substitutability. The substitutability evidence of any party is rarely outright false and usually it is the case that the evidence of one party is merely more compelling than another's – which implies weighting by the court. Furthermore, even if only econometric estimates are allowed as evidence for market definition, the weighing of probabilities *still* applies. Despite more extensive knowledge about substitutability and access to more sophisticated models, the application

of knowledge to a specific case cannot be objective. Econometric models will not remove the need for judgment, given that these models involve a large number of assumptions and rely on specific datasets. Competition courts will always have to weigh evidence regardless of the statistical sophistication of these models.

The argument that market definition involves weighing of various pieces of evidence is relevant to South African competition policy, as it emphasises the need for strong economic evidence to underlie a particular relevant market and assessment of market power. Consider, for example, the 2009 approved merger between South African wholesalers Masscash and Finro (Competition Tribunal 2009). Although the case may appear to focus less on the issue of specific market delineation, a substantial portion of the case is devoted to the application of quantitative techniques for the measurement of competitive constraints. In its assessment of these techniques, the Tribunal found that the apparently sophisticated statistical analyses did not hold up to closer econometric scrutiny or were contradicted by other qualitative evidence. The Tribunal's judgment suggests two lessons related to market definition. Firstly, model uncertainty is a common experience in applied econometrics and is not limited to market definition. The type of econometric procedures used in the case is frequently argued to obviate the need for formal market definition, yet these tools are also exposed to model uncertainty. Secondly, one should not engage one-dimensionally with market definition or any issue in competition policy. Any one econometric tool forms part of a broader kit of complementary tools and can never constitute the whole of the analysis. These insights are consistent with the argument that market definition involves a weighing of the probabilities of close and distant substitutability.

The weighing of probabilities during the market definition exercise suggests that it is sub-optimal to view market definition as a strict two-tiered process, where qualitative or crude quantitative evidence are treated as exploratory or indicative, while subsequent econometric work as seen as providing confirmation (see, for example, reports on methodology (Copenhagen Economics 2003)). Instead, one may also view econometric evidence as one piece of evidence that may not necessarily weigh heavier than other pieces of evidence[6] (Bishop and Walker 1998). This argues against a market definition approach that relies on a particular econometric or other quantitative technique. If one views the Bayesian decision rule as a statistical classification rule, multiple tools are preferable for market definition. The following section explores this issue.

[6] This difference in approach is related to a broader debate on whether economics is a scientific discipline in the Popperian sense or a discipline employing the "art" of economic story-telling using numbers and qualitative information. See: Leamer, E. E. (2009). Macroeconomic patterns and stories. Berlin, Springer-Verlag.

5. The need for a variety of tools and evidence rather than a model-specific approach

The SSNIP thought experiment, a widely-used analytical tool for market definition, is frequently implemented via an econometric model (see Motta (2004: 125-134) and Davis and Garcés (2010: 204-227) for a summary of the approach). The SSNIP test is seen as requiring a formal estimate of elasticity for market definition and advances in empirical IO modelling make it increasingly easy to obtain such elasticity estimates. The Bayesian decision rule presented earlier can also be interpreted along econometric modelling lines: the practitioner specifies an IO demand/supply model, estimates cross-price elasticities and then tests whether these elasticity estimates exceed certain thresholds to decide whether a product should be included in the relevant market.

While econometric modelling provides useful evidence for market definition, it is potentially limiting to interpret the Bayesian decision rule as best implemented using a single econometric model – see Budzinski (2008) for a discussion on the problems of a 'monocultural' competition theory. Modern IO models are increasingly sophisticated in the market detail they are able to incorporate. A key requirement for the use of these sophisticated models in defining markets is that they should be stable enough to allow not only for retrospective analysis (for example, estimating the price elasticity), but also for forecasting. Market definition is inherently a forecasting exercise: for example, under the SSNIP thought experiment, market definition requires practitioners to predict the likely response of market players to a price hike implemented by a hypothetical monopolist. Econometrically, this requires practitioners to generate conditional forecasts of the quantity effects of an exogenous change in the price of a product. But conditional forecasting opens up a range of empirical identification problems, including the need to establish whether price in any particular case can indeed be viewed as strictly exogenous (Hendry 1995). It is these and other challenges that have led to the dismal forecasting record of econometric models in general and models in IO are not exempt from this – see a recent discussion by Coate and Fischer (2011) on the evaluation of structural model forecasts in merger analysis.

Nevertheless, while it is remarkably difficult to utilize a single econometric model for forecasting, performance can be improved by when a number of models are collated or where information from a variety of sources are combined (Granger and Jeon 2004; Pesaran and Timmermann 2005). The improvement follows because even the best performing forecasting model does not necessarily encompass all other models, so that a combination of models usually outperforms a single model. This suggests that market definition, as a forecasting exercise, is best conducted using multiple tools.

The classification literature sheds further light on the inherent problem facing the use of a single econometric model for market definition. Consider the ratio $\frac{P(e|C)}{P(e|F)}$, forming part of the decision rule for market definition. The court must judge and weigh these probabilities when defining the market. The judgment and weighing of probabilities rely on economic theory and case law. From a statistical classification perspective, one may say that the court classifies products as in or out of the market on the basis of a classification rule that is developed from economic theory and case law. However, classification rules are only as good as the data on which they are developed. In cases where there is limited theory and case law dealing with substitutability of the type of product under investigation, the classification rule for market definition may be biased. The statistical classification literature finds that unobserved variables lead to suboptimal classification rules (i.e. incorrect weighing of probabilities due to incorrect underlying theories) and incorrect classifications (Urbakh 1971; Hastie, Tibshirani and Friedman 2001). This outcome is likely in the case of many differentiated products, as only a portion of the characteristics driving substitutability is usually measured and/or considered when defining the relevant market. This limitation underlines the need for searching a range of data and evidence. The problem of limited information has led to the development of model averaging and boosting methods to improve on the decision rule suggested by a *specific* classification model (Hastie et al. 2001: 250). Again, a combination of models outperforms a single model, lending further support for a market definition approach based on multiple tools.

More generally, the social science philosophy underlying a model-specific interpretation of the market definition rule conflicts with the type of problem in market definition: arguably, if one is in the field of competition policy one may believe that economists can adequately model and describe economic behaviour and, therefore, devise improvements to the economic system[7]. Even if one supports this position, one must concede that knowledge is frequently outdated in the light of continuous change in the economy. Continuous change requires the use of a variety of sources and tools to collect sufficient and representative information; Budzinski (2008) argues for diversity in economic paradigms, including those of Hayek (1946 [1984]) and Schumpeter (1934), explaining the limits of any one paradigm in explaining innovative activity in the economy. The decision rule for market definition is therefore best implemented using a variety of tools and evidence.

[7] There appears to be a divide in economics between those favouring a rationalist position according to which social science has achieved adequate insights to motivate policy interventions that will effect social change and those that are optimistic about the capacity of the decentralized process to solve social problems. See: du Plessis, S. A. (2007). Two optimistic traditions in the dismal science: rationalism and the 'invisible hand'. Inaugural lecture delivered on 28 February 2007. Stellenbosch, Stellenbosch University.

It is useful to consider a recent competition case in which the competition authority engaged with the problem of uncertainty in market definition. Such a case study will show the extent to which market definition decisions already embodies features of the statistical decision rule discussed above – even if the authority does not explicitly use such a rule – and it will highlight areas for improvement.

6. Illustrative case: radio market definition in South Africa

The paper illustrates the principles outlined above using the Primedia/Kaya radio merger case. The case involved the partial acquisition of 24.9% of radio station Kaya FM (Kaya hereafter) by the media house Primedia and investment company Capricorn. Primedia already owned two other radio stations in the same province, Highveld Stereo (Highveld) and 702 Talk Radio (702). A significant part of the legal proceedings revolved around market definition, with the various parties in sharp disagreement regarding whether Kaya and Highveld (and 702 to a lesser extent) were in the same or separate relevant markets. The South African Competition Tribunal (Tribunal hereafter), in its final judgment, also acknowledged the importance of the market definition not only in facilitating concentration calculations, but also in "analysing incentives to co-ordinate" (Competition Tribunal 2008: 21).

The Kaya case is also particularly relevant for the purposes of demonstrating how the Bayesian framework deals with uncertainty in market definition. As discussed below, the Tribunal explicitly recognized the uncertainty surrounding market definition for radio stations and, more important, attempted to account for this uncertainty in the market definition. The Tribunal sought to move away from a simple 'in' or 'out' approach to market definition and chose instead to rank substitutes of the merging radio stations using an 'inner' and 'outer' circle of competitors. The ranking of competitors and other features of the market definition exercise in the Kaya merger case approximate the approach suggested by the Bayesian decision rule derived earlier. The following subsections study the extent to which the various elements of the decision rule (prior probabilities, loss function, weighting of probabilities and variety of tools) featured in the Kaya market definition exercise.

6.1 Weighing of probabilities

In the preceding discussion of the elements of the Bayesian decision rule, the weighing of probabilities received significant attention: not all substitutes included in the relevant market enter with the same weight of evidence. For some substitutes, the evidence is much less certain than for others. A simplistic 'in or out' approach ignores the weight of probabilities, whereas the decision rule supports an approach that is explicit about these weights: as argued previously, this market definition approach starts with a ranking of substitutes, which is then followed by a formal delineation of the market boundaries. In this

way, two objectives are achieved: on the one hand, a well-defined but general space is defined (useful for concentration calculations, etc) and, on the other hand, information about competition within the market boundaries is retained.

The market definition approach in the Kaya case illustrates the ranking approach. In fact, the Tribunal outlined the uncertainty associated with drawing clear market boundaries in the radio industry and agreed with the position of some parties that "it is far more meaningful to state propositions about relative relations between potential competitors than to make conclusions about absolute boundaries to markets" (Competition Tribunal 2008: 15-16). The Tribunal therefore argued that "it is easier to ask whether A and B are more or less meaningful competitors in a market than say B and C, than to ask which competitors must be regarded as in the market and which outside of it" (Competition Tribunal 2008: 18).

The Tribunal applied the hypothetical monopolist test first to Kaya and then to Highveld to identify *and rank* competitors for each, as shown in Figure 2 (Kaya) and Figure 3 (Highveld). Specifically, the Tribunal ranked competitors by grouping competing radio stations for Kaya and Highveld into inner and outer circles of competitors and placed those radio stations considered closest competitors for Kaya and Highveld in the inner-most circle (indicated with dashed lines in the graphs). The first outer circles (indicated with solid lines) then contain substitutes also reasonably close, while the second outer circles contain less close substitutes that may still constrain price increases by the merging radio stations.

The outer-most circles define the boundaries of the relevant market and can be used for concentration calculations. The various inner circles allow a nuanced assessment of competition; the Tribunal did not view all substitutes as equals and noted that "we must know something of who is in the market, *whether they have similar incentives to co-ordinate, and … how much of the market might be party to the coordination*" (Competition Tribunal 2008: 21, emphasis added). In fact, the Tribunal noted that there are conditions were only a part of the relevant market really matters for Highveld: "We are not certain that the market extends only to the first circle and there may be circumstances for some advertisers, as they are not a homogenous group either, that stations in the second circle are an adequate substitute, and this group of advertisers may be sufficiently large to deter a successful post merger price increase, assuming Primedia was in a position to control Kaya's pricing post merger" (Competition Tribunal 2008: 20).

Figure 2: The market for Kaya as hypothetical monopolist

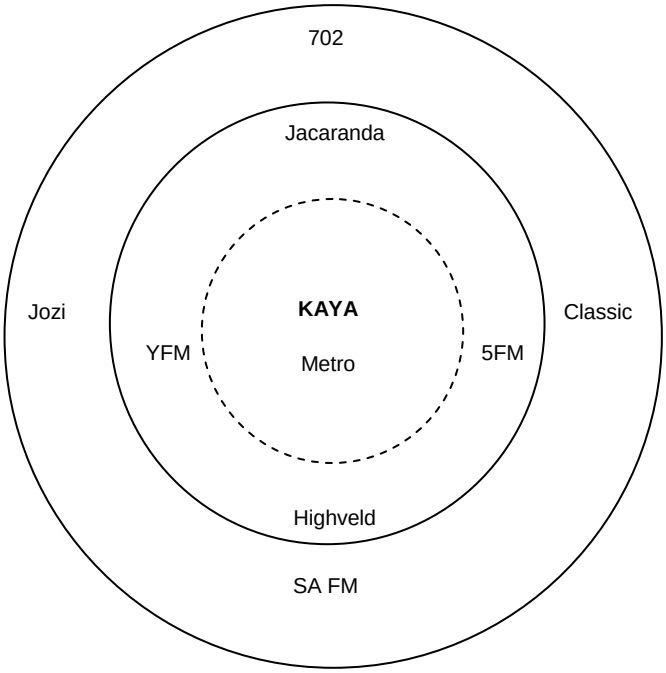
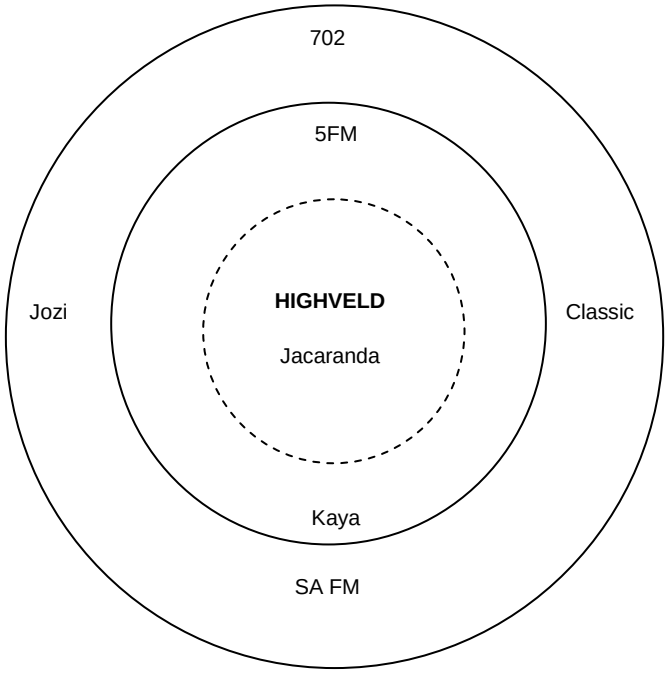


Figure 13: The market for Highveld as hypothetical monopolist



More generally, the Kaya case shows that uncertainty does not prevent rigorous market definition. Uncertainty does not require one to be vague about which substitutes are in the relevant market. It is best to define clear boundaries and then to be explicit about the ranking among the substitutes. This ranking approach is consistent with a statistical decision rule in which probabilities of close and far substitution is weighed – implying that some products will be closer substitutes than others.

6.2 Loss functions

Apart from the weighing of probabilities, the loss function of the decision-maker also affects rational decisions under a Bayesian decision rule. As discussed earlier, where concentration calculations significantly affect the outcome of a competition investigation, the loss functions, and hence market definitions, of opposing parties will tend to diverge strongly. This often occurs in mergers. For example, under South African competition law, mergers that do not significantly raise market shares and concentration (as measured by the Herfindahl-Hirshman Index) are permitted. Arguably, the Kaya merger case therefore offers a potentially good case study of how divergent loss functions affect market definition.

In its judgment, the Tribunal dismissed the more extreme market definitions put forward by the various parties. As discussed earlier, and consistent with a decision rule, this dismissal was based on the Tribunal's assessment of the evidence and, importantly, its own loss function (Competition Tribunal 2008: 18): "At best the economists knocked holes into the more tenuous assumptions of their opponents, and so we can discount certain of the more border line theories of the relevant market…" The Tribunal, assigning similar losses to overly narrow and overly broad markets, therefore doubted proposals of either a single encompassing radio market or, alternatively, a collection of individual radio monopolies. In this sense, the Kaya case shows how the rational decision of an unbiased decision-maker may differ from those of decision-makers with specific biases.

Beyond confirming the existence of biases, the Kaya case offers further and potentially more important insights into the role of the loss function in market definition decisions. Most of the parties did not choose to pursue the extreme definitions. One could argue that it would have been almost expected that these extreme versions would not be accepted as the outcomes of serious analyses and that the issue was really how many substitutes to include before cutting off. As expected, the parties disagreed significantly. The Tribunal was forced to engage with the problem of judging the rankings suggested by the various parties and to come up with particular market boundaries: "we were still left with a middle ground [of markets], where consensus could not be found and on whose assumptions, wildly conflicting notions of the extent of the concentration could be made" (Competition Tribunal 2008: 18). Interestingly, while divergent loss

functions would have influenced the parties' market definitions, the Tribunal do not appear to have considered the loss function a particularly important factor. The Tribunal noted specifically that the problem of radio market definition lay with the difficulty of weighing the evidence *rather* than with partiality of the economists (Competition Tribunal 2008: 18): "Radio markets are complex to analyse and although we had the benefit of the testimony and research of three economists in the course of the hearing in this matter, none of them emerged with a more probable version of the market than the others …. This is not a criticism of the efforts of these economists – indeed they all demonstrated great diligence in examining the data – but the nature of the industry". In fact, the Tribunal admitted its own problems in interpreting the evidence (Competition Tribunal 2008: 16): "the more data we received from the duelling teams of economists … the more the boundaries of the market receded into fog as opposed to clear lines".

This quote from the Tribunal is consistent with a Bayesian decision rule approach to market definition: the Tribunal argues that the loss functions of the various factors are unbiased and, therefore, argues that it is uncertainty in the data – formally, the weighing of probabilities – that is responsible for the different market definition conclusions. The quote also offers an important example where uncertain is not due to decisions being arbitrary.

6.3 Prior probabilities

Apart from loss functions, prior probabilities also feature in the decision rule framework discussed earlier. Prior probabilities were not explicitly mentioned in the Kaya market definition decision, mostly due to the inconclusive nature of the scientific record on radio market definition[8]. For example, one market definition issue in the case concerned whether alternative media types should also be included in the relevant market. The Tribunal and most parties noted that other media (such as newspapers, the Internet or television) should not be included in the relevant market. In contrast, the international literature does not necessarily offer clear guidelines in this regard. There was no formal empirical investigation and weighing of the case evidence in this regard either. Furthermore, while not publicised, the confidential reports of economists for opposing parties did consider the market definition suggested by previous cases in other jurisdictions. This would have contributed towards a situation where the prior probability ratio would have been close to one, and therefore immaterial in the assessment of the actual market.

[8] Arguably, prior probabilities were present in the negative: the Tribunal implicitly assigned a value of one to the prior probability ratio by its comment that the market is intrinsically difficult to analyze.

6.4 Use of a variety of tools

Apart from the various elements of the decision rule, in the form of weighing of probabilities, prior probabilities and loss functions, we have argued that the decision rule suggested in this paper support the use of a variety of tools. In the Kaya case, econometric estimates of cross-price elasticity were not presented, yet market definition relied on a variety of other quantitative and qualitative tools. The Tribunal considered and weighed evidence from a range of quantitative analyses of demographics, but found that these offered inconclusive evidence on market definition: "absent reliable econometric evidence and inconclusive evidence from the demographics of audience and advertiser profiles, the next best evidence we have of who competes in the market are the opinions of the stations themselves" (Competition Tribunal 2008: 17). Subsequently the Tribunal relied on qualitative evidence to form a view of the extent of the market. They avoided over-reliance on any particular set of evidence, including the extensive demographic analyses of either side, and chose to weigh different pieces of evidence. This is consistent with the earlier argument that a decision rule for market definition is not model-specific but based on a range of quantitative and qualitative data.

The Tribunal's market definition approach in the Kaya case mirrors many of the key elements of a Bayesian decision rule approach to market definition. Notably, the weighing of the case evidence (via the various circles) and the explicit distinction between uncertainty and loss function are key features of a rational market definition decision. The need for a variety of tools and, to a lesser extent, the importance of considering prior probabilities, also received attention. In general, the Kaya case demonstrates that a Bayesian decision rule can be useful in defining markets under uncertainty.

7. Conclusions

The market definition decision is exposed to risks of incorrect inferences, due to conceptual ambiguity and model uncertainty. Conceptual ambiguity refers to the challenge of capturing the economic concept of substitutability in a form that is both legally codifiable and amenable to case-specific analysis. Model uncertainty concerns, firstly, the empirical identification problem of inferring substitutability evidence from non-experimental data and, secondly, the local information problem created by the inherently limited scope of our empirical tools.

Given these uncertainties, market definition faces significant risks of Type I and Type II errors. This suggests a role for Bayesian analysis, which can help to elucidate the factors that influence, or should influence, a rational market definition decision. The Bayesian decision rule highlights the role and

interplay of the weighing of evidence, the loss function of the decision-maker, and prior probabilities in determining the market definition decision.

Firstly, the decision rule underlines the importance of viewing market definition as a weighing of probabilities of close and distant substitutability. While the ideal types of 'in the market' and 'out of the market' are useful for constructing the actual boundaries, the rule shows that market definition first requires a ranking of substitution (by weighing probabilities) before actual boundaries are drawn. Not all products are included on the same strength of evidence.

Secondly, the decision rule shows that market definition need not be an arbitrary exercise. It is quite possible that different parties, using the same set of data, can disagree on the extent of the market: depending on the importance of the market definition to the case outcome, the loss functions of different parties may influence their market definition arguments.

Thirdly, the rule shows that the scientific and legal record on substitutability can enhance market definition decisions. The current literature on econometric tools for market definition makes little reference to the role of past cases and research, focusing mostly on improving the use of data in any specific case. The local and limited nature of evidence may be a barrier to proper market definition decisions, especially in differentiated product markets.

Apart from these conceptual contributions, the paper makes a further methodological contribution regarding empirical techniques for market definition and, more broadly, for competition policy. Market definition is cast as both a forecasting exercise and a classification exercise. Building on the forecasting and statistical learning literatures the paper then argues that optimal forecasting and classification is achieved when employing multiple tools. Therefore, the use of a single econometric model for market definition purposes is not desirable and practitioners should attempt to use a broad toolkit rather than a single encompassing tool when defining markets.

The exposition of market definition from a statistical decision rule perspective is attractive to legal practitioners: portraying market definition as a weighing of probabilities is consistent with the legal standard of balancing probabilities, applicable in a number of competition jurisdictions, including South Africa. Given that the decision rule is consistent with legal principles, it could serve to improve future decisions by elucidating the factors that already play a role in decisions and thereby contributing to consistency in judgment. Apart from consistency and improved legal certainty, a decision rule approach also helps to elucidate the trade-offs made in arriving at a particular market definition, helping to address the charge that market definition is necessarily arbitrary.

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