European dominant position and American monopolization: a unifying approach from basic game theory *

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Aggressive behaviours against competitors of major companies in situations in which they control a large share of the market have been alternatively characterized, on both sides of the Atlantic, as anticompetitive actions or manifestations of healthy competition. Symmetrically, antitrust authority interventions to contrast such behaviours has been praised as brave policies in defence of a competitive environment or burocratic interference with the very play of market forces antitrust policy should preserve.

However, examples of stylized antitrust cases cast doubts on the social acceptability of such aggressive behaviours on the part of leading firms. As an example let us assume a market for colas where the market leader has more than 80% of the market and the second player struggles with a meagre 10%; a behaviour where the leader gives special discounts to distributors engaging no longer to carry the competitor's brands is for most practitioners of antitrust and for many economists quite problematic. Intuitively, such behaviour appears in a sense to be violating some important rules of the competition game. Nevertheless, the market leader's defence often argues that the company is only competing, maybe aggressively, but pursuing a rational course of action finalized to defend market share and maximize profits.

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Consider another classic antitrust example: an airline company has a monopoly on a route, operating say 10 flights that take off on the hour; when a rival company starts flying on the same route, the former monopolist moves the schedule of its own flights in such a way that for each rival flight on schedule there will always be a competing flight within 10 minutes. Even in this case most antitrust people, and also a majority of economists, would find that something has gone awry with the competition game. Still, the airline that used to monopolize the market could argue that it is only rationally defending market share and customers.

A third, very controversial behaviour could be that of a large software house, producing complex integrated software, that decides to insert, at no additional cost, in its software some other programme that a lesser competitor sells at a positive price. Here, the debate about the acceptability of such practices among the parties involved and among economists is at its height, particularly as the issue in question – the true interests of the consumer – weighs so heavily on the answer.[1] Still, even in this last case, doubts about the respect of fairness in the competition game appear difficult to evade.

The above examples show that in no area of antitrust policy is the contrast more acute than in evaluation of the actions of a major company directed against its weaker competitors. A frequent refrain against antitrust intervention is the concept that antitrust authorities should defend competition, not competitors. This has often been repeated by antitrust experts, especially in the US, and company defences frequently underline that apparently aggressive behaviours are only strategies undertaken by a company lawfully trying to defend its market share. Actions by large firms involved in the market are defended as rational profit maximizing behavioural responses to competition.

[1] As an example, for the US v. Microsoft case, Klein (2001, p. 60) argues: "The guiding economic principle in deciding whether behaviour by a dominant firm involves 'competition on the merits' is whether the behaviour benefit consumers or produces efficiencies"; and concludes (p. 61): "It is important to recognize that the primary effect of Microsoft's aggressive competitive behaviour in protecting its Window platform was a large, unambiguous gain in consumer welfare". For a contrasting view, Gilbert and Katz (2001, p. 40): "The short run consumer gains from a free or bundled browser may have been limited [...]. In the long run, consumers were likely harmed". For the following general conclusion (p. 42): "Microsoft took actions that appear to have imposed short-run costs on consumers and reduced the long-run likelihood of platform competition. Thus, we believe that some remedy by the antitrust authorities is appropriate".

This paper tries to suggest a frame of reasoning and some tools that could serve to analyze the controversy and help to discriminate, at least in some situations, among the two kinds of behaviour. The analysis makes use of elementary concepts of game theory to give some operational content and clearer economic meaning to well-known definitions commonly found in American and European antitrust law and jurisprudence, and to dispel some logical doubts about them. In particular, my specific intention is to give a more precise economic meaning to fundamental terms used in US antitrust law, like monopoly and monopolization offence, and EU antitrust law, like dominant position and abuse of dominant position. In the course of the analysis we note that, through this unifying treatment of basic concepts, many formal differences of content and application in antitrust law, between Europe and the US, appear less important than usually thought.[2]

The first section gives economic meaning to some essential definitions of antitrust law. In the second section, the core of the paper, a formal casting of antitrust concepts with the instruments of basic game theory is introduced and explained. The third section applies these new definitions to common examples of controversial behaviours by companies. A short conclusion follows.

1. Definitions from American and European antitrust law

To set about analyzing the problem of (un)acceptable behaviour by firms with market power, I attempt to give economic content to some well-known concepts used in American and European antitrust law. Some of the concepts most often used in antitrust have found, both in the US and in Europe, precise definitions in antitrust law or jurisprudence. A firm with a majority share of the market and some other conditions that strengthen it and make it difficult for a competitor to contrast its market power is defined: in the US as a firm that *monopolizes* the market and in Europe as a firm with a *dominant position* in the market. In the US § 2 of the Sherman Act defines and puts a ban on monopolization and attempts to monopolize the market, while in Eu-

[2] For a more problematic view of the differences see Kolasky (2004).

rope Article 82 (former 86) of the European Union Treaty is dedicated to the dominant position and lists examples of its possible abuses.

But what exactly does the locution – a firm that monopolizes the market or a firm that holds a dominant position of the market – mean? The US Supreme Court (1956) stated that a firm with monopoly power "has the power to control prices or to exclude competition". The European Court of Justice (1978, para. 65), with an often repeated Sentence, has stated its own interpretation of what article 82 of the European Treaty means:

> "The dominant position referred to in this article relates to a position of economic strength enjoyed by an undertaking which enables it to prevent effective competition being maintained on the relevant market by affording it the power to behave to an appreciable extent independently of its competitors, its customers and ultimately the consumers".

Economists have a relatively clear understanding of what an economic monopoly is, and one could assume that when the US Court says that a firm controls prices or the EU Court affirms that a behaviour is independent from consumers, they simply mean that the firm facing a whole demand curve can fix a price that maximizes its profit without risking loss of a significant part of its customer base to the competition.

However, in the second half each of these definitions becomes more puzzling and perhaps more revealing: what exactly does the Supreme Court mean when it says that a monopoly can "exclude competition" or what does the European Court mean when it says that the dominant firm can behave "independently" from its competitors?[3] Does it amount to the same thing? It is an intriguing question, especially if one recalls that all the suspicious behaviours I listed in the introduction were actions taken by firms with market power against competitors. If the Courts' definitions underline the independence of the dominant firm from its competitors or its ability to exclude competitors, then it is puzzling that the behaviours under antitrust scrutiny

[3] The same question has puzzled also Motta (2004, p. 34); referring to the same European Court quotation cited above, he writes "it is difficult to translate into economic terms the precise meaning of the legal expression". (But see also footnote 88, at page 35, where the author hints at a possible answer not far from the one I propose in the next section.)

are so often those taken directly against competitors. Independence or ability to exclude obviously seems to imply the possibility to take actions against somebody. But is there a limit?

Actually the limit, both in the US and in Europe, lies in the law: a fundamental definition in American antitrust law is *monopolization offence*. This concept is clarified by the Supreme Court as the combination of two elements:

> "(1) the possession of monopoly power in the relevant market and (2) the willful acquisition or maintenance of that power as distinguished from growth or development as a consequence of a superior product, business acumen, or historic accident".[4]

The corresponding concept, in EU antitrust law, is an action from a dominant firm that violates acceptable rules of competitive behaviour; this is called *an abuse of dominant position*. The European Court of Justice explains:

> "the concept of abuse is an objective concept relating to the behaviour of an undertaking in a dominant position which is such as to influence the structure of a market where [...] through recourse to methods different from those which condition normal competition [...] has the effect of hindering the maintenance of the degree of competition still existing in the market or the growth of that competition".[5]

But a clear link between economic theory and legal definition is needed if we are to understand what kind of abusive behaviour is under scrutiny. The US Supreme Court is saying that behaviours preserving market power are acceptable only if the "growth or development" of a firm with a monopoly of the market come "as a consequence of a superior product, business acumen, historic accident". The European Court is stating that, from a dominant firm, methods or practices that differ from "normal competition" are not acceptable. But what exactly is normal competition, especially in a context characterized – "as a direct result of the presence of the undertaking in question" – by the dominant presence of an enterprise that can behave independently of competitors? This issue will be dealt with in the next section.

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[4] US Supreme Court (1956).

[5] European Court of Justice (1979, para. 91).

Finally, starting especially from European case law, I focus on a third concept – an idea that may not be as fundamental as the first two, but is no less intriguing, the *special responsibility* of the dominant firm. This definition is often mentioned by the EU Court of Justice as a guide to indicate behaviour which is acceptable for a dominant firm. I think that the same idea, based on the requirement of some sort of *asymmetric obligations* for firms with monopoly power, is also present in the US antitrust law and jurisprudence.

On the point the European Court of Justice (1983, para. 57) affirms:

> "A finding that an undertaking has a dominant position is not in itself a recrimination but simply means that, irrespective of the reasons for which it has such a dominant position, the undertaking concerned has a special responsibility not to allow its conduct to impair genuine undistorted competition on the common market".

What exactly the asymmetric obligations or the special responsibilities of the monopolist or of the dominant firm are is quite an interesting matter for economists to get to grips with. The Court appears to be saying that the dominant firm has some sort of negative responsibility, "not to allow its conduct", i.e., the dominant firm has to abstain from certain behaviours. However, it is very clear that the Court is saying that these behaviours are not allowed only because we are in the presence of a dominant firm; most likely the same behaviours are allowed to a normal firm. But was not this same Court saying earlier that the dominant firm has to follow practices or behaviours inspired by normal competition? Some clarification is certainly needed. Furthermore, one might ask if the Court is also implying that there are situations in which the concept of special responsibility calls for positive actions on the part of the monopolistic/dominant firm (MDF) firm – positive actions that the firm would not choose to adopt without the constraints imposed by competition law.

Finally, in American law, we find an additional legal concept: *attempt to monopolization*, an idea only partially present in European antitrust law.[6] This concept needs to be clearly distinguished from the

[6] In the EU non-dominant firms do not have special unilateral obligations. One important exception does, however, exist: the case of merger control, where a specific type of "attempt to monopolization", called creation of a dominant position, is explicitly forbidden by European law.

special responsibility of the MDF, but, nevertheless, I remark its logical connection with the general idea of preservation of 'normal' competition. This specific requirement of US antitrust law constitutes a sort of special responsibility for a normal firm that has the potential to alter an otherwise ordinary competition game.

In the next section I try to build a meaningful economic framework to contain all these thorny questions.

2. The competition game

Direct application of game theory to antitrust themes obviously is not new. While there are many highly formal treatments of agreements between enterprises and unilateral behaviours of firms, in this paper I use basic intuitions derived from non-cooperative game theory to propose a new, simple formalization of unilateral behaviours of firms with market power.

In this section, borrowing ideas and formal concepts from basic game theory, I use them to give precise economic content to two fundamental antitrust definitions, monopoly or dominant position and monopolization offence or abuse of dominant position, and to the important corollary of the latter about the special responsibility of the monopolist or the dominant firm not being allowed to further distort an already weakened competition game.

I interpret competition as a game where firms, with different market power, compete by choosing strategies based on their own sets of possibilities and the existence of competition law.[7] For the greatest possible simplicity, my essential representation of market interaction will employ a static game without repetition: all dynamic interaction is collapsed in a one shot choice of strategy.[8]

The existence of competition law implies that the set of behaviours from which a firm with market power can choose is limited to legally acceptable behaviours. On the contrary, normal firms are allowed a full set of choices, but, being devoid of market power, are as-

[7] In the games I shall consider action and strategy are not distinguishable concepts.

[8] Time in this paper plays no role, as I examine only a one shot static game.

sumed to be rational and not to adopt abusive strategies. To be clear on the point: *the set of strategies available to a firm with market power is restricted* ex ante *by the existence of antitrust law.*[9]

In game theory when a player has a strategy that, irrespective of what other players may choose to do, will bring him a result superior to all the others, in the attainable payoff space, this strategy is called *a dominant strategy*. The definition of a dominant strategy, implying the possibility to choose without taking into account other players strategies, suggests a natural parallel, even a linguistic one, with the definition of the firm with market power – "the firm with a dominant position" – that we find in European antitrust law. But such a concept readily applies to the American firm with monopoly power. The possibility to choose a dominant strategy ignoring other players' choices appears *prima facie* logically comparable to the requirement of independence or the ability to exclude competitors defined in antitrust law or jurisprudence. Therefore, exploiting this important analogy, I concentrate my analysis on a firm that has enough market power that, under either jurisdiction, it would be considered a monopoly or a dominant firm; from now on I shall speak of an MDF.

Hence, I assume that the power to behave 'independently' from competitors, referred to by the European Court of Justice, or the ability to 'exclude' competitors central to the US definition, can be given a precise logical and economic meaning using the game theory definition of dominant strategy. To be clear, starting from the definitions of independence from competitors given by European and US courts, and giving formal content to their logical implications, I formally state my position in the following theorem.

Theorem 1: *an MDF has a dominant strategy in the competition game.*

Proof: let there be a firm D and (a) competitor(s) C, if D is a firm with a monopolistic/dominant position its choices are, according to the assumed definition of independence, independent from competitor(s) C choices. Therefore, given a set of strategies $|d|$, D will choose the strategy d^* that maximizes its payoff $p(d^*)$, so that $p(d^*) \geq p(d)$, for all

[9] For instance, article 82 of the European Treaty lists examples of behaviours that a dominant firm cannot adopt.

d in |d|, independently of its competitor(s) C choices. The strategy d* is D's dominant strategy. The proof of the theorem is by contradiction; if, following a competitor's choice of c', there exist a d^0, different from d*, for which $p(d^0) > p(d^*)$, then d* is not a dominant strategy, but also firm D's choices are not independent from competitor(s) C's choices, and hence D is not an MDF. QED.

The concept of strong independence assumed in this definition is essential to the proof of the theorem and to understand the logical implications of the reasoning of the Courts, therefore, it deserves some more scrutiny. The independence of the MDF from competitors is not absolute, nor is it in the nature of market interaction; it appears here only as a logical construction.

In fact, it essentially derives from the joint presence of market power and competition law. If it is granted that without market power there can be no independent behaviour of the MDF, one has also to recognize that without competition law an MDF could find it convenient, in many (most?) situations, to react to competitors' actions, making its strategy *dependent* on their choices, with the goal to monopolize the market or to abuse of market power, for example adopting actions such as those included in the list of forbidden behaviours of article 82 of the European Treaty.

However, the Courts consider this kind of actions illegal in the presence of competition law: but then the consequence is that *the existence of competition law is an essential logical foundation for theorem 1 and especially for the independence from the competitors' assumption of the MDF.*

On theorem 1 there are also some other remarks to make. First, it is easy to notice that the opposite of the theorem does not hold; it is quite possible that a firm has a dominant strategy in the competition game but it is not an MDF.[10] Second, the competition game of an MDF appears to be relatively simple; it can always adopt its dominant strategy irrespective of other players' behaviours, competitors, cus-

[10] As a simple, extreme example, consider a firm with an inferior product that is evaluating whether to enter a market: if the firm realizes that entrance will cause only losses in all states of the world, it will have a dominant strategy, stay out, but certainly not a dominant position.

tomers or consumers alike.[11] Third, going back to the European definition of dominant position, I can now suggest an even more subtle interpretation to the locution "appreciable" independence from competitors used by the European Court of Justice. In fact, theorem 1 can be interpreted as stating that, in the competition game that the MDF is playing, its payoff is affected by the presence of other players but is not affected by their choices, i.e., an MDF can choose its strategy independently of other firms' choices, but this "appreciable" independence is limited, insofar as the existence of other firms still influences the payoff matrix of the game.

Similarly, if we concentrate on the US definition, we can interpret the power to exclude competition as the possibility to choose without taking competitors' actions into account in the formation of the MDF strategy; nevertheless, also in this case, the existence of competitors affects the attainable payoffs.

Very different is obviously the situation of the other players in the game: other firms are affected by the presence and by the strategy of an MDF firm and, rationally, they must take into account its set of choices in defining their own strategies.

As is well known, we have a Nash Equilibrium (NE) in a game when, once the decisions of all other players are revealed, no player finds it to his/her advantage to change their earlier decisions. But, following theorem 1, for an MDF this should always be true!

Hence, from the given definition of an MDF and from the presence of an MDF in a game, I can define a specific type of NE for our competition game: when the competition game is played by an MDF and other competitors devoid of market power, we find an (MDF) NE for the game any time other firms find their no regret strategy. Let me establish this more precisely in the following corollary to theorem 1.

Corollary 1: *a competition game in which an MDF participates has an (MDF) NE when other firms in the game have no interest in changing their choices.*

Discussion: let there be a firm D and a competitor(s) C, D is an MDF. By theorem 1, given a set of strategies $|d|$, D has a dominant strategy

[11] A more complex strategic dimension would be introduced if the MDF could choose to respect or to violate competition law, but more on this later.

d^* that maximizes its payoff $p(d^*)$, so that $p(d^*) \geq p(d)$ for all $|d|$. Let us assume that C can choose a strategy c^*, from a set $|c|$, that maximizes its payoff $p(c^*)|d^*$, such that $p(c^*) \geq p(c)$ for all c in $|c|$ given d^*. Then $[p(d^*), p(c^*)]$ is an (MDF) NE that would constitute the normal competition result of the game.

The common definition of the NE, in the presence of an MDF, places on the search of the equilibrium in the game, as compared with a game in which participate only normal players, a somewhat looser requirement. There are two reasons for this simple consideration: first, one of the participants in the game, the MDF, has a dominant strategy and is expected to play it; second, other players, having a high level of confidence in the expected MDF's behaviour, will better calibrate their optimal strategies, a fact that lowers their *ex ante* uncertainty and renders less likely the adoption of choices that could cause situations of *ex post* regret.

On these bases I advance the following conjecture.

Conjecture 1: *a competition game in which an MDF participates, relative to a normal competition game, is more likely to have an (MDF) NE and this NE will more likely be unique.*

I shall not elaborate here on conjecture 1, but its rationale is intuitive. The MDF has a dominant strategy, so its choices should never be a source of *ex post* regret; other players, understanding and anticipating the realization of this dominant strategy, should optimize their behaviour taking it into account and be more able to select a best solution among all possible outcomes of the game. In practice, the presence of an MDF in the competition game, notwithstanding all other disadvantages it can have for competition, seems at least to offer one advantage: the game is better understood and more predictable for all participants.[12] Hence, the intuition that the presence of an MDF in the competition game reduces the difficulty of finding a NE and also reduces the probability of having multiple NE.

But leaving aside technical considerations, we came to the more interesting question: by recasting the concept of NE, through corol-

[12] For the same reason this kind of competition game should also be better understood by the antitrust authorities. Without any doubt an encouraging conjecture!

lary 1, in the concept of an (MDF) NE, can we deliver any analytic advantage?

There is one angle of this question that is particularly worth exploring: a very interesting development of the analysis could emerge when an MDF 'surprisingly' decides to modify its predictable behaviour and not to follow its dominant strategy in the game. What meaning can be given to the behaviour of a player that abandons its dominant strategy in a game? Is that necessarily irrational? Below I discuss the question from the specific point of view that the violations of an (MDF) NE are a (possible) result of a firm market power. In other words, in my analysis, to abandon the dominant strategy means playing the competition game with different rules: the set of choices available to the MDF is reinterpreted and under this new light antitrust law can be violated and competitors damaged, maybe at a cost. Hence, independence of behaviour assumes a completely different meaning.

I suggest that if an MDF abandons its dominant strategy, this can be interpreted as a violation of the legal conduct of the competition game. Returning to the European Court, we know that the dominant firm should not follow "methods different from those which condition normal competition" with the effect of "hindering the maintenance of the degree of competition still existing in the market". The US Supreme Court would accept as legitimate behaviours based on "superior product" or "business acumen", but will condemn "willful acquisition or maintenance of that (market) power". I interpret these statements as norms of competition law that, limiting the set of allowable choices, impose on the MDF not to change its independent (and predictable) dominant strategy with the purpose/effect of damaging competitors.

If modifying an independent dominant strategy to exclude or damage competitors, on the part of the dominant firm, corresponds to abandoning methods of normal competition and to wilful acquisition or maintenance of market power, this is something that the Courts would consider illegal. It follows that a very attractive specific interpretation can be given to these kinds of violations from the MDF. To be precise I state my interpretation in the following theorem.

Theorem 2: *an MDF which violates an (MDF) NE, worsening a competitor's(s)' expected payoff, commits an abuse of dominant position or a monopolization offence in the competition game.*

Proof: let there be a firm D and (a) competitor(s) C; D is an MDF. Considering corollary 1, we assume that there exists an outcome of the game [p(d*), p(c*)] that is an (MDF) NE and would constitute the normal competition result of the game. Assume now that D chooses a different d' in |d|, such that $p(d') < p(d^*)$: we have two possible consequences for firm C: 1) $p(c^*)|d' \geq p(c^*)|d^*$ or 2) $p(c^*)|d' < p(c^*)|d^*$. In case 1) D violates the NE worsening its position but without negative consequences for C: this is an economic mistake but is not abusive. In case 2) D violates the NE worsening its position *and* C's position: this cannot be considered normal methods of competition and is therefore abusive. QED.

Under what appear to be quite general and reasonable conditions, a violation of an (MDF) NE could constitute an abuse of dominant position or a monopolization offence. Abandoning the notion of strong independence, embodied in theorem 1, and reacting to a competitor's choice with a 'surprise strategy' appears as a necessary, but not sufficient, condition for an MDF violation of antitrust law.[13]

The practical value of these 'formal signals' of abusive behaviour, however, should not be overrated: first, Theorem 2 only states necessary conditions for an abuse and, second, its utility depends on the ability of the law in discriminating *ex ante* legal from illegal behaviours. We rely on the rough screening value of a way to look at concrete behaviours of an MDF firm comparing them directly with our perception of what should be the 'independent' competitive behaviour of the same firm.

But before discussing some practical examples, let us finally return to the concept of special responsibility of the dominant firm or to the general idea of the asymmetric behaviour required of an MDF. In

[13] One might wonder whether it is possible that there exists a strategy d" that is superior for the MDF, abusive toward competitors, and also included in the set of allowed strategies of the initial competition game. But this would mean that the law does not discriminate *ex ante* all abusive behaviours or, in other terms, that the Courts' definition of strong independence of the MDF based on market power and competition law is unfounded.

Europe, the Court has said that a dominant firm has "a special responsibility not to allow its conduct to impair genuine undistorted competition". If abandoning a dominant strategy to respond to choices of lesser competitors could be abusive, then the special responsibility of the MDF can be reinterpreted as playing the game respecting "methods of normal competition", i.e. pursuing its normal predictable course of action. I establish this with the following corollary of theorem 2.

Corollary 2: *the special responsibility of an MDF consists in preserving the normal outcome of the competition game.*

Discussion: let there be a firm D and (a) competitor(s) C; D is an MDF and $[p(d^*), p(c^*)]$ is an (MDF) NE that would constitute the normal competition result of the game. By theorem 2, D abuses its power as an MDF if it chooses a d' in $|d|$, such that $p(d') < p(d^*)$ and $p(c^*)|d' < p(c^*)|d^*$, as this outcome of the game is inferior for all players, hence competition is impaired and the special responsibility of preserving the normal outcome of the game is violated.

Special responsibility here comes down to playing in such a way as not to alter, through strategic considerations which are external to the actual competition game, what would be its normal result.[14] A few examples in the next section will show possible applications of the concepts I defined.

Finally let me remark that a related theme, but different from the special responsibility of the MDF, is the norm of US law stopping "attempts to monopolization" or even the European rule forbidding the "creation" of a dominant position through a merger. One could take these rules as interventions regarding another type of game, an 'ordinary' competition game, a game starting *without* an MDF. In this case, through its provisions, antitrust law imposes the preservation of outcomes that are "normal" and "rational" *only* before, and insofar as,

[14] A good example of a strategic consideration "external" to the present game would be a situation where an MDF decides that respecting competition law is not profitable no matter the consequences. In such a case, destroying competition, illegal and sanctionable, as it might be, could (likely?) alter the future payoff matrix of the dominant firm in a positive way.

the attempt to monopolize or the competition reducing merger have not taken place yet. Firms participating in this game, for the law, have a different sort of special responsibility: not to alter the possible outcomes of an ordinary competition game *when they have the potential to do so.*[15]

These specific interventions can obviously be linked to the general idea of preserving a 'normal' competition outcome – an idea at the core of the framework I examined – but they need to be studied in a totally different context. Mapping the frontier between games with an existing MDF and games with one in 'potential' formation, however, goes beyond the scope of this work.

3. Examples

The starting point of this paper was a list of stylized behaviours that could appear rational, from the point of view of the firm with a major market share, but seem to violate some acceptable standards of fairness in competition.

Let go back to one of the stylized facts in the introduction. A cola company has an 80% share of the market and decides to attack its only real competitor with a special discount offered only to distributors that will no longer carry the competitor's product.

I shall illustrate the reasoning behind my basic concepts with a very simple example. Let assume that in our game there are only two firms: the MDF and one competitor. We summarize the normal form of this game in the following payoff matrix: the first value is for the MDF, the second is for the competitor.

[15] In the US, the law, given certain circumstances, could condemn a firm without a monopoly position of *attempt to monopolize*. In this sense, even if the reference to the special responsibility of the MDF appears less common in US jurisprudence, the attention to the preservation of the competition game proves, at least in principle, more radical than in Europe. A theme that certainly deserves further research.

		COMPETITOR I	COMPETITOR II
MDF	A	2/1	4/0
	B	5/1	6/3

The MDF can choose between two strategies, **A** and **B** but, coherently with theorem 1, has a clearly dominant one; we will take this to be its normal course of business. We then assume that the MDF will play **B**, having regard only to its own behaviour and the payoff matrix. If the MDF is bound to choose **B**, the competitor will anticipate and choose **II**, and the outcome of the game will be 6/3. Once the result of the game is known, the other firm will have no incentive to change its choice, because the alternative **I**, given **B**, would produce an inferior payoff. Therefore, the outcome 6/3 is an (MDF) NE of the game: neither the MDF nor the competitor can regret the result once their choices are made.

Let us reconsider the same payoff matrix of the previous example. Assume that the MDF, predicting that its competitor will play **II**, instead of pursuing the outcome 6/3, decides to move to **A** and prefers the outcome 4/0. This behaviour, apparently irrational, is exactly how a predatory behaviour might appear in a payoff matrix of a game. The loss of profit for the MDF caused by the move from **B** to **A** might be the discount offered to distributors not to carry competitors' products or any kind of other sacrifice of immediate profit that makes life more difficult for the competitor. The MDF reduces its payoff from the game in exchange for some gain that appears, and actually is, outside what would seem a rational outcome of the present game.

One could suggest that the rational purpose of such a behaviour could be based on the strategy of being able to avoid repeating the game in the next period. Looking at our payoff scheme let us assume that, if the other firm obtains a payoff 0 in this game, it will be obliged to leave the market. In this case the competition game will be over and the MDF will have become a complete monopolist, with a maximum profit higher than any possible outcome of the competition game and a payoff limited only by the shape of the market demand curve.

However, in our representation, this strategy is illegal; recall theorem 2: the MDF move, violating an (MDF) NE, accomplishes an abuse of dominant position or a monopolization offence. One could

discuss if, and in which context, the 'surprising' choice of the MDF, possibly finalized to eliminate the competition game in the next period, is economically rational, but certainly this possible 'rationality' of the MDF behaviour would fall outside the borders of the present competition game or, better, outside the rational ordering of the set of allowed lawful solutions of the game. In the present competition game the MDF has special responsibilities in respecting the normal solution of the game; violating these responsibilities is an abuse of its dominant position or a monopolization offence.

The same reasoning, maintaining the simplicity of our previous example, could well fit other stylized events: the airline that shifts its flights to discourage entrance into its formerly monopolistic market or the software house that offers one programme for free to devalue the market for a competing programme sold by a weaker competitor. In all these situations one could immediately spot a deviation from the simplest form of action, "from the normal methods of business" or from normal competition based on "superior product" or "business acumen". The MDF abandons its dominant strategy, foregoes immediate profits, but also worsens its competitors' payoffs and hence impairs the competition game. Its future possible gains are not immediately perceivable and in any case outside the correct ordering of the solutions of the present game. Here we find a hint of what could constitute abusive behaviour or monopolization.

One could argue that even an MDF has the right to defend its market position. But this is exactly the question: in competition law dominant positions are accepted, in the language of the European Court, "a finding that an undertaking has a dominant position is not in itself a recrimination". Even in the US there is no Statute against monopolies; they may be the result of former competition games from which they emerged by superiority on the merits.[16] But whatever their origin, a dominant position or a monopoly can be defended *only* with normal methods of competition accepted by competition law.

To fully understand if these suggested interpretations of antitrust concepts are useful in other types of abuses or monopolization of-

[16] In Europe a dominant position can also derive from the liberalization of a former legal monopoly or by a merger realized before this way of creating a dominant position was forbidden by competition law (first Merger Regulation of 1989).

fences, where the predatory or exclusionary nature of the behaviour is less clear, is a task I must leave to a future work.[17]

There is, however, one different type of example that I wish to examine here – a case where some public authority thinks that an MDF has a specific obligation to realize positive actions in favour of competition. To take a familiar example, let us imagine an incumbent Telecom which is required to offer competitors unbundled access to some element of its network particularly difficult to duplicate. What I want is to see whether my framework can accommodate this kind of analysis and deliver some useful insight.

Let us consider the example in slightly more general terms. We shall assume a situation in which an integrated company, which owns some kind of essential facility, has to decide to sell or not to sell an essential input to a competitor that wants to compete in a downstream market.

As before, I start with a game that in his normal form has a payoff matrix in which the dominant strategy is evident.

		COMPETITOR	
		I. Buy Little	**II. Buy a Lot**
MDF	**Sell**	2/1	1/0
	Not Sell	3/0	3/0

If the MDF plays **Not Sell**, the other firm is indifferent between abstract possibilities **I** and **II**: they are both elementary solutions of an (MDF) NE, but one could say that the competition game has already collapsed.

However, it is possible that this is not the right competition game to be examined. Perhaps, in this game what an authority could consider the abusive behaviour of the MDF has already been embodied.

We recast a different competition game that will be played in two steps: a production game and a distribution game. In the first step, the production game, the MDF chooses to sell or not to sell its input to the competitor. In the second step – the distribution game – the two firms compete on the market. Assume that a regulator can impose on

[17] A difficult case could be to discriminate between an MDF that is creating strategic barriers to entry or adapting to emerging new market practices or demands. An interesting example could be that of an MDF that creates a costly technical standard particularly difficult for smaller competitors to attain.

the MDF rigid separation of the two steps in the payoff consideration.[18] The payoff table of the production game could than appear as follows:

		COMPETITOR	
		I. Buy Little	**II. Buy a Lot**
MDF	**Sell**	3/–1	4/–2
	Not Sell	1/0	1/0

The second step, the distribution game, in our simple example, will not even be a true game, however. Depending on the result of the first step, we can have three solutions:

High Competition	-3/2	as a consequence of **Sell/Buy a lot**
Medium Competition	-1/2	as a consequence of **Sell/Buy little**
No Competition	2/0	as a consequence of **Not Sell**

The payoffs of the second step of the game can now be added to the payoffs of the first step. It is evident that if the MDF could choose its strategy free from any regulatory/antitrust constraint, its combined dominant strategy would give the same result as in the cumulated game above – it would play **Not Sell** and obtain a **No Competition** 3/0 cumulated payoff.

However, if the two steps of the game are separated by regulation/antitrust, the MDF in the first step should play its dominant strategy in the production game, i.e. it should play **Sell,** and the competitor, obviously taking into account also the second phase competitive payoff, will play a strategy of **Buy little,** with the final result for the two firms of **Medium Competition** and 2/1 as cumulated payoff. This result, given the regulatory constraint, corresponds to an (MDF) NE for the recast competition game.

It is clear in this framework that a behaviour of an MDF that violates, in the recast production game, its 'new' dominant strategy by refusing to choose **Sell** is no different from the kind of abuses discussed in the previous examples. The instruments of analysis are the same and the conclusions one can reach are analogous.

[18] In a sense, the regulator is integrating *ex ante* competition law, giving further indications about admissible behaviours for an MDF firm.

4. Conclusions

In this paper I did not explore all the possible advantages of giving precise meaning to some fundamental legal definitions of European and American antitrust laws using basic concepts of game theory, but from the more modest effort I have made it appears that this line of research can deliver fruitful insights. Key concepts like the dominant position of a firm, the abuse of such a dominant position, the special responsibility of the dominant firm, monopoly and monopolization offence are all legal ideas that appear vague or even puzzling to many economists. Looking for more precise meanings and possibly for operational content is a very important task. It appears possible to apply the new formalized definitions, and in particular theorems 1 and 2, discussed in the paper to probe the logical foundations of Courts' judgements and, perhaps, to discriminate better in concrete situations companies' behaviour between actions of healthy competition and aggressive choices of firms with market power aimed to disrupt the competition game.

Independence of behaviours, as defined by both the Supreme Court and the European Court of Justice, in a competition game in which there is an MDF – and competition law *ex ante* restricts the set of its strategies to legal ones – logically implies that this kind of firm is left with a dominant strategy fully independent from competitors' actions. In this situation, an MDF's choices should ignore competitors and never be a source of *ex post* regret. Other players, understanding and anticipating the implementation of the dominant strategy, should optimize their behaviour taking it into account and selecting a best solution among all possible outcomes of the game. In practice, the presence of an MDF in the competition game, notwithstanding other drawbacks this may have for competition, offers one advantage: the game is better understood and more predictable for all participants. All this I summarized with theorem 1 and its logical consequences.

The second central point of the work is to explore what kind of behaviours an MDF can legitimately adopt to defend its market share and economic position. Many economists have argued that firms with market power have the full right to defend their market position because this is at the core of the competitive process. The European Court of Justice, however, has stated that a dominant firm may only compete using normal methods of competition. The US Supreme

Court ruling, using different expressions, means essentially the same. In fact, this is exactly the core of the question: in competition law a dominant position or a monopoly is accepted – "that an undertaking has a dominant position is not in itself a recrimination", writes the European Court – but, whatever its origin, it can be defended *only* with normal methods of competition, or, as stated in US jurisprudence, by competition on the merits. Unpredictable behaviours, surprise choices, actions that a normal firm would not adopt, ring a bell: they could represent hints of abusive conduct or of monopolization offences. This is the kernel of theorem 2.

The practical value of these ways of looking at the competition game largely depends on the clarity of the *ex ante* guidelines that we have from the law and from our ability to screen unusual behaviours from normal or merit competition – not an easy task, but at least the theorems seem to offer a suggestion on the direction to begin to look at.

In the context of this analysis, the theme of the special responsibility of a firm with market power boils down to an apparently simple concept: an MDF has to play the competition game in a way so as not to alter it, through external strategic considerations, and should not change its normal results. In a nutshell, lowering its own payoff, with the purpose of lowering a competitor's payoff, is not a normal way to play a competition game and the outcome cannot lead to normal results.

One obvious development of this work is to search for other legal definitions of antitrust law to which basic concepts of game theory can be applied and try to exploit any new insight that derives. A good candidate for these further applications would appear to be the legal definition of collective dominance, an area of antitrust practice that needs to be reconciled with common economic understanding. Other excellent candidates, upon which I have only briefly touched, are attempt to monopolization and the creation of a dominant position through a merger – difficult issues directly related to the theme of the preservation of the competition game.

A first step for further research directly linked to this work is to verify if theorems 1 and 2 can be applied to other types of abuse or monopolization offences, particularly those different from predatory and exclusionary practices, and especially abuses of exploitation and discrimination.

Finally, there is the central question that remains the primary aim of any future work on the line developed here: to ascertain if this suggested interpretation of the Courts' view of dominant firm's characteristics and set of choices, when applied to concrete real situations, has at least some first screening value that can help to set the investigation of possible violations of antitrust law on the right track.

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