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Exclusionary practices and two-sided platforms - Note by Andrea Amelio, Liliane Karlinger and Tommaso Valletti

Hearing on Re-thinking the use of traditional antitrust enforcement tools in multi-sided markets

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Exclusionary practices and two-sided platforms

Note by Andrea Amelio, Liliane Karlinger and Tommaso Valletti

1. Introduction

1. Two-sided platforms refer to situations where (at least) two distinct user groups (i.e. two demands) interact with each other through a common platform and the participation of at least one of these groups impact the value of participation for the other group(s). Following Evans (2003), "a platform constitutes the set of the institutional arrangements necessary to realise a transaction between two users groups".[1]

2. Typically, these two distinct customer groups cannot contract directly. This is because the transaction costs for customers individually reaching enforceable agreements are too high. As a result, a third party usually creates a place or space – a platform – where the different groups of consumers/users can get together. In such situations, the need to convince agents to participate on all sides of the platform creates a so-called chicken-and-egg problem, in that members of each group are willing to participate in the market insofar as they expect many members from the other side to participate.

3. For a market to be considered two-sided, it has to do more than just allow two or more groups "to connect or engage with each other". As expressed by Rochet and Tirole, "if the analysis just stopped there, pretty much any market would be two-sided, since buyers and sellers need to be brought together for markets to exists and gains of trade to be realized."[2] Yet two-sided markets are characterized not only by the existence of cross-side network effects/indirect network effects, but also by the feature that the platform can use its fee/pricing structure to influence the volume of transactions between users. Rochet and Tirole therefore define a two-sided platform as one in which the volume of transactions between users depends on the structure and not only on the overall level of the fees charged by the platform.

4. Multi-sided platforms are very common and are present in many markets including: stock exchanges, internet portals, payment card systems, newspapers, television broadcasters, directories, smartphones, mobile and fixed telecommunication networks and estate agents. These examples cover very diverse industries affecting many different aspects of consumers' lives. For antitrust authorities it is therefore essential to have a thorough understanding of these platforms to properly enforce antitrust scrutiny.

5. Two-sided markets are an area of considerable recent economic research in the field of Industrial Organization. The paper does not intend to provide an exhaustive review of the two-sided market literature. The aim of the paper is two-fold. First and foremost, it focuses on the literature dealing with exclusionary pricing and discusses whether the presence of indirect network externalities makes platforms more or less prone

[1] Evans, David. "The Antitrust Economics of Multi-Sided Platform Markets." Yale Journal on Regulation 20 (2003): 325-82.

[2] Jean-Charles Rochet and Jean Tirole. "Two-sided markets: a progress report." RAND Journal of Economics 37, 3, (2006): 646.

to adopt exclusionary conducts. Often, in the public debate, it is advocated that multi-sided platforms deserve a special (typically, more relaxed) scrutiny by antitrust authorities.[3] The result of our preliminary research is not in line with this conclusion. Similar exclusionary behaviours taking place in single-sided markets also carry over to multi-sided markets. This suggests that the typical tools that one applies in the analysis of single-sided markets need not to be abandoned: it is enough to adapt them. Second, the paper discusses policy aspects that are particularly relevant in the current discussion about platform competition and on which more research would be desirable.

6. The views and comments put forward in this paper are intended to add to the ongoing debate on platforms and cannot be read as providing guidance on the European Commission's past or future assessment of competition cases involving multi-sided platforms. Our contribution has more modest goals and its main purpose is to contribute with some embryonic research grounded on economic principles to the discussion about the likelihood of exclusionary practices in multi-sided markets.

2. A close-up on exclusionary pricing in multi-sided platforms

7. A natural approach when starting to model exclusionary pricing in a multi-sided framework is to turn to the literature on exclusionary pricing in standard one-sided markets, to see how they can be adapted to fit the two-sided framework, and to what extent the results obtained for one-sided markets carry over to the multi-sided framework. There are many different avenues that one could take, and this article does not attempt to provide a full treatment of this question.

8. For instance, we do not consider here the rich literature on predatory pricing which builds on asymmetric information between incumbent and entrant, and thus explains the rationality of predation through signalling or reputation building on the side of the better informed incumbent. These models tend to focus on the informational asymmetry among the two suppliers, while treating the competitive interaction on the goods market in a rather reduced-form way. This is why these models do not lend themselves easily to an adaption to a two-sided context, where the exact nature of competition on either side of the market is arguably an important feature if one wants to gain further insight beyond what is known about one-sided markets.

9. This article therefore zooms in on two important strands of literature regarding exclusionary strategies which are not driven by asymmetric information, and which are often associated with the works of Segal and Winston (2000)[4] and Dixit (1980).[5] Segal and Winston (2000) explore the mechanism of "divide-and-conquer" strategies, whereby one group of buyers is locked in by the incumbent with very favourable offers, so as to prevent a potential entrant from reaching critical scale, thus allowing the incumbent to then monopolize the rest of the market. Dixit (1980) instead belongs to an earlier literature on entry deterrence through limit pricing, where an incumbent can discourage

[3] See, for instance, Evans, David and Richard Schmalensee. “Industrial Organization of Markets with Two-Sided Platforms.” Competition Policy International 3, 1 (2007): 27.

[4] Segal, Ilya R., and Michael D. Whinston. "Naked exclusion: comment." The American Economic Review 90, 1 (2000): 296-309.

[5] Dixit, Avinash. "The Role of Investment in Entry-Deterrence." The Economic Journal 90, 357 (1980): 95-106.

entry by setting a price just low enough (or producing an output just high enough) to render prospective entry unprofitable.

10. Both model families, "divide-and-conquer" and limit pricing, rely on the presence of scale economies to achieve foreclosure, but divide-and-conquer strategies require the existence of multiple buyers who can be played off against each other, while limit pricing models give a first-mover advantage to the incumbent in making its price (or output) choices in a way that leaves no room for entrants to establish their business alongside the incumbent in the market.

11. This paper builds on these seminal works and adapts these models to incorporate a multi-sided logic. We study how the presence of externalities, typical of multi-sided platforms, changes the incentive of an incumbent firm to undertake exclusion.

2.1. Extending Segal and Winston (2000) to multi-sided platforms

12. We start by examining the first strand of literature on "naked exclusion" strategies, which originates in the works of Rasmusen et al. (1991)[6] and Segal and Whinston (2000).[7] While the canonical naked-exclusion models are cast as an analysis of exclusive dealing contracts, the mechanism they propose can be applied to a wider set of circumstances.

13. The crucial concept developed in the naked exclusion literature is that of "divide-and-conquer strategies": Consider an industry where an entrant needs to reach a certain scale in order to be viable, and there are multiple buyers who choose independently from which supplier (either the incumbent or the entrant) to buy the product. To fix ideas, suppose that in order to reach the critical scale, the entrant has to serve the entire market demand. If the incumbent wishes to thwart entry, it is sufficient to convince just one out of the many buyers to buy from the incumbent instead of the entrant. A single buyer who turns away from the entrant prevents the latter from reaching the critical scale, implying that entry will not take place, i.e. the incumbent remains the only available supplier. All the other buyers will therefore be forced to buy from the incumbent as well, even if they can do so only at very high prices.

14. Of course final buyers are worse off in this monopoly than they would have been in a duopoly with a more efficient second supplier. But as soon as one buyer turns away from the entrant, the others no longer have a choice but to buy from the incumbent as well. The incumbent will therefore only have to compensate the first buyer for giving up the possibility to buy from the entrant. The compensation paid to the first buyer is thus the "price" that the incumbent has to pay to monopolize the entire market. This compensation is paid out of the profits that the incumbent makes from selling at monopoly prices to all remaining buyers: in this sense, the incumbent's strategy is one of "divide-and-conquer".

15. This strategy exploits the fact that a single buyer, when deciding from which seller to buy, only takes into account its own payoff, i.e. it compares the prices and possibly other terms (e.g. an exclusivity clause in exchange for a certain reward) offered

[6] Rasmusen, Eric B., J. Mark Ramseyer, and John S. Wiley Jr. "Naked exclusion." The American Economic Review (1991): 1137-1145.

[7] Segal, Ilya R., and Michael D. Whinston. "Naked exclusion: comment." The American Economic Review 90, 1 (2000): 296-309.

by the two sellers to this particular buyer, and then chooses whichever offer is more favourable to itself. However, a single buyer will not typically take into account the consequences its supplier choice has on the other buyers; in particular, when the buyer decides in favour of the incumbent and against the entrant, and the entrant fails to reach the critical scale because of this one buyer, this has a negative impact on all other buyers because it deprives the latter of a second supplier.

16. The buyer thus exerts a "negative externality" on all other buyers. Exploiting this negative externality to its own advantage is at the heart of the exclusionary strategy deployed by the incumbent in the literature on "naked exclusion". In the following, we will examine how this concept can be applied to two-sided markets.

2.1.1. Is exclusionary pricing anticompetitive in two-sided markets?

17. The first paper to introduce naked exclusion pricing strategies into a two-sided market framework is Vasconcelos (2015).[8] It makes a number of assumptions that distinguish it from the previous literature on two-sided markets; in particular, the model studies the case of discrete buyers on each side of the market, as opposed to a continuum of massless consumers typically assumed in the traditional models of two-sided markets. Allowing consumers to have positive mass is crucial for the mechanism of "divide-and-conquer" strategies to work: A single buyer must have a sufficient level of demand to be "pivotal", i.e. to represent a sufficiently large share in the entrant's total sales so as to be decisive for whether or not the entrant reaches the critical scale.

18. The model assumes that there are two groups of agents, labelled $i = 1, 2$, which interact with each other via platforms. There is an incumbent platform I which already has an installed base of buyers on each market side of size $\beta^I > 0$, and an entrant platform E whose installed base is $\beta^E = 0$, but which has a lower unit cost of serving a user. The asymmetry in installed bases mirrors the entry barrier in traditional naked exclusion models, which typically assume some physical setup costs which the incumbent has sunk already, while the entrant can still avoid them by choosing not to enter the industry.

19. The two platforms compete for a new generation of buyers of size N on each side, whose utility from joining platform $k = I, E$ is increasing in the number of (old and new) buyers who joined the same platform on the other side (i.e. network effects are indirect here). The key assumption made about network externalities is that they are one-sided: only group 1 buyers care about the number of buyers on side 2 of the platform they join, while group 2 buyers are indifferent as to the presence (or absence) of buyers on side 1.[9] The utility function of the buyers can thus be represented as:

$$U_1^k = z\left(\beta^k + N^k\right) - p_1^k \text{ and } U_2^k = r - p_2^k,$$

where r and z are two positive parameters, and p_i^k is the price charged by platform k to an agent on side i of the market. With one-sided externalities, it is clear that, in this model, only group 2 buyers will ever be pivotal: by providing the platform they join with a

[8] Vasconcelos, Helder. "Is exclusionary pricing anticompetitive in two-sided markets?" International Journal of Industrial Organization 40 (2015): 1-10.

[9] The results of this paper are qualitatively similar if instead network externalities run in both directions.

critical mass *N*, they "lock in" the group 1 buyers with this platform as well, allowing the winning platform to charge high pric

20. The model rules out multi-homing, i.e. each buyer will join either platform 1 or platform 2, but not both. Thus, competition between *I* and *E* is of the "winner-takes-all" nature, i.e. the new generation of buyers will always tip to either one or the other supplier. The old generation does not buy again, so they are assumed to stay with the incumbent. This model thus generates two kinds of possible equilibria: one where the incumbent's platform is the only one, and reaches maximum size $\beta^I + N$ on side 2; and another equilibrium where the entrant serves the new generation of buyers, so that the two generations of side 2 buyers are split across the two platforms, giving rise to two smaller networks, the entrant's network of size *N*, and the incumbent's network of size β^I.

21. The model further assumes that platforms can only charge uniform prices on each side of the market, but different prices across the two sides of the market. Importantly, prices are allowed to be negative, i.e. the platform can pay agents to join the platform.[10] In the present setup, the buyer group which will benefit from low prices is group 2, the pivotal group that is decisive for whether or not entry of a new platform will be feasible.

22. Clearly, the fact that the entrant can serve buyers at a lower unit cost represents an important competitive advantage, as this cost differential allows the entrant to make more aggressive price offers. However, the lack of an installed base proves to be a serious obstacle when competing against the incumbent: If the entrant wins the new generation of group 2 buyers, it will still have to compete against the incumbent for group 1 buyers, because the incumbent's platform has positive value for group 1 buyers thanks to the presence of the installed base. Thus, the profits that the entrant can recover on side 1 are capped by the presence of a competitive incumbent.

23. The same is not true if instead the incumbent manages to attract group 2 buyers. Then, the entrant's platform is completely worthless to group 1 buyers, so that the incumbent is effectively a monopolist on this group and can extract monopoly rents from them. The incumbent can therefore afford to be very aggressive in the fight for group 2 buyers, because it can expect to recover higher profits on the other side of the market.

24. The paper shows that exclusion of the entrant can arise for a broad range of parameters, namely when the cost advantage enjoyed by the entrant is relatively low compared to the importance of the installed base. However, this does not necessarily imply that exclusion is inefficient. A reader who is familiar with the literature on naked exclusion may erroneously conclude that the fact that the entrant can serve buyers at a lower cost than the incumbent automatically implies that total welfare is maximized when the entrant serves the buyers, so that any equilibrium in which instead the incumbent prevails is necessarily inefficient.

[10] Subsidizing consumption on one side of the platform makes sense whenever a platform wishes to build an installed base of users on one side, so as to make its platform more attractive for users on the other side, who will then be willing to pay a positive price to join. In this sense, platforms may apply pricing practices that resemble divide-and-conquer strategies even without any exclusionary intention, in particular whenever the network externalities are two-sided. In the present model, however, a monopolist would not need to subsidize consumption on any side of the market: any price slightly below *r* will ensure that group 2 buyers want to participate in this market, so that the platform will also attract group 1 buyers and can charge positive prices to them.

25. However, this conclusion does not necessarily carry over to the case of two-sided markets. Here, there is an additional effect of entry on total welfare which needs to be considered, namely the cost of splitting the two generations of group 2 buyers, old and new, across two different platforms.[11] This is inherently inefficient, because it deprives the young generation of group 1 buyers of the benefit of the network externality exerted by the old generation of group 2 buyers, and vice versa.

26. More specifically, when both generations of group 2 buyers reside on the same platform, the network benefits enjoyed by any buyer on the other side of the same platform amount to $z(\beta^I + N)$; if all group 1 buyers get to enjoy these network effects (recall that the total population of group 1 buyers is $\beta^I + N$), the total benefit will be $z(\beta^I + N)(\beta^I + N)$. If instead the two generations are fragmented across the two platforms, then the incumbent platform generates network benefits of $z(\beta^I)^2$, while the entrant's platform generates zN^2. This is clearly smaller than the total benefits when both cohorts are on the same platform, i.e. $z(\beta^I + N)^2$, because the latter also generates network benefits across cohorts, not just within cohorts.

27. Under the assumptions of the model, only the incumbent network can generate the full network effects of $z(\beta^I + N)^2$, while entry necessarily leads to suboptimal network benefits of $z(\beta^I)^2 + zN^2$. Overall, this model therefore exhibits an intricate set of externalities: (i) the network benefits running from side 2 buyers of any platform to its side 1 buyers, (ii) the network benefits running from the old cohort of the incumbent's platform to its buyers in the young cohort, and (iii) the "contracting externalities" running from the new cohort buyers on side 2 to those on side 1, because the side 2 buyers' choice of platform also determines the available options for side 1 buyers. It is therefore not at all obvious how these three layers of externalities will play out when the incumbent engages in divide-and-conquer type of pricing.

28. The paper shows that when exclusion occurs in this model, it is always socially optimal: Exclusion will occur when the entrant's cost advantage is not sufficient to outweigh the benefits from having both generations of buyers concentrated on the same platform; and this is precisely the condition under which entry is not desirable from a social welfare point of view either. Moreover, there are equilibria where the entrant prevails but which are nonetheless inefficient; in other words, this model may exhibit excessive entry.

29. Two lessons can therefore be learned from this model. The first lesson is that divide-and-conquer strategies may be successfully used also in two-sided markets. As in a standard one-sided market, some buyers may not fully internalize the impact their supplier choices have on the options available to other buyers in the market, and an incumbent may take advantage of this fact to lock in one part of the market by making very aggressive offers to the other side of the market, thus preventing potential entrants from gaining a toehold in the market.

30. The second lesson is that the impact of exclusion on social welfare might be different in a two-sided market from a one-sided market. In this particular setup, the existence of an old cohort of buyers, who are locked in with the incumbent, generates welfare losses if the new cohort is served by the entrant instead of the incumbent, so that network externalities are not maximized. Policies such as a ban on below-cost pricing,

[11] Recall the assumption that the old buyers are locked in with the incumbent and cannot switch platform in case of successful entry.

which are aimed at preventing inefficient exclusion, may end up favouring inefficient entry instead.

2.1.2. A simple theory of predation

31. One key feature of the model by Vasconcelos (2015) is that the two platforms compete simultaneously for both sides of the market. This begs the question what happens if this assumption is relaxed and instead a sequential setup is considered, whereby the two platforms first approach one side of the market, and then the other. Exclusionary pricing under this sequence of moves is studied by Fumagalli and Motta (2013).[12] While their paper is cast as a general analysis of predatory pricing that applies to one- and two-sided markets alike,[13] their treatment assumes that the two buyers who are approached sequentially by the two suppliers belong to the same side of the market, and exert within-group externalities on each other. The incumbency advantage in this setup is that the incumbent can provide more network benefits to any single buyer than the entrant, but provides lower benefits than the entrant when serving both buyers.

32. In this section, instead, we think of the two buyers as representing the two sides of a platform, where the first buyer exerts a cross-group externality on the second, but not the other way round. This is quite a natural and relevant setting in practice. The following analysis illustrates the main mechanism in the specific context of a media outlet (say a newspaper) financed by advertisement.

33. Let there be competition over two possible user groups, the readers and the advertisers. For simplicity, assume that each group has exactly one user (or that the group has mass 1), so that coordination of purchases within a given group is no issue here. Advertisers care about the number of readers a newspaper has, as more eyeballs imply higher advertisement impact and hence more profits from any given ad. Readers instead care about the number of other readers the same newspaper has, for instance because reading the same newspaper allows readers to engage in an exchange with their friends about the content. In other words, readers exert a cross-group externality on advertisers, and an own-group externality on each other.

34. Assume that there is an incumbent newspaper, called *I*, with an installed reader base of size n_I. Readers' utility from buying the newspaper is an increasing function of the newspaper's reader base, $v_I(n_I)$. There is a rival newspaper, called *R*, which competes with the incumbent for the new cohort of readers and advertisers. The rival newspaper has a smaller installed reader base than the incumbent, $n_R < n_I$, so that its newspaper currently provides lower utility to readers than the incumbent's, but has the potential to provide higher utility if it manages to attract the new cohort of readers:

$$v_R(n_R) < v_I(n_I) \text{ but } v_R(n_R + 1) > v_I(n_I + 1). \quad (Condition\ 1)$$

35. Likewise, as regards advertisers' valuation for the newspapers, denoted $a_i(\cdot)$, the rival newspaper, given its current small reader base, provides lower utility than the incumbent, but is more efficient in providing advertisement benefits, so that advertisers would prefer the rival newspaper if it managed to attract the new cohort of readers:

[12] Fumagalli, Chiara, and Massimo Motta. "A simple Theory of Predation." The Journal of Law and Economics 56, 3 (2013): 595-631.

[13] In fact, their paper discusses the applicability of the general results to two-sided markets in a subsection.

$$a(n_R) < a_I(n_I) \text{ but } a_R(n_R + 1) > a_I(n_I + 1). \quad (Condition\ 2)$$

36. Also assume that the network externalities (both own-group and cross-group) increase with a newspaper's reader base, but at a less-than-proportional rate. In order to simplify the exposition, while still showing the main insights, we will focus on the special case where the incumbent newspaper has fully exhausted all network effects, while the rival newspaper still benefits from additional readers on both sides of its platform. In other words, the readers' utility from reading the incumbent newspaper, v_I, is unaffected by whether or not the newspaper manages to attract the new cohort of readers of size 1, and the same is true for advertisers:

$$v_I(n_I) = v_I(n_I + 1) \text{ and } a_I(n_I) = a_I(n_I + 1).$$

37. This assumption allows us to simplify our notation, by denoting respectively as v and a the (constant) value to the readers and the advertisers when joining the incumbent platform. Instead, variables with an overbar refer to the entrant when it manages to attract the new cohort, while variables with an underbar refer to the opposite case when it fails to do so. Hence we can restate our initial conditions as:

$$\overline{v} > v > \underline{v}, \quad (Condition\ 1')$$
$$\overline{a} > a > \underline{a}. \quad (Condition\ 2')$$

38. We will also make the simplifying assumption that both the cost of providing an ad, and of providing the reader access to the newspaper, is zero.

39. Consider the following sequence of moves: first, the two newspapers compete for the new cohort of readers by setting a uniform cover price for the newspaper, denoted p_I^r, p_R^r, and then, they compete for the new cohort of advertisers by setting a uniform price per ad, denoted p_I^a, p_R^a.[14]

40. We can therefore apply backward induction to analyse which newspaper will prevail. Clearly, at the second stage, competition for advertisers will depend on the outcome of the first stage, i.e. whether it was the incumbent or the rival who managed to attract the new readers. We consider each case in turn.

(2a) If the new cohort of readers bought *I*'s newspaper at stage 1, then *I*'s reader base is of size $n_I + 1$, which provides benefits of size a to advertisers, while *R*'s reader base remains at level n_R, yielding lower benefits of $\underline{a}$ to advertisers. The advertisers will compare the net utility they are offered by *I*, namely $a - p_I^a$, to the net utility offered by *R*, i.e. $\underline{a} - p_R^a$, and will place their ads in *I*'s newspaper whenever:

$$a - p_I^a \geq \underline{a} - p_R^a.$$

Given that this is the last stage of the game, the lowest price *R* will be willing to offer its advertisers is zero, so that *I* wins the advertisers with a positive price of

$$p_I^a = a - \underline{a},$$

which leaves advertisers with a net utility of $a - p_I^a = \underline{a}$.

[14] Competing first for readers, rather than advertisers, is a natural modelling choice here, given that advertisers care about the readers anyone of the two newspapers manages to attract, while readers are indifferent about the platform picked by the advertisers.

(2b) If instead the new cohort of readers bought *R*'s newspaper at stage 1, so that *R* has a large reader base of size $n_R + 1$ and provides a high utility of $\overline{a}$ to advertisers, the latter will prefer *I*'s newspaper whenever:

$$a - p_I^a \geq \overline{a} - p_R^a.$$

In this case, Bertrand competition among *I* and *R* will drive *I*'s price offer down to zero, and *R* wins the advertisers with a positive price of

$$p_R^a = \overline{a} - a,$$

which leaves advertisers with a net utility of $\overline{a} - p_R^a = a$.

41. Let us now turn to competition for readers in stage 1. Recall that we assumed that readers are indifferent as to how many advertisers any of the newspapers will attract at stage 2, i.e. they only care about the newspaper's reader base, and its cover price. Thus, if they opt for *I*'s newspaper, the latter will have a reader base of size $n_I + 1$, which provides net benefits of $v - p_I^r$ to readers; if instead they decide to buy *R*'s newspaper, the latter will have a reader base is of size $n_R + 1$, which provides net benefits of $\overline{v} - p_R^r$ to readers. Readers thus buy from *I* whenever:

$$v - p_I^r \geq \overline{v} - p_R^r.$$

42. To see which of the two newspapers can make the more competitive offer to win the readers, first note that their aggregate profits over the two periods, when successful in period 1 (and ignoring discounting across the two periods), are:

$$\Pi_I = p_I^r + p_I^a = p_I^r + a - \underline{a}$$
$$\Pi_R = p_R^r + p_R^a = p_R^r + \overline{a} - a.$$

(1a) Consider first the scenario where *I* wins period 1 competition for readers. Bertrand style competition between *I* and *R* ensures that the lowest price *R* is willing to offer is the one that would drive its aggregate profits down to zero:

$$\Pi_R = 0 \rightarrow p_R^r = -(\overline{a} - a).$$

If *I* wants to match *R*'s offer to win the readers in period 1, it has to offer:

$$v - p_I^r = \overline{v} - p_R^r \rightarrow p_I^r = v - \overline{v} - (\overline{a} - a).$$

Note that, given our assumptions on the parameters, this price is necessarily negative (which is equivalent to being below marginal cost in this model, as the latter was assumed to be zero). In other words, the incumbent can only attract readers by subsidizing their consumption.

At this price, *I* can break even whenever:

$$\Pi_I = p_I^r + p_I^a = v - \overline{v} - (\overline{a} - a) + a - \underline{a} > 0.$$

(1b) If the above break-even condition is not satisfied, i.e. if instead $v + a - \underline{a} < \overline{v} + \overline{a} - a$, then *I* will prefer to lose readers to *R*, so that *R* will make the sales to them at the lowest price *I* is willing to offer, namely:

$$\Pi_I = 0 \rightarrow p_I^r = -\left(a - \underline{a}\right).$$

R will then win the readers with the following offer:

$$v - p_I^r = \overline{v} - p_R^r \rightarrow p_R^r = \overline{v} - v - \left(a - \underline{a}\right).$$

This leaves *R* with aggregate profits of

$$\Pi_R = p_R^r + p_R^a = \overline{v} - v - \left(a - \underline{a}\right) + \overline{a} - a,$$

which is positive by the above assumption.

43. We can therefore conclude that, whenever

$$v + a - \underline{a} > \overline{v} + \overline{a} - a \quad (Result\ 1)$$

is satisfied, the entrant will be excluded; otherwise, the entrant will prevail. This is the main finding of this analysis and it deserves further comments.

44. First, we note that exclusion is more likely to occur if

1. the difference $a - \underline{a}$ is large, i.e. the rival is strongly disadvantaged vis-à-vis advertisers because of the incumbent's installed base,
2. the difference $\overline{a} - a$ is small, i.e. the rival is not much more efficient at providing advertisement benefits than the incumbent is,
3. the difference $\overline{v} - v$ is small, so that the rival's value to readers is not much larger than that of the incumbent's.

45. Second, having established that exclusion can be an equilibrium, we consider its welfare properties. Whether such exclusion is socially desirable or not depends on the strength of the network externalities and the size of the respective cohorts. Under exclusion, the total welfare generated by the newspaper industry is

$$W_{excl} = (n_I + 1)v + a + n_R\underline{v}.$$

46. When instead the rival is successful in attracting the new cohort of readers and advertisers, total welfare is given by

$$W_{entry} = n_I v + (n_R + 1)\overline{v} + \overline{a}.$$

47. Comparing the two welfare expressions, we see that entry always yields higher social welfare, i.e.

$$W_{entry} > W_{excl}.$$

48. This result is directly implied by our (Condition 1') and (Condition 2'), i.e. our assumption that $\overline{v} > v > \underline{v}$ and $\overline{a} > a > \underline{a}$.

49. Thus, whenever (Result 1) is satisfied, so that exclusion will arise, we know that it is anticompetitive in the sense that welfare will be reduced. We therefore demonstrated that divide-and-conquer strategies may lead to inefficient exclusion even in a two-sided market such as the media industry. The presence of network externalities, in itself, is not sufficient to overcome the exclusionary effect exerted by divide-and-conquer pricing. On the contrary, if the advertisers' valuation of the incumbent's installed base is particularly strong, this represents a huge entry barrier for the rival newspaper.

50. Also note that in this model, exclusionary pricing always involves negative prices to readers:

$$p_I^r = v - \overline{v} - (\overline{a} - a) < 0 \text{ because } v + a < \overline{v} + \overline{a}.$$

51. Thus, a ban on negative prices would be an efficient policy tool to prevent exclusionary pricing in this model. As argued above, exclusion is socially inefficient in this model, because the entrant is more efficient than the incumbent at providing utility to

both readers and advertisers, provided it can attract both sides of the new cohort of consumers; we also showed that whenever the incumbent instead manages to attract the readers (which implies that all advertisers will then turn to the incumbent as well), this requires the incumbent to set negative prices to the readers. It therefore follows that a ban on negative prices will ensure that all instances of inefficient exclusion are ruled out.

52. Note, however, that this policy would not make everyone better off: whenever exclusion would have occurred absent this ban on negative (i.e. below-cost) prices, buyers on the reader side of the market will now pay a higher cover price, or, more precisely, they will lose the subsidy they would have received from the incumbent. Advertisers instead will benefit from this policy, because they obtain a larger net benefit in case the entrant prevails.

2.2. Extending Dixit (1980) to multi-sided platforms

53. The previous section studied a rather canonical case where inefficient exclusion can happen with two-sided platforms. This possibility result, though, does not give too many insights into whether exclusionary practices are more or less likely to arise in a two-sided environment. We tackle this question more directly in this section, by building on the seminal paper of Dixit (1980). Dixit (1980) argues that the threat of predating on an entrant is not credible unless the incumbent finds a way of committing to such a course of action. Using the words of Dixit, "the prospective entrant was assumed to believe that the established firm would maintain the same output after entry as its actual pre-entry output. Then the established firm naturally acquired a Stackelberg leadership role. However, the assumption is dubious on two opposing counts. First, faced with an irrevocable fact of entry, the established firm will usually find it best to make an accommodating output reduction. On the other hand, it would like to threaten to respond to entry with a predatory increase in output. Its problem is to make the latter threat credible given the prospective entrant's knowledge of the former fact."

54. The analysis in this section takes this strategic behaviour described by Dixit (1980) and it applies the same logic in the context of multi-sided platforms by introducing indirect network externalities. For the purpose of this exercise, the model underlying our analysis is based on the framework developed by Armstrong (2006).[15]

55. We start by recalling the basic features of the framework developed in Armstrong (2006). There are two groups of agents, i.e. two demands, and two competing platforms. The utilities of the agents are defined such that utilities of a consumer on one side of the platform i increases in the participation of consumers on the other side, n_j^i, of the same platform. The parameters that capture the marginal increase in utility due to indirect network externalities are α_1 and α_2. Denote by p_1^i and p_2^i the prices paid by customers to join platform i on side 1 and 2, respectively. Hence utilities of customers are respectively

$$U_1^i = \alpha_1 n_2^i - p_1^i \qquad U_2^i = \alpha_2 n_1^i - p_2^i.$$

56. Following the Hotelling model, customers are located along the unit line. Under some regularity conditions, a set of demand functions that are well-behaved and a market-sharing equilibrium exist. The two platforms compete by setting prices, and consumers are bound to single-home.

[15] Armstrong, Mark. "Competition in two- sided markets." The RAND Journal of Economics 37, 3 (2006): 668-691.

57. In this standard setting, the analysis of Dixit (1980) is applied, with the important difference that competition is in prices, not in quantities. One platform is considered to be the incumbent and there is another platform that, if it decides to enter, will have to bear an entry cost of *K*. This entry cost impacts negatively the expected profit of the new entrant. The existence and the size of *K* is public information and therefore the incumbent platform can take advantage of it. The incumbent has thus the option to either accommodate entry becoming a Stackelberg leader, or to exclude entry and enjoy monopolistic profits, albeit under the constraint that its output must be high enough (i.e. its price must be low enough) to not leave any room for an entrant to cover its fixed cost of entry.[16] Dixit (1980) shows that above a certain level of *K*, the incumbent has the incentive to exclude the new entrant by expanding its capacity to a point where production of the entry-deterring output level becomes a credible threat. In the setting of the paper where platforms compete by setting prices, the analysis shows that the incumbent has the same incentive to exclude the new entrant by decreasing prices.[17]

58. The introduction of the indirect network externalities does not change the basic intuition identified in Dixit (1980), so that even platforms find it profitable to exclude entry. In the following, the basic results of the analysis are derived and presented.[18]

59. By assuming symmetric indirect network externalities, i.e. $\alpha_1 = \alpha_2 = \alpha > 0$, and solving the basic strategic game as described above, it is possible to derive the equation below that identifies the difference between the profit of the incumbent from exclusion and from accommodating entry.

$$\Delta_{symm} = \frac{1-\alpha}{8}\left(32\sqrt{K/(1-\alpha)} - 25\right).$$

60. By solving the equation for $\Delta_{symm} = 0$, one can find the critical threshold level for the entry cost, $K^*(\alpha)$, above which the incumbent prefers to exclude rather than accommodate the entrant. This threshold depends on the intensity of the externality, α.

$$K^*(\alpha) = \frac{625(1-\alpha)}{1024} < \frac{25}{16}(1-\alpha).$$

61. By studying the function, it is straightforward to see that the higher the externality, the lower $K^*(\alpha)$. This implies that for any given *K*, the strategy of exclusion (i.e. lowering the prices) becomes *more* attractive for the incumbent when indirect externalities are stronger. Figure 1 below is another way of presenting the result, where the shaded area represents the parameter region in the *α-K* space where the incumbent has the incentive to exclude entry. The dark blue middle line represents the threshold level

[16] It is worth mentioning that the incumbent, under the monopoly scenario, serves the entire set of customers, which in the Hotelling model amounts to a demand equal to 1, i.e. 100% of the population.

[17] One way for the incumbent to achieve commitment to such a limit price is to sign long-term contracts with consumers which explicitly exclude price increases over the time horizon relevant for entry.

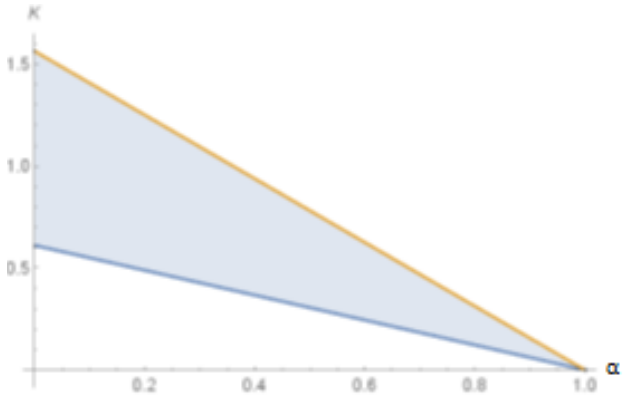
[18] Note that the demand functions in this model also depend on the differentiation parameters in each Hotelling market, t_1 and t_2. For the purpose of this exercise and in order to simplify mathematical expressions, the analysis sets $t_1 = t_2 = 1$. This means that the degree of differentiation of the two markets involved are symmetric. For the purpose of the analysis this is irrelevant. On a more technical ground, this assumption implies that the necessary and sufficient condition to have a market sharing equilibrium becomes $4 - (\alpha_1 + \alpha_2)^2 > 0$ which also implies that $2 - \alpha_1 - \alpha_2 > 0$.

$K^*(\alpha)$. Below this line, the fixed cost of entry, *K*, is too low to make it worthwhile for the incumbent to deter entry; the incumbent would rather accommodate the entrant and enjoy duopoly profits, because deterrence through low prices would be too costly.

62. The yellow upper line represents the second threshold for *K*, namely the level at which entry is "blockaded": when *K* exceeds the entrant's duopoly profits in the accommodating scenario, it is never profitable for a competitor to enter because its expected profit will never be positive.[19] This value also decreases with the level of the externality, meaning that as the externalities become more intense, a monopoly is more and more likely to arise even without any need for the incumbent to put an exclusionary strategy in place.

63. The blue wedge in Figure 1 is the most interesting from a policy point of view, because it is the parameter region where the entrant would enter absent the strategic foreclosure by the incumbent, but the incumbent finds it profitable to foreclose. It is possible to observe that for a given *K* the presence of indirect network externalities makes the strategy of foreclosure more attractive for the entrant. At the same time, we see from Figure 1 that for any given level *K*, it is also more likely that entry will be blockaded, i.e. that entrants will not find it profitable to enter even though the incumbent sets its prices in good faith, i.e. in a way that is compatible with accommodation.

Figure 1. Exclusion arises in the shaded area



64. By relaxing the hypothesis of symmetry between the parameters capturing the indirect network externalities, it is still possible to derive the equation below that identifies the difference between the profit of the incumbent from exclusion and from accommodating entry (and thus the strategic incentive of the incumbent to foreclose entry). Relaxing this assumption is quite crucial given that arguably, the different sides of platforms typically show different degrees of externality, which will not change simultaneously.

$$\Delta_{asymm} = -(2-\alpha_1-\alpha_2) + \frac{2(\alpha_1+\alpha_2)^2+\alpha_1\alpha_2-9}{4(2+\alpha_1+\alpha_2)} + (\alpha_1+\alpha_2)\sqrt{2(2-\alpha_1-\alpha_2)K}$$

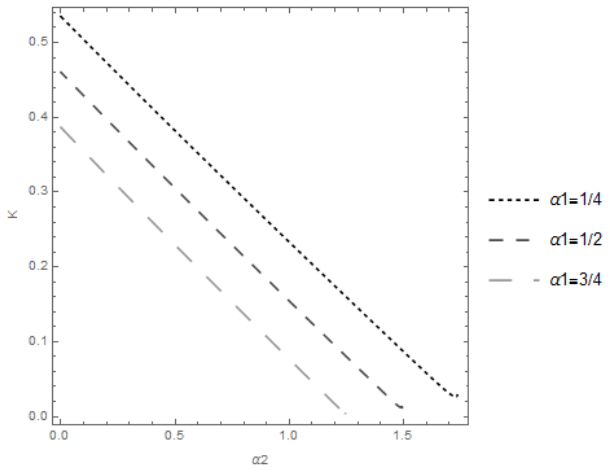
65. In this framework, solving for $\Delta_{asymm} = 0$ and finding the analytical expression of $K^*(\alpha_1,\alpha_2)$ is more complex. The assessment is therefore done numerically, fixing one

[19] The expression of the threshold value for "blockaded" entry is $K = \frac{25}{16}(1-\alpha)$.

parameter capturing the externality, here α_1, while letting K and α_2 vary.[20] Figure 2 shows the results of this exercise. The graph confirms the existence of the critical threshold $K^*(\alpha_1,\alpha_2)$, above which exclusionary strategies become attractive for the incumbent.[21] Moreover, it is also possible to observe that if there is a positive shock to either of the parameters α_1 or α_2, the area where exclusionary strategies are desirable for the incumbent expands. In other words, even for lower entry cost K it is still profitable for the incumbent to price low in order to prevent the entrance of a competitor.

66. This allows concluding that it is enough to have a strong externality on one side of the platform to make exclusion more attractive for the incumbent. A preliminary assessment of these results suggests that the incumbent has the possibility to exclude entry on either of the two sides. This can be consistent with the fact that the two sides are interchangeable, and so the incumbent will always charge the lower price on the side of the market where it is least costly to do so. Therefore, this might explain why the structure of the network externalities across the two sides of the market does not seem to matter, but only their overall intensity.

Figure 2. The critical threshold level $K^*(\alpha_1,\alpha_2)$ when network externalities are asymmetric across the two sides of the platform



67. The application of these results should not be limited to the case of entry deterrence as described above. It is also conceivable to interpret the entry cost parameter K as a financial shock that can reduce the profitability of the follower. By giving this interpretation to K, the results of the model take the flavour of financial predation. Observing the financial shocks of the rival, the incumbent is taking advantage of these financial fragilities of the rival and decides to decrease its price in order to make it unprofitable for the rival to remain active in the market. This behaviour of the predator is incentive compatible given the new structure of costs of the prey. The analysis above seems to suggest that, in the presence of indirect network externalities, platforms are even more prone to pursue predatory strategies of the kind described above.

[20] Results are exactly symmetric if instead α_2 is fixed and α_1 is allowed to vary.

[21] Note that in this graph the area of blockaded entry is not shown but it exists. The decision of not showing was simply dictated by clarity purposes.

68. All in all, the extensions of two strands of the literature on exclusionary practices are consistent with indirect network externalities making it more likely for the incumbent to engage in exclusionary behaviour. Moreover, it is enough to have an increase in the indirect network externalities on at least one side of the platforms to make exclusionary strategies more attractive to the incumbent.

3. Policy

69. The increasing importance of platforms in the current economy has raised several policy debates. In this section, we select those that are the most relevant to the European Commission and on which more research should be focused in order to come to a solid understanding.

3.1. The definition of platforms and the existence of indirect network externalities

70. In recent years, the European Commission has been more than ever confronted with arguments related to the presence of indirect network externalities. It seems therefore that there is an increasing tendency of trying to characterize many businesses as two- or multi-sided platforms. It is worth recalling that it is very important to verify the existence of such indirect externalities. Investigating a possible existence is however not enough. Their presence has to be significant for users, and there has to be evidence that externalities affect strategic business decisions. It is submitted that only under those circumstances it is deemed necessary to embark on an analysis that includes all the multiple sides of the platform and that tries to disentangle their relationship.

71. Along this line, it is important to understand when network externalities are exhausted. It is possible that beyond a certain level of adoption, a marginal increase in participation does not increase the utility of participation of the other participants anymore. In mature markets, it is conceivable that a marginal increase in the size of the network does not create any indirect network externality. The size of the platform seems then to be an important preliminary indication in order to understand whether such externalities are still present. In a similar vein, it is conceivable in certain circumstances that only a small subset of customers can generate externalities, i.e. “marquee customers”. Indirect network externalities are generated as long as these particular users participate. Beyond these customers, the participation of many other customers can very well be irrelevant and may not trigger any externality on customers on the other side. Essentially, customers can be differentiated and such differentiation can be responsible for the presence or absence of indirect externalities.

72. One additional element to take into consideration is the cost of multi-homing by users. Typically the presence of strong network externalities is correlated with the presence of high costs of multi-homing. Given that it is difficult for customers to “home” several platforms, it is likely that those customers would value large participation on the other side. Eventually, it is also important to understand the sign of the indirect externality. Those externalities can be positive or negative and this will have an impact on the assessment of the strategic interaction of platforms.

3.2. Complexity does not imply softer antitrust scrutiny

73. One of the important features of multi-sided platforms is that indirect network externalities affect the pricing decisions of platforms. It is a well-known result that platforms can price one side below costs. This has often lead many commentators to argue that below-cost pricing of platforms should not be a concern for antitrust authorities. However, it seems that the evidence is not unanimous and that there are also commentators supporting a different view, including the results of this paper.

74. It seems conceivable that prices on both sides of the market can be set by a firm at a level that is insufficient to cover the total variable costs of the platform. In these circumstances, a competing platform may become unprofitable irrespective of how it structures its prices and will exit the market, allowing the predatory firm to raise its prices on both sides and earn economic profits sufficient to more than recoup its earlier losses. In this case the analysis might still focus on a comparison of incremental revenues versus incremental costs defined over packages of goods or services that serve the interests of customers on both sides of the platform.

75. Moreover, as described in Fletcher (2007),[22] a dominant platform may predate through asymmetric pricing between the two sides of the market. The issue is whether a given pricing structure can affect market structure, and specifically whether low pricing on one side of a market can prevent entry into both sides. Fletcher (2007) argues that it is conceivable to assume that in case of asymmetric platforms predatory strategies can take place. Assume competitors of the dominant platform have limited ability to turn extra business on one side of the market into incremental revenues on the other. Such firms could find it hard to compete against a very asymmetric pricing structure, and therefore may be excluded from both sides of the market. In line with the theoretical discussion developed in Fletcher (2007), the more formal results of this paper also seem to suggest that predatory strategies typically observed in the context of standard markets carry over to markets exhibiting indirect network externalities.

76. It is, however, important to stress that an analysis of indirect network externalities should be part of the antitrust assessment. The typical tools applied in the analysis of single-sided markets need not be abandoned but it is crucial to adapt them in order to capture the specificity of platforms. One example of this effort is described in Behringer and Filistrucchi (2015).[23] In order to evaluate predatory strategies of platforms, they propose an augmented Areeda-Turner test that encompasses the presence of indirect network externalities. By applying this test to two real-life examples they obtain two interesting results. The first result shows that false positives might occur by applying a one-side test in a context of indirect network externalities. This is indeed a call for using the right tool when assessing platform competition. Their second result shows that a false negative might also occur by applying a one-side test. This last result is thus also consistent with the presence of predatory strategies performed by multi-sided platforms. This empirical evidence in turn supports the position of maintaining an unchanged scrutiny of antitrust authority for multi-sided platforms.

[22] Fletcher, Amelia. "Predatory pricing in two-sided markets: A brief comment" Competition Policy International, Spring 2007, Vol. 3, No. 1.

[23] Behringer, Stefan, and Lapo Filistrucchi. "Areeda–Turner in two-sided markets." Review of Industrial Organization 46, 3 (2015): 287-306.

77. In conclusion, there seems to be convincing evidence that suggests that price structures due to indirect network externalities can be used in a predatory fashion. Above-cost predation is also possible if predation means sacrificing short-run profits to weaken rivals and doing so in a way that lowers welfare. In this framework, predation can be hard to detect: a standard price-cost test will not be reliable because there are non-predatory reasons to price below cost;[24] and using the exit of rivals as indicator is not a sufficiently solid standard of proof either, because the market may also tip absent predation. We can thus conclude that the standard tools of antitrust analysis need to be adapted to the context of two-sided markets to avoid false positives and false negatives alike.

3.3. Business asymmetries

78. A topic that seems to attract significant attention is asymmetric competition between the advertising supported business model (i.e. multi-sided platform) and the subscriber-based business model (traditional company). The asymmetry in the business models has a direct repercussion on the competition for customers. One possible scenario faced by consumers is that free products offered by the platform will compete with the products offered at a positive price by the traditional company. In these circumstances it is often the case that products show some degree of differentiation, either horizontal or vertical. Therefore it is likely that the obvious effect of customers consuming the free product can be significantly mitigated. However, from a policy perspective it might be important to understand whether events like market exits by traditional businesses, which are most likely to be displaced, should trigger antitrust intervention.

79. This is an open question and so far little effort has been put into trying to formally understand the welfare implications of the competition between these two business models.

3.4. More attention to leverage theories, for instance tying strategies

80. In Eisenmann at al. (2006),[25] in the context of defining strategic behaviour of platforms, the authors identify the so-called "risk for envelopment". They explain that any platform, especially the small and specialised ones, face the risk of been enveloped by a bigger platform that decides to start competing head-to-head by enlarging its bundle of offers. New entry into adjacent markets is typically welfare increasing and should be welcomed by antitrust authority. However, the risk of a platform leveraging market power in one market into adjacent markets should not be underestimated. Recent research, like Choi and Jeon (2016),[26] focuses on the use of anticompetitive tying in order to overcome price constraints, i.e. impossibility to charge negative prices. Price rigidities can be the result of several factors, including the fear of triggering antitrust investigations

[24] See also DG Competition, "Communication from the Commission — Guidance on the Commission's enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings", OJEU 2009/C 45/02, of 24 February 2009, Recital 26, Footnote 3: "[…] in the case of two sided markets it may be necessary to look at revenues and costs of both sides at the same time."

[25] Eisenmann, Thomas, Geoffrey Parker, and Marshall W. Van Alstyne. "Strategies for two-sided markets." Harvard Business Review 84, 10 (2006): 92.

[26] Choi, Jay Pil, and Doh-Shin Jeon. "A Leverage Theory of Tying in Two-Sided Markets." (2016). Unpublished manuscript.

for predatory pricing. What the paper then suggests is that anticompetitive tying and predation are interchangeable strategies. More attention therefore has to be put on tying and more generally leveraging given that it can mask anticompetitive entry.

4. Conclusions

81. The aim of the paper is two-fold. First, it has a research objective as it extends two strands of the literature about exclusionary pricing to the framework of indirect network externalities and platform competition. Our preliminary results show that traditional exclusionary practices carry over to platform competition and in some circumstances indirect network externalities accentuate the incentive to foreclose by incumbents. Second, it also discusses some of the main policy topics that are currently discussed in the public domain, complemented with some topics that so far have received little attention despite their relevance.