1. Market definition in multi-sided markets

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Abstract

Drawing from the economics of two-sided markets, I provide methodological suggestions for the definition of the relevant market in cases involving multi-sided platforms. In particular, I provide suggestions regarding a) how to identify the two-sided nature of a market; b) when multi-sidedness should be taken into account; c) how many markets should be defined; d) how the SSNIP or HM test should be performed; e) how the relevant market should be defined when one-side of the market is free. I also discuss when and to what extent one-sided methods may be harmless, or even useful.

1. A working definition of a two-sided market

Many authors have proposed different definitions of a two-sided market. While the debate may not be fully settled, for all practical purposes a good working definition[1] is that a two-sided market is a market in which a firm acts as a platform and sells two different products or services to two groups of consumers, while recognising that the demand from one group of customers depends on the demand from the other group and, possibly, *vice versa*.[2]

Importantly, the demands on the two sides of the market are linked by *indirect network effects*[3] and the firm recognises the existence of (i.e. *internalises*) these indirect network effects.

The buyers of the two products, however, do not internalise these effects, which are therefore often called *externalities*.

Although firms' strategies in two-sided markets may be, under some conditions[4], similar to those in one-sided markets with complementary products, the fact that buyers do not internalise these externalities makes a two-sided platform different from the case of complementary products[5]. In the case of complements, both products are bought by the same

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buyer, who, in her buying decision, can therefore be expected to take into account both prices. Customers of a two-sided platform do not typically take into account both prices. [6]

Typical examples of two-sided platforms include (i) media companies, that sell content and advertising space, (ii) payment cards companies, that sell the use of a card to buyers and that of a point-of-sale (POS) terminal to shops, or (iii) online intermediaries, that sell their services to buyers and sellers.

In media markets, advertisers' demand for ads on a media outlet increases with the number of consumers of content (viewers, readers, listeners, etc.), while the latter might also be, positively or negatively, affected by the quantity of advertising. Similarly in payment cards markets, the more cardholders there are, the higher the demand from shops and vice versa. Card issuers such as American Express or VISA are well aware of this relationship between the two demands they face. Also online intermediaries such as eBay know that the more buyers visiting their website, the more likely it is that sellers will use their services and vice versa. In fact, the most common business model on the Internet, as shown by the success of Google or Facebook, is to attract users with various free services and sell their attention to advertisers.

2. A useful distinction among two-sided markets

Different classifications of two-sided markets have been proposed. Although most of them have some type of rationale, crucial for the analysis of market definition in two-sided markets is the distinction between two-sided *transaction* and *non-transaction* markets.[7] This distinction is important because it highlights a fundamental difference in the pricing strategies available to platforms in the two types of markets.

Two-sided non-transaction markets are characterised by the absence of a transaction between the two sides of the market and, even though an interaction is present, it is usually not observable by the platform, so that the platform is unable to set a per-transaction or per-interaction fee or a two-part tariff.[8] Examples of two-sided non-transaction markets are traditional media markets. Newspaper publishers, for instance, set access prices on both sides.

Two-sided transaction markets are instead characterised by the presence and observability of a transaction between the two groups of platform users. Then the platform is not only able to charge a price for joining the platform but also one for using it, i.e. it can charge a two-part tariff.[9] An example of two-sided transaction market is the market for payment cards[10].

While two-sided non-transaction markets are characterised by *membership externalities* (or indirect network effects), two-sided transaction markets are characterised also by *usage externalities*.

Membership externalities arise from joining the platform (buying a newspaper or placing an ad in a newspaper, holding a payment card or having a point-of-sale terminal, listing your product at an auction or attending an auction), whilst usage externalities arise from using the platform (paying or accepting payment with a card, selling and buying a product at an auction).

The value of joining the platform depends on the number (or more generally the demand) of customers of the other side. The benefit of using the platform similarly depends on the demand for usage by the other side.

For instance, assuming that a customer holds a card and a shop has the corresponding point-of-sale terminal, even if this customer wants to pay by card, the merchant has to be willing to accept that card for that particular transaction and vice versa. Once again these externalities are not internalised by the users of the platform, i.e. the cardholder and the merchant. For instance, suppose a given merchant would benefit from being paid by card because she would not need to go to deposit cash and she would not have to face the risk of being robbed. A cardholder would not take that into account when offering to buy in cash or by card. He would only consider his own convenience.

In a two-sided market, where two products or services are sold to two groups of customers, one can define the two distinct concepts of *price level* and price *structure*[11]. The price level is (roughly) the sum of the two prices, while the price structure is (roughly) the ratio of the two prices.

For a market characterised by a transaction between end-users to be two-sided, it is also necessary that, not only the price level, but also the price structure affects the volume of transactions.[12] For that to be the case, it needs to be impossible for the side that pays more to the platform to pass through the difference in price to the other side. If a complete pass-through were possible, the price structure chosen by the platform would not matter. The platform would not control the relative price charged to the two sides.

Clearly, a complete pass-through can only take place if there is a transaction between customers on both sides of the market. Only in those markets there may be market conditions such that the market is in fact not two-sided[13].

In markets where there is no transaction between end-users of the platform, no pass-through between the two sides can take place. Thus, the platform has perfect control of the relative prices charged to the two sides.[14]

3. Assessing the two-sided nature of the market

Before being concerned with how to perform market definition when the market is two-sided, we should assess whether the market is in fact two-sided and, if so, whether two-sidedness is likely to matter.

In order to assess the two-sided nature of the market, it is crucial to identify and characterise the indirect network effects that link the demands on the two sides of the market.

One might therefore ask whether such indirect network effects exist, whether they are one or two, whether they are both positive, or one is positive and one negative and, finally, how significant they are.

For instance, when analysing a merger in the newspapers market, one might want to know whether a larger readership of a newspaper ceteris paribus (i.e. holding constant also prices) implies a higher demand to advertise on that newspapers, whether readers dislike advertising and, if so, whether advertisers like readers more than readers dislike advertising. Similarly for a merger among TV channels.

If a market is a non-transaction market, looking at externalities is sufficient.

If instead the market is a transaction market, then one should also check if there are transaction costs or, more generally, limits to the bilateral setting of prices among buyers and sellers or if there are platform constraints on pricing between customers on the two sides.

In payment cards markets, for instance, this could be the case not only of the no-surcharge rule but also of menu costs for a shop that wishes to set a different price for its products depending on whether the buyer pays by cash, by VISA debit, VISA credit or AMEX. But it could also be the case of a shop that faces a lot of competition from shops nearby and therefore has a high probability of losing a customer when attempting to surcharge.

Only if these constraints exist then the market is two-sided, because the side charged the higher price by the platform would be unable to pass through completely the difference in prices to the other side.

Indeed, the lower the pass-through among the parties that transact, the more important the two-sided nature of the market.

In practice, in order to assess the two-sided nature of the market, both qualitative and quantitative approaches are possible.

As a first step one could use a qualitative approach and focus on checking whether there are indirect network effects and, if so, what their sign is, i.e. whether these effects are both positive or one is negative.

For instance, one might want to know not only whether advertisers base their decisions on which newspaper to place their ads on the number of readers and whether indeed they attach positive value to a higher readership, but also whether readers like, dislike or are indifferent to advertising.

If they are not present, one could then proceed considering the market(s) one-sided.

If instead indirect network effects are present, one needs to distinguish :

- If the market is a non-transaction one, since the pass-through between end-users is by definition zero, the market is two-sided.
- If the market is a transaction one, one should check to what extent transaction costs, or constraints set by the platform, limit the possibility of pass-through between the two sides. If there is scope to believe that the pass-through is high, then one could come to the conclusion, that although the market is two-sided, the two-sided nature of the market might not play a great role in practice.

The simplest way to assess qualitatively the two-sided nature of a market could in some cases be a logical argument.

For instance, in the case of newspapers or TV, it would appear evident even at first sight that advertisers value positively the number of readers of a newspaper or the number of viewers of a TV channel. Indeed, the only reason advertisers advertise in a newspaper or on TV is that they aim to reach readers or viewers with their message.

Unfortunately this approach cannot always be followed, as in some cases it is not clear whether one side cares about the other and a fortiori whether it values the other side positively or negatively.

For instance, despite some evidence for specific countries, it is not clear what the attitude of readers is towards advertising in different media.

In fact, one of the drawbacks of this deductive approach is that it may lead to different conclusions on the existence and, more importantly, the sign of the network effects.

A slightly superior way to assess qualitatively the two-sided nature of a market could be interviewing agents in the market (i.e. business people but also their customers) or making them fill-in a questionnaire with the aim of assessing whether they value, positively or negatively, the presence of more customers on the other side, and in case of a transaction market, whether there are factors limiting the platform's ability to control the price ratio.

For instance, in the case of newspapers, one could ask newspaper readers whether they like advertising on the newspaper, whether they are annoyed by it or whether they are indifferent to it.

In some cases such surveys might indeed already exist.

This is the case, for instance, in many countries where communication or social scholars run surveys with regard to the use and the perception of media.

The main drawback of this interview approach, and of any qualitative approach, is that it does not allow one to measure the size of the indirect network effects. Yet the latter is crucial to establish to what extent indirect network effects play a role in market definition[15].

Hence, as a second step, one might need to assess the two-sided nature of the market by using a quantitative approach and turn to checking not only whether there are indirect network effects and whether they are positive or negative but also on measuring their size.

For instance, in a case involving newspapers, one might want to know how much advertisers value an additional reader or, in a case involving payment cards, one might want to check whether merchants care more about one additional cardholder than a cardholder cares about one additional merchant having a point-of-sale terminal.

In order to answer these questions one can follow two different quantitative approaches: the stated preference approach (i.e. designing a survey) and the revealed preference approach (i.e. collecting actual data). Both are often more time consuming than a qualitative approach as they require the collection and analysis of data. They would thus seem more applicable in a second phase of an analysis.

In fact, having already identified two-sidedness using a qualitative approach might help in figuring out which are the relevant questions to formulate and the relevant data to collect.

4. Defining one or two markets

The main purpose of market definition is to identify the products that exert competitive pressure on the products sold by a particular firm or firms, be they firms that plan to merge, a firm suspected of anti-competitive behaviour or firms that might become the target of a regulatory intervention. Market definition is therefore an attempt to define a group of products, which are substitutable to such an extent that the firms producing them can be perceived as competing against each other, thus constraining each other's ability to increase prices.

In a two-sided market, a firm sells two distinct products on the two-sides of the market and the demands for these products are linked by the presence of indirect network effects. Firms in a two-sided market can be seen as platforms that need "to get both sides on board"[16] in order to do business.

The question then arises whether there are two (interrelated) markets to be defined or only one market encompassing the two sides.

For instance, when analysing a merger among TV broadcasters the question is whether there is a market for TV or there is a market for advertising (on TV) and a market for TV content. Similarly, in a case involving payment cards, the question is whether there is a market for payment cards services or a market for payment cards services to cardholders and a market for payment cards services to merchants.

It turns out that, whether one needs to define one or two markets, depends crucially on the type of two-sided markets. More precisely,

- In two-sided non-transaction markets, one should define two (interrelated) markets.
- In two-sided transaction markets, one should define only one market.

In fact, in a two-sided transaction market the product offered is the possibility to transact through the platform. It takes the form of two distinct products, one for each side of the transaction, because such possibility needs to be offered to both sides. Yet none of these two products is sufficient without the other. A customer on one side can consume his product only if the corresponding customer on the other side consumes his product too. In other words, the two products need to be consumed in a fixed 1:1 proportion, as perfect complements, but by two different consumers.

For example, in the purchase of a pair of shoes through a shop, the merchant cannot receive money through the POS terminal unless the client has a payment card and is willing to use it; and vice versa.

Importantly, a two-sided transaction market candidate substitute products constraining the ability of the two-sided transaction platform to raise prices are not only other platforms, which offer, to both sides, the possibility to transact but also non-intermediated transactions.

One of the consequences of defining only one market is that a firm would be either on both sides of the market or on none. Defining instead two interrelated markets would allow a platform to be on one side of the market but not on the other. Whether one or the other outcome is right depends on the type of two-sided market under consideration.

A payment card company such as Diners Club is either in the relevant market on both sides or on none, for the simple reason that either the transaction between the buyer and the merchant takes place using Diners Club services on both sides, or it does not take place through Diners Club. The analysis of a merger between two payment-card platforms should thus consider, for instance, whether cash transactions or PayPal exert competitive pressure on these payment card companies.

However, in a case involving TV broadcasters, a product might be in the relevant market on the advertising side but not on the viewers' side.[17] For instance, suppose that people do not regard TV and newspapers as substitutes because they read the latter on the metro going to work and watch TV at home in the evening. Assuming that advertisers are interested in reaching each person only once during a day, they will tend to regard TV and newspapers as substitutes. TV would then be in the same relevant market as newspapers on the advertising side but not on the viewers' side. The analysis of a case involving TV broadcasters should then be allowed to conclude that newspapers exert competitive pressure on TV in the market for advertising but not in the market for content.

Clearly, in two-sided transaction markets end-users on the two sides can be charged both a fixed fee for joining the platform and/or a per-transaction fee for using the platform. Conceptually this feature is not present also in single-sided markets where customers are charged two-part tariffs, as for instance the traditional market for fixed mobile phone services. Consistently with previous practice in these one-sided markets, one should define a single market, in which both membership and usage are sold.

The peculiarity of two-sided transaction markets is not the presence of two-part tariffs. The differences with respect to a single-sided market are the presence of indirect network effects between the membership markets on the two sides and the fact that the usage market is a transaction market linking the two-sides. These differences imply that a single market encompassing membership and usage cannot but comprise both sides of the market.

In a two-sided non-transaction market instead there is no transaction and, as a result, there is not such a strong link in the usage market. In these markets the link among the membership markets is present, because of the indirect network effects, and needs to be taken into account when defining the relevant market, but it is not so strong that it implies the necessity of a single market for the purpose of market definition.

5. Considering both sides of the market

Given the necessity to define a single relevant market ecompassing both sides, it is obvious that one should consider both sides of the market when defining the relevant in the case of two-sided transaction markets.

For instance, one should look at both buyers and merchants when one defines the market for (transactions by) payment cards. It may be that ex post, i.e. after the analysis, one concludes that one side plays a decisive role in the decision. However, a priori it is clear that both sides need to agree for the transaction to take place through the payment card company.

Also in the case of two-sided non-transaction markets, competition and regulatory authorities should take into account both sides of the market when defining the relevant market[18]. Indeed, they should consider the role of the indirect network effects and define two interrelated markets.

For instance, in a merger among newspapers, one should look also at the advertising side when defining the relevant market for readers and vice versa.

A platform in a two-sided market needs both sides "on board" and therefore competes for customers on both sides. How much competition a platform faces in getting customers on one side also depends on its competitive position on the other and *vice versa*.

It is well known in the economic literature that product differentiation, whether vertical or horizontal, relaxes price competition in a one-sided market.[19] Similarly, on each side of a two-sided market, the degree of competition faced by a given platform depends on the degree of vertical and horizontal product differentiation on that side.

For example, the level of competition faced by a TV station on the advertising side depends inter alia on the number of its viewers compared to other TV stations. For instance, if a TV station has many more viewers than its rivals, one can expect a similar price increase on the advertising side to lead to a smaller loss in advertising than if the TV stations were closer to each other in terms of number of viewers. One can argue that from the advertisers' point of view TV stations are vertically differentiated in the number of viewers.

Moreover, the level of competition faced by a TV station on the advertising side is also likely to depend ceteris paribus on the demographic composition of its viewers with respect to that of the viewers of rival TV stations. To the extent that different advertisers might value some demographic groups of viewers more than others, TV stations can also be perceived as horizontally differentiated on the advertising side.

Market definition in one-sided markets typically takes product differentiation as given. However, in a two-sided market both horizontal and vertical product differentiation is largely determined by pricing decisions.

From the point of view of advertisers, TV stations are likely to be vertically differentiated (because they have a different number of viewers) and horizontally differentiated (insofar as they have different types of viewers). Yet both the number and the type of viewers also depend on the price charged to viewers (whether positive or zero) and, to the extent that viewers are annoyed by advertising, on the price charged to advertisers, which contributes to determine the quantity of advertising in the TV station.

Thus, product differentiation on one side not only affects pricing decisions on that side (as in one-sided markets), but may also depend on pricing decisions on the other side. Pricing decisions on the two-sides are interrelated.

Hence, the competitive constraints faced by a platform in its pricing strategies can be assessed only by taking into account both sides when defining the relevant market.

Moreover, neglecting one side of a two-sided market when the product on that side is priced at zero is conceptually wrong. In fact, firms are competing also on that side.

For instance, one might think that traditional phone directories, that were distributed for free, competed only on the advertising side. Yet, if a phone directory raised advertising tariffs and experienced a drop in listings, it would likely suffer not only a direct drop in profits but also an indirect drop in usage due to people finding less information in the directory compared to competing directories. Similarly, if the phone directory experienced a drop in the number of users, possibly because of the appearance of a competing product of higher quality for users, it is likely that this would lead to a drop in demand for ad slots from advertisers. The phone directory may then be forced to lower the price charged to advertisers and/or experience a decrease in the amount of advertising and in the corresponding revenues.

By failing to consider all sides in the definition of the relevant market one would then ignore the real competitive pressure faced by the firms under consideration.

It is only in the particular case of a two-sided non-transaction market with only one externality, that one could safely perform a market definition exercise, on the side of the market that does not exert any externality, irrespective of the other side.

For example, in a case involving newspapers, if one finds that advertising has no effect on the readers' side of the market, one needs to take into account the advertising market when defining the readers' market but one can safely define the advertising market irrespective of the readers' market. In fact, in that case, whatever the pricing choices of publishers on the advertising side, they will not affect the readers' side. Hence, the platform on the advertising side of the market will not behave differently from a firm in a single-sided market facing the same advertising demand.

More generally, when defining the relevant market in the case of a multi-sided non-transaction market, it is only necessary to consider all the other sides towards which the side under consideration exerts an externality, either directly or indirectly.[20]

6. The SSNIP test and the HM test

The most rigorous conceptual tool used to define the relevant market is the so-called "Small-But-Significant-Non-Transitory Increase-in-Price Test"[21] (in short the SSNIP test), which defines the market as the smallest set of substitute products[22] such that a substantial (usually five or ten percent) and non-transitory (often one year) price increase by a hypothetical monopolist would be profitable.

Starting from a set of candidate products, the SSNIP test is implemented by first simulating a given price increase above the current level[23] by a hypothetical monopolist who owns just one product[24] and, as long as that leads to estimated losses in profits, progressively increasing the number of products owned by the monopolist and simulating a price increase of all the products the monopolist owns. When the hypothetical monopolist does not estimate profits to decline following a small but significant increase in price, the set of products owned by the monopolist in the last simulation constitutes the relevant market.

The SSNIP test is often performed by Critical Loss Analysis (CLA), for which formulas are derived under the assumptions of constant marginal costs and either linear or constant elasticity of demand.[25] Under these assumptions, performing a CLA is exactly identical to performing the SSNIP test.[26]

In any case, the idea behind the SSNIP test (and thus CLA) is that if the small but significant non-transitory increase in price is unprofitable, then there exists at least one close-enough substitute to the product whose price is raised. If so, the two products should be in the same relevant market. And so on and so forth. Thus, both the SSNIP test and CLA analysis set an implicit benchmark for substitutability between products to be in the same relevant market.

In addition, the iterative procedure described above is designed to ensure that a relevant market is defined as the smallest set of substitute products on which a monopolist would find it profitable to increase prices by a small-but-significant amount; it thus makes sure that the market is defined in such a way that a monopolist has market power, which is a basic requirement of economic theory.

If order to preserve the same logic of the one-sided test, the SSNIP test (and CLA analysis), should be modified differently according to the type of two-sided market:

- In a two-sided non-transaction market, one should check the overall profitability of a rise in price on each side of the market.
- In a two-sided transaction market, one should instead check the profitability of an increase in the price level (i.e. the sum of the prices paid for the transaction by the two sides).

Ideally, in both cases one should allow the hypothetical monopolist to re-optimise the price structure following the price increase.[27]

Furthermore, in a two-sided transaction market, the SSNIP test should take into account the changes in overall profits (i.e. the sum of the profits on both sides of the market) and

all feedbacks between the two sides of the market when judging the profitability of a price increase.

Since positive indirect network effects between the different sides of the platform reduce the profitability of any price increase, the risk of applying a one-sided SSNIP test, which does not account for these feedback effects, is that in such cases the two markets may be defined too narrowly.

Consider a two-sided platform with sides A and B linked by positive indirect network effects. The application of a one-sided SSNIP test on side A would only account for the direct effect that a price increase will have on the demand and profits of side A. It would not account for the fact that a reduction of the number of customers on side A is likely to lead to a reduction of the number of customers on side B so that, if the price on side B is kept constant, there will be a loss in profits also on side B. It would also not envisage the fact that the smaller number of customers on side B will in turn reduce the demand of side A, and so on. Hence, it would also underestimate the loss in profits on side A. The iterative procedure of the SSNIP test would then stop too early. Similarly for the application of a one-sided test on side B. On both sides the market would be defined too narrowly.

In other words, in two-sided non-transaction markets with positive network effects, a one-sided SSNIP test can provide a *lower bound* to the relevant market.

If instead one network effect were positive and one negative, the implications of applying a one-sided SSNIP test, which does not account for these feedback effects, is that in such cases the market may be defined too broadly on the side that exerts a negative externality and may be defined either too narrowly or too broadly on the side that bears the negative externality.

Consider a two-sided platform with side A exerting a negative externality on side B and side B exerting a positive one on side A. The application of a one-sided SSNIP test on side A would not account for the fact that a reduction of the number of customers on side A is likely to lead to an increase of the number of customers on side B; so that, if the price on side B is kept constant, there will also be an increase in profits on side B. It would also not envisage the fact that the higher number of customers on side B will in turn increase the demand of side A, and so on; so that, in the end, it would also overestimate the loss in profits on side A. The iterative procedure of the SSNIP test would then stop too late on side A. Hence, on that side, the market would be defined too large. Similarly, the application of a one-sided test on side B would not take into account the resulting loss in profits on side A and would overestimate the resulting loss in profits on side B. The iterative procedure of the SSNIP test may then stop too early or too late on side B.[28] Hence, on this side, the market may be defined too narrowly or too largely.

In other words, in two-sided non-transaction markets with one negative (and one positive) network effect, a one-sided SSNIP test can provide a *upper bound* to the relevant market on the side that exerts the negative externality and enjoys the positive one. It would not instead be informative on the side of the market that exerts the positive externality and bears the negative one.

Only in the presence of a single (positive) externality linking the two-sides of the market could the traditional SSNIP test (and single-sided formulas for CLA) be safely applied in a two-sided non-transaction market to define the market on the side that does not exert an externality on the other.

Some authors have proposed that the SSNIP test (and CLA analysis) be performed without allowing the hypothetical monopolist to re-optimise the price structure.[29]

While using the standard single-sided SSNIP test or CLA formulas would lead to a too-narrow or too-large definition of the relevant market, adopting a two-sided SSNIP test (or using two-sided CLA formulas) that do not allow the HM to re-optimise the price structure would lead to a too-large definition of a market. In fact, not allowing the price structure to be re-optimised would always overestimate the loss in profits due to the increase in prices, because by definition the optimal adjustment by the hypothetical monopolist will tend to reduce such a loss.

Hence, both in two-sided transaction and non-transaction markets a two-sided SSNIP test that does not allow the hypothetical monopolist to re-optimise the price structure can provide an *upper bound* to the relevant market.

Finally, it is often the case in two-sided markets that customers on one side of the market do not pay. Such a situation may arise both in transaction and non-transaction markets, but it raises different issues in the two types of markets.

In a transaction market, one mainly needs to predict the likely reaction of non-paying customers to a price increase. This can usually be done by designing an appropriate survey of existing customers to elicit their willigness to pay. Once this is measured, in a two-sided transaction market, the SSNIP test can be performed.

When the market is a non-transaction one, a two-sided SSNIP test can be safely performed on the paying side of the market. However, on the side where the price is zero it is not possible to perform a SSNIP test. Here the issue is not only that the reaction of customers to a price increase is not known, but, more fundamentally, that increasing the price by 5 or 10% has no meaning when the starting price is zero. Any price increase one would consider would be arbitrary and change the benchmark with respect to the practice in one-sided markets and the extension just discussed to the paying side of a two-sided market.

However, if the question of interest is whether the free product is in the same relevant market with a product that is sold at a positive price, one could envisage performing the SSNIP test starting from this other product and checking whether the test would lead to adding the product of interest to the relevant market[30].

If instead the question of interest is whether the free product is in the same relevant market of another free product, then one cannot resort to the SSNIP test.

In fact, it could be argued that in such a case the SSNIP test might even not make much sense[31]. In general, the price is only one dimension of competition among firms. Conventionally, competition policy has considered it to be the most important dimension of competition, leaving aside for instance choices on the variety or quality of the products. The fact that on one side of the market the price is zero most probably indicates that, on that side of the market, the most important dimension in which firms compete is not the price. Most likely, competition takes place on quality or variety.

If the relevant competitive dimension is quality, one could envisage an alternative test, similar to the SSNIP test, where the HM, rather than increasing price, would be decreasing quality. Such a SSNDQ test has been proposed already for one-sided markets[32]. The starting assumptions are both that a decline in quality leads to a loss in customers and that an HM would be more likely to find a decline in quality unprofitable if the product it sells has fewer or less close substitutes. Then the iterative procedure would be similar to the one of the SSNIP test.

The proposal of a SSNDQ test has not been very successful. In particular, it has been argued that, since product differentiation is most often multi-dimensional, it is difficult to establish what is the relevant quality dimension in practice.[33] More fundamentally, if, as it is the case in one-sided market, customers are paying for the product, it is not certain that, in the presence of substitute products, an HM would lower the quality of its product less.[34]

However, differently from a one-sided market, on the non-paying side of a two-sided market, given that the price is zero (and assuming it will remain zero), an HM would most likely lower the quality of its product less in the presence of substitute products, consistently with the assumption of the SSNDQ test.[35]

On the non-paying side of a two-sided market, one can then envisage a SSNDQ test that is performed by changing the quality and looking at profitability for an HM.

Importantly, as with the extension of the SSNIP test to two-sided markets, and for the same reasons, such a test should look at overall profitability (i.e. profitability on both sides) of the quality decrease and should take into account all feedbacks between the two sides of the market.

While also in a two-sided market it is difficult to establish what is the relevant quality dimension in practice, there is an obvious dimension that could be taken into account. In fact, in a two-sided market, one important dimension of quality is, as already argued above, the size of the network effect, i.e. the number of (some type of) users on the other side of the market. Thus, identifying the dimension of quality due to the network effect may be less contentious than in a one-sided market, once the market is established to be two-sided and the presence of the relevant indirect network effect has been confirmed.

Hence, if the non-paying side bears an externality (whether negative or positive), one can envisage a SSNDQ test that is performed by changing the quantity on the paying-side of the market and looking at the profitability of the change for an HM.

Depending on whether the externality is negative or positive, such a SSNDQ test would ask the HM to raise the network effect or lower it, respectively. For instance, in a case involving TV stations, assuming it has been found that TV advertising annoys viewers, one should ask the HM to raise advertising quantity, while in a case involving traditional phone directories, having assessed that readers are interested in the amount of listings, one should ask the HM to lower the number of listings.

Notably, the size of the network effect enjoyed or borne by customers on one side also depends on the price paid by customers on the paying side of the market. Hence, in a two-sided market in which one side does not pay, the quality on the non-paying side of the market also depends on the price paid on the paying-side.

A SSNDQ test on the network effect on the non-paying side of the market would thus be linked, albeit not equivalent, to the SSNIP test on the paying-side of the market.

More precisely, a high substitution towards a competing product on the non-paying side of the market as indicated by the above SSNDQ test would contribute to a high substitution on the paying-side of the market as indicated by a SSNIP test on the latter side, but it would neither be sufficient nor necessary.

To conclude, although the relevant benchmark would clearly change by switching from a test on price to a test on quality, such a SSNDQ test would allow competition authoritities to apply the same logic as a SSNIP test.

Since in practice, the SSNIP test is rarely used in its mathematical form and is most often seen as a conceptual tool to define the relevant market, such a SSNDQ test may be a reasonable solution to adress the issue of market definition on the non-paying side of the market when the candidate substitute product on that side of the market are for free. When instead one or more of the candidate substitute products are paid for, it may be preferable to perform a two-sided SSNIP test starting from one of these candidate products, as discussed above, because in such a case it is harder to assume that price is not the relevant dimension of competition.

7. Conclusions

Drawing from the economics of two-sided markets, I provided methodological suggestions for the definition of the relevant market in cases involving multi-sided platforms. In particular, I provided suggestions regarding a) how to identify the two-sided nature of a market; b) when multi-sidedness should be taken into account; c) how many markets should be defined; d) how the SSNIP or HM test should be performed; e) how the relevant market should be defined when one-side of the market is free. I also discussed when and to what extent one-sided methods may be harmless, or even useful.

My overall conclusion is that, while two-sided markets certainly need particular attention from competition authorities, traditional antitrust tools for market definition can still be useful, provided they are implemented taking into account the two-sided nature of the market.

Notes

1   This definition is due to Evans (2003).

2   For a market to be two-sided, it is enough that one indirect network effect is present. For more discussion what makes a market two-sided and on identifying two-sidedness in practice, see Filistrucchi (2010) and Filistrucchi et al. (2013).

3   Demand is characterised by a direct network effect when consumers' willingness to pay for a product depends on the number of other consumers (or the quantity bought) of the same product; demand is characterised by an indirect network effect when consumers' willingness to pay for a product depends on the number of consumers (or the quantity bought) of another product.

4   These conditions relate to the size and sign of the indirect network effects.

5   See Rochet and Tirole (2003).

6   This distinction has important implications for the assessment of the welfare impact of these strategies.

7   This distinction was originally proposed by Filistrucchi (2008), who used however the terms "two-sided markets of the media type" and "two-sided markets of the payment cards type". It was later renamed as above by Damme et al. (2010).

8   Note that in a media market, an interaction is often present between the two sides of the market in that, for instance, a reader may read an ad placed by an advertiser. Such an interaction is even

observable online (when one clicks on an online ad to open it) and, in such a case, the platform can charge for it. However, at best only a delayed transaction is present (when someone who saw an ad buys the advertised product) and this transaction is usually not identifiable (as it is impossible to say whether someone bought a product because he or she saw an ad), so that the platform is unable to charge a fee for it. Only recently, using online tracking technologies, it has become possible to charge advertisers for online transactions between an advertiser and an internet user that buys a product online after having seen an online advertisement. The ability to track purchases resulting from an ad are currently limited but such technological developments may eventually push some media markets to become two-sided transaction markets.

9   Note however that the fact that a two-part tariff can be charged does not necessarily imply that it will be charged. Indeed both or either of a membership fee and a per-transaction fee can be charged. In fact, the crucial point is that a per-transaction fee can be charged. For example, for most payment cards in Europe and the US, cardholders pay at most an annual fee, while merchants pay a two-part tariff.

10   Other two-sided transaction platforms are virtual marketplaces, auction houses and operating systems.

11   See Rochet and Tirole (2006).

12   I write "roughly" because prices on the two sides are in different units of measurement. For instance, in the case of a newspaper, the cover price is per copy of the newspaper, while the advertising tariff is per page or per column millimetre. Thus the price level is not simply the sum of the two prices, but rather the sum of the two prices expressed in the same unit of measurement. Again, in the case of newspapers the price level is the sum of the cover price and the per-copy advertising revenues. Similarly, the price structure is the ratio of the two.

13   This will be discussed more in detail in the next section.

14   In practice, a two-sided market without a transaction is just an extreme case of a two-sided market: one where no pass-through is possible. At the other extreme, when the pass-through is complete, one finds a one-sided market. In the middle lie many different two-sided markets, those in which some pass-through is possible, although not complete.

15   This will be discussed further in the next sections.

16   Rochet and Tirole (2006).

17   See Evans and Noel (2005).

18   See also Evans and Noel (2008).

19   Two products are said to be vertically differentiated (or differentiated on quality) when, if faced with the same price, all consumers would buy one of them (the one with the highest quality). Two products are instead horizontally differentiated (or differentiated on variety) when, even faced with the same price, some consumers would buy one of them and others would buy the other (because consumers have different tastes).

20   Indeed, in a multi-sided platform, side A could exert an externality on side B when customers on side B value more customers on side A, but it could also exert an externality on side B when customers on side B care about customers on side C and customers on side C care about customers on side A. Both cases above would lead to equivalent suggestions with respect to market definition on side A.

21   In the US, the corresponding test is the "hypothetical monopolist test" (HM test). The two tests are slightly different. See Werden (2003) for a historical account of the ascent of the HM test.

22   For purely expositional reasons, I refer here only to the definition of the relevant product market and not to the geographic market.

23   In fact, the current level is assumed to be competitive. This is a drawback of the test giving rise to the so-called "cellophane fallacy" in one-sided markets. In two-sided markets the fallacy may or may not arise depending on the sign and size of indirect network effects.

24   One of those of the merging parties in a merger case, one of those owned by the potentially dominant firm in case of abuse of dominance.

25   Critical Loss Analysis works as follows: first, one calculates the so-called "critical loss", which is the maximum percentage loss in sales that can be sustained without a given price increase becoming unprofitable; second, the "actual loss" is defined as the expected percentage loss following the same price increase. If the actual loss is higher than the critical loss, it would not be profitable to increase prices. Vice versa, it would be profitable.

26   CLA formulas are different in the EU and in the US, reflecting the difference between the SSNIP test and the HM test. See Werden (2002a, 2002b).

27   This is proposed also by Emch and Thomson (2006) for two-sided transaction markets. It is instead proposed by Filistrucchi et al. (2014) for two-sided non-transaction markets.

28   These results are based on a linear specification for the demand function. Linearity, however, is often assumed in the application of the SSNIP test. As noted above, existing CLA formulas are based on such an assumption.

29   See Evans and Noel (2008).

30   In fact, the SSNIP test is not a symmetric algorithm. See Werden (2002b). Hence, this could be considered a second best solution,

31   See also Evans (2011).

32   See Hartmann et al. (1993).

33   See, for instance, OECD (2013).

34   For instance, in a vertical product differentiation like Mussa and Rosen (1978) or Shaked and Sutton (1982), the lower quality firm finds it more profitable to lower quality exactly because it has a competitor with a higher quality: by lowering quality, it differentiates more and relaxes subsequent price competition.

35   Since in this case there is no price competition, by increasing quality, a lower quality firm would steal customers from the higher quality firm.

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