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MECHANISMS OF VALUE CREATION IN PLATFORMS MARKETS: EVIDENCES FROM THE DIGITIZED NEWSPAPER INDUSTRY

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Abstract

The literature on platforms and network externalities have traditionally emphasized the role of network size as the key driver of value. More recently, strategy scholars have instead started considering other aspects that can be responsible for value creation in networks, beside the size aspect. We decided to join this growing debate to identify some of those additional mechanisms, thus helping better understanding competitive advantage in modern interconnected industries. The paper considers a situation in which a platform market has undergone a technological transition. We found that, when a new technology reduces transaction costs for newly opened markets for existing products, the value of the old cross-side externalities between traditional markets declines; interestingly, such decline goes beyond what the sole cannibalization of old market size can explain. Thanks to this external shock we can show that the value generated by cross-side externalities depends on the possibilities of transactions that a network enables in a specific moment in time, and not simply on the size of the interconnected markets. The value reduction of the existing cross-side externalities then justifies a drop in platform performance. The empirical setting is the Italian newspaper industry, where a decline in advertising revenues and the emergence on new value creation mechanisms were visible after the advent of the Internet. We combine both dynamic panel data (period: 2004-2012) and 25 qualitative interviews to develop and test our hypotheses. The study offers new theoretical and managerial implications for aspects of value creation and capture, platform performance and technological changes.

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The literature on platforms and network externalities have traditionally emphasized the role of network size as the key driver of value. More recently, strategy scholars have instead started considering other aspects that can be responsible for value creation in networks, beside the size aspect. We decided to join this growing debate to identify some of those additional mechanisms, thus helping better understanding competitive advantage in modern interconnected industries. The paper considers a situation in which a platform market has undergone a technological transition. We found that, when a new technology reduces transaction costs for newly opened markets for existing products, the value of the old cross-side externalities between traditional markets declines; interestingly, such decline goes beyond what the sole cannibalization of old market size can explain. Thanks to this external shock we can show that the value generated by cross-side externalities depends on the possibilities of transactions that a network enables in a specific moment in time, and not simply on the size of the interconnected markets. The value reduction of the existing cross-side externalities then justifies a drop in platform performance. The empirical setting is the Italian newspaper industry, where a decline in advertising revenues and the emergence on new value creation mechanisms were visible after the advent of the Internet. We combine both dynamic panel data (period: 2004-2012) and 25 qualitative interviews to develop and test our hypotheses. The study offers new theoretical and managerial implications for aspects of value creation and capture, platform performance and technological changes.

Keywords:

Value creation, platform performance, externalities, technological change, newspapers and digitalization.

INTRODUCTION

The concept of network effects is intrinsically related to the concept of value, since actors in a network derive benefits from the presence of other members or complementary products. In turns, the concept of value is related to the size or installed base of a network. Indeed, network literature has explained how networks characterized by a higher numbers of members or complementary products allow to make more transactions, and therefore help generating more value (e.g., Katz and Shapiro, 1985; Farrell and Saloner, 1985). Industries were this has always been evident are telecommunications, software, and video game. Similarly, also the platform market literature have remarked the importance of network size as a key driver of value. Researchers in this tradition have shown that the larger is the installed base in one market-side, the higher can be the benefit (or cross-side externality) for participants in an opposite market. The platform that mediates such massive exchanges, in turns, can gain advantage over competing platforms (e.g., Rochet and Tirole, 2003; Parker and Van Alstyne, 2005; Armstrong, 2006). Industries such as media, video games, payment card systems, and matchmaking services are common examples. It is not surprising, therefore, that a fundamental implication of these literatures is to achieve critical masses of consumers and engage with many complementary producers to "tip the market" in a winner-take-all game (e.g., Shapiro and Varian, 1999; Gawer and Cusumano, 2002; Eisenmann, Parker and Van Alstyne, 2006;).

However, more recently management scholars have also started suggesting that the process through which platforms create value depends not only on network size but also on other factors. Examples are the time of entry and the learning orientation (Shilling, 2002), the strength of network ties (Suarez, 2005), and customer preferences (Cennamo and Santalo, 2013). Afuah (2013) even suggested that the value of network externalities depends on the entire structure and conduct of networks. We join this growing debate to help highlighting some of the mechanisms that explain value creation in the presence of network effects. This problem of understanding what drives value creation and capture in today's interconnected industries is also very important from a practical

standpoint, as companies like Google, Facebook, Apple, and Amazon are shaping the performance landscape of many industries thanks to their successful network strategies in adding value for their ecosystems. The paper asks the following questions: What does explain the performance of platforms capturing value from network effects? How does a change in technology can alter the value of pre-existing network effects, thus also influencing platform revenues? In answering these questions we also introduce a new lens, that is how new technologies (e.g., Tushman and Anderson, 1986; Henderson and Clark, 1990) impact network functioning by altering its means of value creation from the point of view of a platform (e.g., Rosenkopf and Tushman, 1998; Afuah, 2013).

Our empirical setting is the Italian newspaper industry from 2004 to 2012. This industry was selected since newspapers are exactly platforms operating in two-sided markets (Seamans and Zhu, 2012). The two markets are represented by advertisers and readers, and the first group of customers perceives a positive network externality from the second group. The advent of the Internet has been considered because we wanted to have a situation in which something might have triggered an equilibrium in the way value is created for the two groups of customers. Such a technological change has modified the transaction possibilities in several markets and sectors (e.g., Clemons, Reddi, and Row, 1993; Amit and Zott, 2001; Casadeusus-Masanell and Zhu, 2012), and therefore it might have also influenced the way value is created in network industries.

We combined qualitative and quantitative methodologies (e.g., Jick, 1979; Sutton and Rafaelli, 1988) to understand the setting, develop and test hypotheses, and finally refine the explanation with the insights from our informants. Our quantitative study consists of dynamic panel instrumental variable (IV) estimations on a final sample of 56 newspapers. Taking the perspective of the platform (e.g., the publisher), we found that the new digital marked (online version of the newspaper) has an additional depressing effect on the revenues that newspapers collect form offline advertisers, on top of the canonical negative effect induced by the cannibalization of offline copies

by online readers. Our findings, further substantiated by 25 in-depth interviews with selected informants, reads that new technologies can alter the transaction possibilities between the two market sides of a platform (e.g., advertisers and readers), thus changing the rules of value creation beyond the network size aspect.

Overall, our study contributes to strategy literature on platforms and the value of network effects (e.g., Shilling, 2002; Suarez, 2005; Cennamo and Santalo, 2013; Afuah, 2013), but also to studies regarding the sources of value creation and capture (e.g., Amit and Zott, 2001; Jacobides, Knudsen, and Augier, 2006; Priem, 2007; Adner and Kapoor, 2012). We show how platform revenues, a function of the value of cross-side externalities, can be affected in two different ways when a new technology allows the platform to offer a similar product through different markets. First, a new technology can influence platform revenues by indirectly affecting the network size of its old markets (our hypothesis 1). Second, and more importantly, the new technology can also directly impact on the transaction efficiency of a network (hypothesis 2). While the former aspect can be seen as an empirical confirmation of the role of network size to the case of new markets, the latter is also a novel result from a theoretical standpoint, since it unveils the functioning of a new mechanism. More specifically, new technologies can alter the transaction costs (Williamson, 1981) of networks, thus affecting the performance of platforms.

The rest of the paper is organized as follow. First, we present the theoretical background. Second, we derive hypotheses. Third, we describe the research setting and data. Forth, we illustrate the finding of our panel data analysis and our qualitative interviews. Finally, we draw conclusions.

THEORETICAL BACKGROUND AND HYPOTHESES

Economic literature on network industries (e.g., Katz and Shapiro, 1985; Farrell and Saloner, 1985) distinguishes between two categories of network externalities, namely, direct and indirect. Direct network effects are those for which the value for a user changes with the number of

participants consuming a good or service in the network, while indirect network effects are those for which the value steams from the availability of many complementary products with respect to the focal good or service (Katz and Shapiro, 1985). In both cases, the driver of the externality is the size of the network, expressed in terms of the number of either the participants or the complementary products. Such externalities are considered to be positive if their unitary value increases when network size increases. Economides (1996) argued that the number of available complementary goods for a specific product (i.e., software as a complement of hardware) generates value for the product and increases consumption. Wade (1995) discovered that a large availability of supporting goods increases the installed base, which positively influences economic returns. Brynjolfsson and Kemerer (1996) showed how a larger installed base in the spreadsheet market was associated with an increase in the prices, thus suggesting that value for users increases with the number of the adopters of the same technology. More in general, studies on network effects share the common observation that network size creates value for network users, producers and suppliers of products, and this induces further adoptions by the same actors and leads to the success of companies or technologies that quickly create a large installed base (e.g., Shilling, 1999; Evans and Schmalensee, 2010).

The multi-sided markets and platform competition literature (e.g., Rochet and Tirole, 2003; Armstrong, 2006) further extended these concepts. A platform is a company that enables the interaction between two or multiple markets. The size of the interrelated markets affects the value of the cross-sides externalities existing between the two or multiple groups (Armstrong, 2006). The unitary value perceived by an actor in one market depends on the number of participants in the other market (e.g., Rochet and Tirole, 2003). For example, Venkatraman and Lee (2004) showed that the incentives of game developers to produce games for a specific console (a platform) is affected by the size of the user installed base on that platform. Boudreau and Jeppensen (2013) found that the motivation of developers to code without being paid in the multiplayer game industry

is associated with the size of the platform usage. Therefore, also in the case of multi-sided markets a key driver of value is network size, and the platform makes profits by appropriating a fraction of the value of the cross-side externalities .

However, the most recent scholarly debate on networks and value has also incorporated new perspectives which complement the original emphasis on size or installed base. Schilling (2002) was among the firsts to introduce new explanations about the functioning of network effects, since she found that learning orientation and timing of entry are important factors to explain how network externalities drive value thus favoring technology selection dominant standards adoption. The aspect of network strength was, instead, studied by Shankar and Bayus (2003) to show how Nintendo succeed over Sega despite its smaller customer base. Similarly, Suarez (2005) discovered that technology selection in the market of second-generation wireless technologies was not driven by the installed base but by the presence of strong ties. Also the importance of reaching a large installed base to play a winner-take-all strategy has recently been called into question (e.g., Cennamo and Santalo, 2013). Finally, Afuah (2013) developed a comprehensive framework in which the structure and conduct of a network are the two macro-categories that explain value creation for network members and providers, beyond the sole focus on network size.

Another characteristic of traditional network effect literature is that it originally developed by examining how network externalities influence technological evolutions, such as technical standard's emergence (e.g., Katz and Shapiro, 1985; Farrell and Saloner, 1985; Shilling, 2002; Soh, 2010). The opposite direction of causality, that is how technological evolutions influence network externalities, has been overlooked (see Venkatraman and Lee, 2004 for an exception). However, the examination of this problem could be very informative. For example, Afuah (2013: 260) observed that "technological innovation renders the network obsolete or enables network providers to improve product benefits enough to overcome the network size advantage". Thus, we decided to also embrace this latter aspect, by investigating how new technologies affect the value of existing

cross-side externalities, and how this finally influences platform performance. Figure 1a (left side of Figure 1) offers a schematic representation of a traditional two-sided market. The two groups of customers, Market 1 and Market 2, are connected by a platform that enables interactions. In this paper the dependent variable will be the revenues of the platform, which is a function of the value created through the transactions between the two markets. To simplify our analysis, we assumed that there is only one cross-side externality, going from Market 1 to Market 2, while the cross-side externality in the opposite direction (from Market 2 to Market 1) is insignificant. This means that the presence of Market 1's customers generate value (a positive cross-side externality) for Market 2's customers, and not vice versa. This assumption is not very restrictive, and for example it matches with realities in the case of newspapers: advertisers get a positive value from reaching readers while readers are almost indifferent to advertisements.

--Include Figure 1 (a, b) about here--

Platform and Network Size

Technological changes often open totally new channels for existing products (e.g., Henderson and Clark, 1990; Christensen and Bower, 1996). In the case of platform businesses, this can mean that an established platform, after a technological change, might end up operating also in two new markets (New Market 1 and New Market 2), which are technologically more advanced than its two old markets (Old Market 1 and Old Market 2). Figure 1b (right part of Figure 1) provides a graphical representation of a platform operating in new and old markets. The idea is that the new technology could open new ways to sell the same products and services to new or existing customers through different channels that overlap with the traditional ones. Figure 1b illustrates the particular perspective we take in developing hypotheses. Notice that our unit of analysis is the platform and its revenues from Old Market 2[1].

[1] We do not empirically consider the revenues from New Market 2. It is worth to note that the revenues that publishers gain from online advertisers (new market 2) are still a very small fraction of the total revenues of publishers, around 4,1% in Italy in 2012 (FIEG, 2012).

To examine how a new technology influence the value of pre-existing cross-side externality we first have to start by considering its impact on the size of existing markets. Technological advancements can bring to a substitution of markets served by old technologies (e.g., Anderson and Tushman, 1990; Adner and Kapoor, 2010). A substitution is more likely to happen when the old and new markets are perceived as equivalent on comparable attributes but the new market is superior on certain alignable differences, like for example prices (e.g., Zhang and Markman, 2001), that are valuable for new and current customers (see also Christensen and Bower, 1996). We can expect that, when the network size of an Old Market 1 is cannibalized by the opening of a New Market 1, the cross-side externality that the Old Market 2 derives from the cannibalized Old Market 1 will be negatively affected. A reduction in this externality undermines the revenues a platform can extract from its Old Market 2. We can state our first hypothesis as follows:

> Hypothesis 1: After a technological change that opens new channels for an existing product, the revenues that a two-sided platform extracts from the externality between its two old markets diminishes if one of the old markets is cannibalized.

Platform and Transaction Costs

We here suggest that, after a technological change, the value of old cross-side externalities can be altered not only by a reductions in the size of old markets, but also because new technologies can directly affect the transactions possibilities in new markets. With respect to Figure 1b, we examine the case where the value of the existing cross-side externality between two existing markets (Old Market 1 and Old Market 2) reduces because a new technology makes more efficient for customers of Old Market 2 to search, target, and coordinate with customers of New Market 1. This situation is likely to occur when a new technology induces changes in the characteristics of networks. For example, Afuah (2013) illustrated how two different networks of similar size can generate different value if they are structured differently so that the numbers of possible transaction is not the same (e.g., phone vs card holder networks). We can expect that, if a new technology reduces transaction costs (e.g., Williamson, 1975; 1981) by making easier to search, coordinate, and

exchange (e.g., Clemons et al., 1993; Amit and Zott, 2001), the value for network participants in the new market will be higher because transactions are facilitated. Therefore, when a technological change introduces new channels to convey products and services to customers in more effective and efficient ways (thus lowering transaction costs), consumers will devalue the old channel that does not permit similar benefits. The revenues that a platforms can capture, in turns, will reduce. Indeed, platform revenues are essentially related to the capability to favor transactions and capture a portion of the exchanged value (e.g., Bakos, 1997; Casadesus-Masanell and Zhu, 2012). If one of the two markets finds less valuable to reach customers in the classical way, it means that it will pay less or make less transactions in response of the devaluation of the existing cross-side externality. This leads to a lower platform performance. Moreover, the competence itself and the role of a platform in matching two groups of customers might also be perceived as less valuable if new channels with lower transaction costs emerge. Capabilities and transaction costs are highly complementary in determining how firms organize their activities (e.g., Williamson, 1999; Jacobides and Winter, 2005; Argyres and Zenger, 2012). Customers that now do not necessarily need to use platform's matching service to make transactions might decide to paying less for it.

In sum, we suggest that the value of an existing cross-side externalities reduces if a new technology improves the transaction possibilities in newly opened channels for similar products. As a consequence, the revenues that the platform extracts from the old externality reduce. More formally:

Hypothesis 2: After a technological change that opens new channels for an existing product, the revenues that a two-sided platform extracts from the externality between its two old markets diminish, beyond the size effect of potential cannibalization, if the new technology reduces transaction costs in the new markets.

QUANTITATIVE STUDY: METHODS

Research Setting and link to Hypotheses

The setting of the study is the Italian newspaper industry transitioning from analog to digital technologies. We constructed a database including newspaper-level data about 56 publications (the

99% of the entire population) for the period 2004 – 2012. Our dataset contains accurate yearly information about financial, organizational, and technological aspects of each newspaper in the sample. We relied on multiple sources. From a yearly study of the Italian Federation for News Publishers (hereafter, FIEG) we collected data related to newspapers revenues (from advertising), metrics about offline newspapers' success (number of copies sold), and information regarding changes of the organization providing the selling of sell ad spaces for publishers (called, advertising sales houses). From a national yearbook about press (in English, "The Great Italian News Industry Book") we gathered data about changes in managing editors of each newspaper, the cover price of the offline copies sold, the year of foundation of each publication, and the date of major innovations done by each publisher regarding their rotary presses. Also the shared capital of the publishing companies and other data were collected from the same book. Data about product success of each newspaper website, in terms of unique audience, number of pages viewed, and time per session, were gathered by contacting the Nielsen Media Research Institute. The cumulative number of journalistic awards gained by each newspaper was collected by referring to "Premiolino", the oldest and most prestigious Italian journalistic prize (its US-equivalent is the Pulitzer Prize). Many of these data were triangulated with similar data from alternative sources. For example, the Audit Bureau of Circulation (in Italian, ADS) was used to triangulate data about offline newspaper sold copies and their cover prices. The Italian Authority for Communications (hereafter, AGCOM) was also contacted to double-check and integrate certain data.

We chose this industry because it allows to address our research question. Newspapers are two-sided market (e.g., Seamans and Zhu, 2013), and they are also recently undergone through a major technological change (e.g., O'Reilly and Tushman; 2004; Gilbert, 2005, 2006), the web. Newspapers match readers (Market 1) and advertisers (Market 2), by selling content to the first market and advertising spaces to the second market that is interested in readers' attention. After the advent of the Internet, newspaper publishers have started serving not only their two offline markets

for readers and advertisers (Old Market 1 and Old Market 2) but also two newly opened online markets that mirror the previous ones (New Market 1 and New Market 2).

In our sample, majority of newspapers started experimenting with digital ventures around 1998-1999, with some paper being real pioneers, like the local newspaper L'Unione Sarda in 1994 and the national newspaper la Repubblica in 1996. In the years around 2000 almost all Italian newspaper had a web presence, but the burst of the dot.com bubble in 2001 caused a subsequent stop in digital investments, as for all media companies in the rest of the world. Online investments and the creation of digital-dedicated newsrooms restarted in 2003-2004, and become a reality by 2005, when the online Internet penetration in the country also reached 10% of the population (World Bank, 2013). For all these reasons, our data analysis started in 2004, anticipating of year the moment when the Internet stared to really take off in the country. In the following we present our dependent and independent variables, and the list of controls we utilize in our dynamic panel estimation.

Dependent Variable

Platform revenues. Our dependent variable represents the value that the platform can capture from the old cross-side externality. We measure it as the yearly offline advertising revenues that each newspaper gain from advertisers. In a two sided-market, the value internalized and captured by a platform (e.g., the revenues that newspapers can get from advertisers) is a function of the value that the platform helps creating (e.g., the value that advertisers perceive by reaching readers of newspapers). Clearly, the value captured is more easily quantifiable than the value created along the cross-side externality, but it is still a good proxy of it. Indeed, the more newspapers gain revenues from advertisers, the more it means that advertisers are perceiving value from reaching readers. Therefore, we use the revenues that publishers extract from their offline advertisers as a measure of the value created along the cross-side network externality between readers and advertisers.

Independent Variables

Product success in the old market 1. To measures the success that a platform obtains in its Old Market 1 we use the number of products sold (Nerkar and Roberts, 2004) by the platform in the old market. We collected the yearly number of copies sold of each newspaper (at the kiosk and through offline subscription). This measurement gives an objective representation of the network size of offline readers.

Product success in the new market 1. This construct mirrors the previous explanatory variable, with the difference that here we refer to the new market channel opened after the technological change, the New Market 1. We measure the success with the product delivered on New Market 1 by computing the number of customers that the platform is able to attract on that new market. We collected data about the number of online readers visiting each newspaper website, and we adopted a standard metric used within the industry: unique audience[2]. Since the variable (collected at the daily and monthly level by metric institutes) cannot be summed up, we selected the month of June of each year as a proxy of the yearly data.

Control Variables

Platform age. This is a cumulative count of the years of existence of each newspaper since its foundation. The age of the newspaper can impact readers (and indirectly advertisers) since it influences the authoritative tone and the trustworthy relation of newspaper with its community. Moreover, platform age can generate network inertia (Katz and Shapiro, 1994).

Editor experience. Each newspaper is managed by one executive editor, who gives the editorial line, influence the selection of content, and determines the positioning and differentiation strategy of the newspaper. Therefore, the editor experience is important to have success with readers and advertisers.

[2] Nielsen Media Research defines unique audience as "The total number of unique persons that have visited a website or used an application at least once in the specified reporting period. Persons visiting the same website or using the same application more than one time in the reporting period are only counted once".

Platform quality. The variable captures the editorial quality of each newspaper, by counting the cumulative number of journalistic awards gained since foundation. The editorial quality can have an effect on the type of advertisers and their willing to pay, but also on the number of readers.

Innovation in the old market. The variable measures the time when newspapers introduced an important innovation in their printing plants: the full-color rotary presses. Publishers that early invested in this new technology could have attracted and maintained more attracted more offline readers and advertisers. The variable take the value of 1 in the year when the newspapers moved to a full-color production and then unitarily increases for each year passing.

Changes in vendors. Platforms often need sales forces to favor transactions between two separate groups of customers. Newspapers utilize sales agents to sell readers' eyeballs to advertisers. Larger publishers often incorporate these sales agents within their firm's boundaries, creating their own ad sales houses, while smaller publishers sometimes need to outsource this selling service to the national or local level. We use two dummies, one for changes in local vendor and one for changes in national vendors. Change in sales agents can impact advertisers benefits and the revenues extractable from them.

Company size. The size of the company owning a platform can influence platform's ability to attract customers. We measured the yearly share capital of each publishing company, since higher share capital can mean larger investments and better revenues.

Country growth. We measure the yearly growth rate of the gross domestic product (GDP) of a country. Thus we control for readers' ability to spend for newspapers (installed base) and for advertisers' ability to invest in ad campaigns (newspaper revenues).

Technology growth. The adoption and diffusion of the new technologies by consumers can affect the success of platforms operating in the new technological domains. To proxy the evolution of online digital technologies in the selected country we use the broadband penetration. Table 1 illustrates summary statistics and correlations for all variables.

--Include Table 1 about here--

Statistical Method

We use paned data fixed-effect model to test the two hypotheses. The estimation model assumes the form of the following equation:

$$\text{Platform revenues}_{i,t} = \text{const} + \alpha_1 \text{Success in the old market 1}_{i,t} + \alpha_2 \text{Success in the new market 1} + \beta X_{i,t} + \Phi_i + T_t + \varepsilon_{i,t}$$

where i is the newspaper, t the time, X the vector of control variables, Φ_i is the platform fixed effects, T_t is the dummies for time fixed effects, and ε the vector of residuals. By using platform fixed effect we can account for platform-specific unobserved heterogeneity that can influence our dependent variable. Fixed effect was also chosen because our sample includes almost the entire population of newspapers, whereas random effect is recommended when the sampled companies are randomly selected (Wooldridge, 2003).

We also needed to use instrumental variables (hereafter, IV) to solve an endogeneity problem between the two variables Product success in the old market 1 and Product success in the new market 1. Endogeneity problems are common with platform markets studies, due to circular effects caused by indirect network externalities (e.g., Cennamo and Santalo, 2013). This is also the case of news publishing industry, as addressed by previous scholars (e.g., Song, 2011). In our model the endogeneity steams from the circular network effects between the number of copies sold (success in the old market 1) and the number of online users of the newspaper website (success in the new market 1). The success with readers offline can positively influence the success with the online reader but the success of newspaper website can negatively affect the number of sold copies (and offline readers). Therefore, our estimates about how the two variables influence platform revenues could potentially be not consistent, and thus we turned to a two-stage least square (2SLS) estimation. By mixing theoretical considerations with exploratory regressions we obtained a list of three IVs, which had to be related with the endogenous variables in the first stage but unrelated with

the dependent variable in the second stage (Kennedy, 2003). The first instrument was cover price, which is the price at which publishers sell their offline copies. This price clearly influences the number of offline readers but do not affect the number of online readers. The second and third instruments were instead obtained by subtracting from the two endogenous variables their cumulative averages and by taking the one-year lag of these newly generated variables. This particular methodology, based on a dynamic panel logic, was originally advanced by Bhargava and Sargan (1983) and Arellano and Bover (1995). These scholars showed that by taking the difference between the core variable and its individual time mean it is possible to eliminate the fixed component of the error term, whereas the lag makes the IV correlated with the core variable but uncorrelated with the unobserved component of the error term. We also run typical tests for IVs. The F-test for strong instruments is significant and largely above the threshold of 10. The Hausman test indicated that there was a significant ($p<0.01$) systemic difference between the IV and endogenous variables. The test for overidentified restrictions revealed that the three instrumental variables were correctly excluded from the second-stage regression and where uncorrelated with the error terms.

RESULTS

Table 2 contains the results of our ordinary least square estimates (OLS) and subsequent 2SLS estimation. The coefficients in our model will be interpreted as corresponding to standardized variables, whose means are 0 and standard deviations are equal to 1. Model 1 and model 2 are OLS and represents, respectively, the baseline model (only control variables) and the model that also adds the endogenous variables. Model 3, instead, represents the second stage of a 2SLS that accounts for the IVs. It is important to notice that the coefficient of one of the two endogenous variables, unique audience, changes sign from model 2 (0.129; $p<0.01$) to model 3 (-0.154; $p<0.05$). This supports our suspect of endogeneity, since the effect of one independent variable on the dependent variable totally inverts its sign when moving from an OLS to a 2SLS-IV estimation. The

source of endogeneity, as already illustrated, regards the expected reverse causality between the two independent variables, unique audience and copies sold. Notice also that the two variables were highly correlated (0.79; see Table 1). If we examine, instead, the impact of copies sold on offline advertising revenues we notice that the coefficient is and remains positive and significant across the OLS (0.826; $p<0.01$) and the 2SLS (0.729; $p<0.01$) estimations. This means that revenue from advertisers are high when newspapers can guarantee larger offline readerships, and this confirms a main prediction of network studies regarding the positive relationship between value (created and captured) and network size.

--Include Table 2 about here--

Model 4 in Table 3 displays the first stage of the 2SLS estimation, where the two endogenous variables are regressed on the selected IVs. The IV called "LagAudienceMinusCumMean" (that we obtained by subtracting from the unique audience its cumulated mean and then lagging by one year) was found to have a negative and significant effect on copies sold (-0.148; $p<0.01$). This suggests that the online success of newspaper websites negatively influences the number of copies sold (at the kiosk or through subscription), providing an evidence of cannibalization between the old and new market for readers. At the same time, the bottom of Table 3 shows that the reverse direction of causality, from sold copies (LagCopiesMinusCumMean) to unique audience, is much weaker (-0.041; $p<0.05$). The direct comparison between the two coefficients is possible exactly because all our variables have been standardized.

--Include Table 3 about here--

Overall, Model 4 brought evidence of cannibalization of offline newspapers by their online counterparts. Model 3, instead, had shown that an increase in the number of copies sold would positively influence offline advertising revenues (+0.729; $p<0.01$). We can now combine the two effects, the cannibalization of copies and the positive effect that an increase in copies would have

on offline advertising revenues. From the first-stage we know that 1 standard deviation increase in online audience results in -0.148 standard deviation decrease in copies sold. From the second-stage we know that 1 standard deviation increase in copies sold results in +0.729 standard deviation increase in offline advertising revenues. By solving the two equations we obtain that 1 standard deviation increase in online audience causes a loss of -0.11 standard deviations in offline advertising revenues. Hypothesis 1 gains support from this result, which states that the cannibalization of an old market 1 by a new market 1 negatively impacts the externalities that an old market 2 perceived by the network size of the market 1, and this diminishes the revenues that the platform captures from the old market 2 (see again Figure 1b). Hypothesis 1 is therefore consistent with our empirical evidence. Said in more simple terms, a new technology reduces platform performance if it cannibalize the network size of one old markets, thus undermining the value of the cross-side externality generated by that market.

Our regression shows a second interesting result. Using the 2SLS-IV procedure we are able to measure the residual effect of the two independent variables (copies sold and unique audience) on platform revenues, after controlling for the reversed causality between the two variables. Therefore, the negative coefficient of -0.154 from Model 3 (second-stage) can be considered as the residual effect of unique audience on platform revenues, after controlling for how this variable indirectly affected platform revenues (through its impact on offline copies sold). This means that 1 standard deviation change in online audience really results in a net -0.156 standard deviation reduction in platform revenues (this effect is separate from the one illustrated above). Therefore, hypothesis 2 gains support from data[3], even if we are still quite agnostic on the mechanisms that govern this effect. To explain the causes of such a residual effects, we have theorized about the possible impacts that a new technology can have on the transaction possibilities on a network. In

[3] As a robustness check we repeated all regressions by substituting the measure of one of the two key independent variables, "product success in the new market 1", using "time per person" instead of "unique audience".The new metric capturs the average time spent by the unique users on a certain website in a month - June in our study (source: Nielsen MediaResearch). Hypotheses 1 and 2 were found to be robusts also to the new variable.

order to develop a clearer understanding on this aspect, we conducted a qualitative study, whose results are summarized in the next section.

QUALITATIVE STUDY

We run 25 semi-structured interviews with newspaper managers, executive from advertising companies, and experts in the broad domain of media and advertising. The informants from newspaper companies were selected from the two major national newspaper in Italy (Corriere della Sera and la Repubblica), both included in our empirical sample. Among the executives from the advertising companies we interviewed people from ad agencies but also managers of technology companies offering ad services. We also asked questions to experts working in news industry associations and authorities. The content of each interview was taped and transcribed, and then analyzed by also making triangulations with archival data deriving from extensive industry reports and financial statements.

Qualitative Results

The first aspect that emerged is how advertisers derived value in the offline business. The Director of Audipress, the Italian institute collecting data about press, explained: "By gathering data about the exact offline readership of each newspaper, we offer advertisers the possibility to estimate the potential reach of their ad campaign. Our socio-demographics data about readers permit advertisers to customize the message. Therefore, our surveys data on the size and characteristics of newspapers' readership have always been valuable for ad planners". At the same time, advertisers make their investment decisions also based of archival data. The Managing Director of ADS (Accertamento Diffusione Stampa, in English: Audit Bureau of Circulation) said: "Since advertisers need certified data, we gather and check all data about newspapers' circulation and copies sold". Despite our first interviews revealed what generate value for advertisers in the offline business, we also quickly discovered that the entity of such value was bounded by the typical limitation of a

physical print and distribution network. For example, publishers could provide their certified performance metrics to advertisers only after the collection and certification processes was completed, which means a biannual periodicity for Audipress and a three months lag for each closed month for ADS. The new technology of the Internet, instead, has introduced the real-time in the trading of online advertising spaces. The former Director of Digital Content and Product Development of la Repubblica stated: "The real-time communication of data is very important for advertisers because ad buyers want to reach their potential customers exactly when those are on the news website". Moreover, digital technologies permitted to reduce the lack of transparency that characterized offline transactions. As indicated by the Marketing Director of National Print of the ad sales house of La Repubblica: "The higher unobservability of privately managed offline transactions allowed strong publishers to practice different prices to advertisers for the same ad space. The digital technologies, instead, allowed better measurement and searchability, thus transferring value to advertisers in the form of a pricing that reflects only real consumptions". These first aspects suggest that, independently on the network size, the value that advertisers can get when reaching their readers online is potentially higher, due to technological improvements regarding real-time measurement and higher accountability.

The interviews also revealed that the web has caused a substantial enhancement of the targeting possibilities. Even if offline newspapers provided advertisers with socio-demographic information about their readers (e.g., Chandra, 2009), offline ad investors could only statistically expect that a display ad was going to be seen by the target audience. Instead, digital technologies allow to target the single user (e.g., Athey and Gans, 2010) and to precisely measure its action in terms of number of clicks (e.g., Dellarocas, 2012) on each displayed ad. The Web and Mobile Marketing Director of la Repubblica admitted that: "Since the Internet has brought the concept of measurement at the extreme, press has resulted to be the less measurable media. Advertisers using online news website can exactly know when and how frequently a potential consumer is looking at

their ads, and check the performance of their ad campaigns in real-time". It is easy to see that the relative unbalance in the measurement possibilities between online and offline audience is what really penalized offline newspapers in their ability to attract offline ad investment. The same managers was extremely insightful when he also added: "The devaluation of print does not stem from the drop in circulation, which is minimum as compared to the plummet of ad investment on print. The speed of the two falls is not the same, but it is much higher for adverts. The reason is that online media tell advertisers that the ad campaign can be measured". When we asked to an Executive from Corriere della Sera to describe how newspapers entered in the online market a surprising element rose up: "At the incept of the web we felt to be in competition with Yahoo! and other portals and we thus thought that everything was about large audiences. Therefore, we gave away our content for free to reach masses. Retrospectively, this was wrong, since we are now observing that successful online platforms are those who collect information about each of their single users, enabling advertisers to personalize and target each consumer".

The former Managing Editor of the website of Corriere della Sera stated that: "The web has changes the way relations are organized. Before the advent of the Internet advertisers needed to go through offline newspapers, but today they have the chance to search for specific customers and directly talk to them. Given this direct relation and the richer information about customers, web platforms are preferred since they enable new ways of communicating". To the CEO of the ad sales house of Corriere della Sera we asked to explained what has really changed with the Internet regarding the selling of adverts. He stated: "Traditional publishers have maintained their relationship with advertisers but the digital disruption has introduced, or emphasized, new concepts: accountability, measurement, targetization."

Overall, the insight from our inductive study helped to provide a larger support for our second hypothesis and to highlight its underlying mechanisms. More specifically, we found that advertisers devalued the offline medium not because of the reduction of offline readership but

because of the specific value that they could derive on the online medium (see also, The Guardian, 2012). A technological change can therefore improve the searching, coordinating, and transaction possibilities between customers (online readers and advertisers, in our setting) thus making exchanges more valuable for network participants (better measurement, targeting, transparency, accountability, efficiency and efficacy, in our setting)[4]. The illustrated mechanisms help understanding why the revenues that a platform derives from one of its two old markets can decrease beyond the reduction caused by any cannibalization of one its old markets. The explanation of this counterintuitive prediction consisted in showing how a new technology can cause a devaluation in the cross-side externalities of a platform market, thus negatively affecting the revenues that the platforms can extract.

DISCUSSION AND CONCLUSIONS

Network size is a fundamental driver of value in network externalities (e.g., Katz and Shapiro, 1985; Farrell and Saloner, 1985; Rochet and Tirole, 2003). However, recently strategy scholars (e.g., Shilling, 2002; Suarez, 2005; Cennamo and Santalo, 2013; Afuah, 2013) have also started examining additional factors driving value, beyond network size. Our paper adds to this growing debate by showing how the value of cross-side network externalities can be influenced by changes in technologies that open new channels and diminish transaction costs. Our novel finding is that new technologies can alter the value of existing externalities in two ways. First, by opening new markets they can induce cannibalization in the network size of old markets. Second, and more importantly, by reducing transaction costs among new markets they can comparatively reduce the benefits of making exchanges among old markets. In both cases, we also argue about the mechanism explaining why a reduction in the value of existing externalities leads to decline in platforms revenues (our DV). The main explanation we provide is that, when the new technology

[4] Our evidences were consistent with the literature on online auction and targeting advertising (Athey and Gans, 2010; Goldfarb and Tucker, 2011; Bergemann and Bonatti, 2011; Seamans and Zhu, 2012).

causes a reduction in the value created by old cross-side externality (for the two separate reasons illustrated above), then the revenues that the platform can capture from the devalued externalities will be necessarily lower.

To develop and test our theory we combined both dynamic panel data and qualitative interviews, and we based our study on the Italian newspaper industry facing the Internet. By selecting the period 2004 - 2012 we considered a situation in which digital technologies favored the creation of online channels, which temporally coexist with offline channels. The aim was to understand how the web has changed the value of pre-existing cross-side externalities between offline advertisers and offline readers, and how this has then influenced the revenues that traditional newspapers can get from advertisers. Our qualitative evidences showed that advertisers now find more valuable to individually target readers and measure each transaction in real time, and that this is only possible online. Publishers declared that the devaluation of their offline advertising spaces largely steamed from their inability to guarantee, in the offline domain, similarly effective transaction possibilities for advertisers, and not only from the drop in offline readership. Our regressions precisely support these evidences. On the one side we found that offline readers were cannibalized by online readers. On the other side, we discovered that offline readers' cannibalization only partially explains the decline of revenues from offline advertisers. We found that the online success of newspapers had a negative and significant effect on their offline revenues from advertisers, even after controlling for offline circulation decline. This provided support to our hypothesis that the value of network effects goes beyond the sole network size aspect, and precisely can be affected also by exogenous changes that alter transaction possibilities.

Our study contributes to recent platform competition literature (e.g., Shilling, 2002; Shankar and Bayus, 2003; Suarez, 2005; Afuah, 2013; Cennamo and Santalo, 2013) by showing that the value of network externalities is contingent on the possibilities of transactions (e.g., Williamson, 1981; Clemons et al., 1993; Amit and Zott, 2001; Afuah, 2013) in a network, which in turns depend

not only on variations in install base but also on changes in technologies. We found that transaction possibilities referred to aspects such as coordination, searching, efficiency and efficacy of exchanges, all improved by the new technology. With this respect, we help better characterize also Afuah (2013)'s observation that new technologies can overcome the relevance of network size. These findings also offers implications for scholars studying the linkages between transaction costs and competences (e.g., Jacobides and Winter, 2005; Argyris and Zenger, 2012). Further research might analyze how platform competence of enabling transactions evolves when the easiness of making transactions in a network change for exogenous reasons (e.g., changing technologies).

Our study also contributes to the strategy literature about value creation and capture (e.g., Jacobides, Knudsen, and Augier, 2006; Priem, 2007; Adner and Kapoor, 2010; Amit and Zott, 2001), because we unveiled some specific mechanisms of value creation in ecosystems characterized by network externalities. The same findings might be also useful for future researches on business models innovation (e.g.; Zott and Amit, 2007; Gambardella and McGahan 2012).

Finally, the study might also have implications for literature on technological change and incumbent failure (e.g., Tushman and Anderson, 1986; Henderson and Clark, 1990; Christensen and Bower, 1996). Scholars in this tradition have shown that firms inability to adapt can depend on competence-destruction (Tushman and Anderson, 1986), excessive focus on mainstream customers (Christensen and Bower, 1996), and cognitive bias of managers (Tripsas and Gavetti, 2000). Future research could examine if a decline in the value of network effects represent an additional cause of unsuccessful adaptation, especially in industry where incumbents controlled and were making profit from network externalities.

There are also practical implications in our findings. By knowing in advance how a new technology can influence the value of existing network externalities, companies can recognize its impact on their business models. More precisely, in the old technology domain in which existing externalities might have been devalued, managers could decide to reduce their dependence on

network effects by investing in stand-alone markets. For example, publishers from our sample reacted to the loss of interest of advertisers by focusing more on readers and increasing content quality, and then asking them to pay more. Instead, in the new technological domain where transaction possibilities might have been enhanced by new technologies, managers could consider two possibilities. On the one hand, they could offer higher-order level services to orchestrate new transactions. On the other hand, they could shift their attention on attributes different from the sole network size, in order to better fit with the emerging drivers of value. For example, publishers have realized that large online audiences are not sufficient to guarantee their economic success, given also the easiness to search and target single readers independently on aggregated masses. Therefore, they are now experimenting with better targetization of readers (an example of an emerging driver of value) and with online payment strategies (a choice that inevitably reduces the size of their audiences).

Our findings might be extendible to industries characterized by network externalities, such as television, radio, music, gaming, travels, payment systems. Similarly to newspapers, also these sectors have recently experienced transaction cost reductions and revenue declines. Future research could select one of these industries and study performance by also including the value that the platform could capture from the new externalities and from its standing-alone businesses. Finally, our results could also apply to many situations in which new technologies open new markets for existing products. A possible setting here is the case of users playing similar games on both consoles and mobile devices.

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Figure 1a (left), 1b (right)

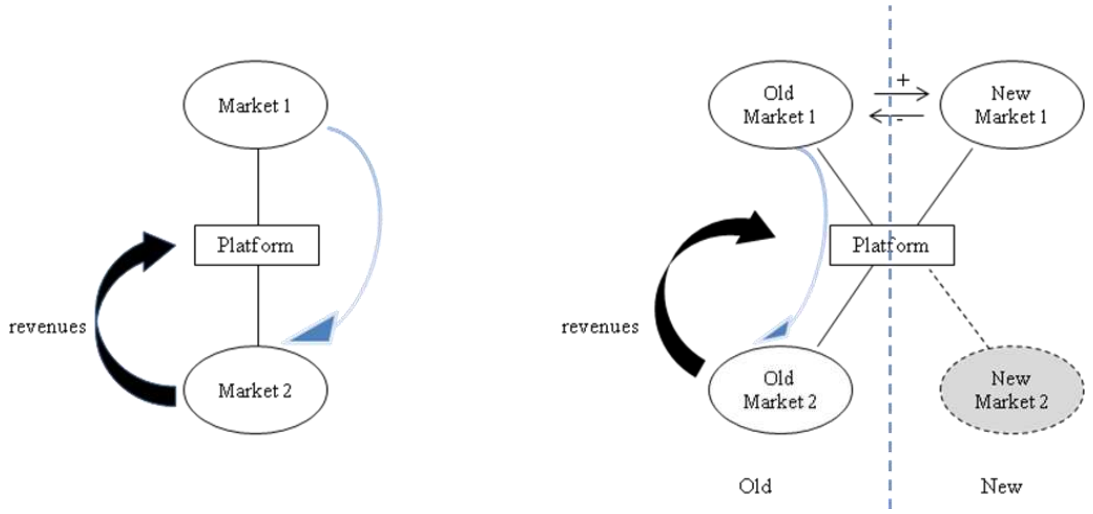

Figure 1a illustrate a classical two-sided market (2SM). Figure 1b represents 2SM after a technological change that opened two new markets for the same product. The study examines the cross-side externality between old markets 1 and old market 2, considering also the impact of new markets 1 on old market 1.

Table 1. Summary statistics and correlations

Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Platform revenues	2.86e-10	1	1.00												
2. Prod success old market 1	2.96e-10	1	0.93	1.00											
3. Prod success new market 1	-2.00e-10	1	0.82	0.79	1.00										
4. Cover price	-1.47e-08	1	-0.04	-0.05	0.15	1.00									
5. Platform age	3.78e-10	1	0.04	0.06	-0.01	-0.06	1.00								
6. Editor experience	-9.67e-10	1	0.01	-0.07	0.02	-0.02	0.06	1.00							
7. Platform quality	-6.97e-09	1	0.74	0.74	0.68	0.05	0.05	-0.05	1.00						
8. Innovation in the old market	-9.19e-09	1	0.28	0.29	0.30	0.40	0.05	0.09	0.22	1.00					
9. Changes in local vendors	2.09e-09	1	-0.04	-0.02	-0.01	-0.01	-0.03	-0.03	-0.04	0.00	1.00				
10. Changes in national vendors	1.93e-09	1	-0.06	-0.04	-0.03	-0.01	-0.01	-0.02	-0.00	0.04	0.48	1.00			
11. Company size	6.02e-10	1	0.44	0.41	0.37	0.09	0.04	-0.09	0.23	0.12	-0.04	-0.04	1.00		
12. Country growth	-1.02e-08	1	0.02	0.02	-0.06	-0.10	-0.01	-0.00	-0.00	-0.18	0.07	0.01	-0.01	1.00	
13. Technology growth	-3.26e-09	1	-0.03	-0.05	0.16	0.62	0.04	0.02	0.01	0.52	0.07	0.04	0.03	-0.36	1.00

Table 2. OLS and Second-stage of the 2SLS estimation

Variables	Model 1 (OLS)	Model 2 (OLS)	Model 3 (2SLS)
DV: Platform revenues			
Independent variables			
Product success in old market 1	-	0.862***	0.729***
		(0. 060)	(0.146)
Product success in new market 1	-	0.129***	-0.154**
		(0. 027)	(0.061)
Control variables			
Platform age	-3.206***	-1.983***	-1.315*
	(0.630)	(0.538)	(0.724)
Editor experience	-0.025	-0.015	-0.001
	(0.019)	(0.016)	(0.018)
Platform quality	-1.963***	-0.706***	0. 368
	(0.152)	(0.229)	(0. 283)
Innov_old_market	0.015	0.005	0.002
	(0.010)	(0.009)	(0.009)
Changes in local vendors	0.003	0.011**	0.010*
	(0.007)	(0.006)	(0.006)
Changes in national vendors	-0.003	-0.002	-0.001
	(0.007)	(0.006)	(0.006)
Company size	-0.085	-0.088	-0.008
	(0.134)	(0.111)	(0.116)
Country growth	0.014**	0.013**	0.009*
	(0.006)	(0.005)	(0.005)
Technology growth	0.091***	0.067***	0.061**
	(0.023)	(0.019)	(0.030)
Constant	0.002	0.029**	0.010
	(0.013)	(0.015)	(0.023)
Observations	486	463	389
F test	170,13	74,83	75,44
R-square (overall)	0,1727	0,0200	0,2493

Robust standard errors in parentheses
*** $\rho<0.01$, ** $\rho<0.05$, * $\rho<0.1$

Table 3. First-stage least squares estimates

Variables	Model 4 (2SLS)
Endogenous variable: Product success in old market 1	
Instrumental variables	
Cover price	-0.008 (0.008)
LagCopiesMinusCumMean	0.113*** (0.010)
LagAudienceMinusCumMean	-0,148*** (0.017)
Endogenous variable: Product success in new market 1	
Instrumental variables	
Cover price	-0.022* (0.014)
LagCopiesMinusCumMean	-0.041** (0.019)
LagAudienceMinusCumMean	0.647*** (0.031)

Notes: The first-stage F statistics is 128,46 for the first endogenous variable and 3,63 for the second endogenous variable