POLITECNICO DI MILANO

School of Industrial and Information Engineering

Two-Sided Markets and Multihoming Phenomenon: An Empirical Analysis in Online Food Delivery Market in Milan

Master of Science Thesis in the Master's Programme Management Engineering

Supervisor: Tommaso Buganza
Co-Supervisor: Daniel Trabucchi

Ali Berk ICOZ
878434

Academic Year 2018/2019

“And medicine, law, business, engineering, these are noble pursuits and necessary to sustain life.

But poetry, beauty, romance, love, these are what we stay alive for.”

Dead Poets Society

ACKNOWLEDGEMENT

Living in Milan, studying in Politecnico di Milano, spending time in this beautiful Italian culture, meeting with many international people and learning a lot with all the aspects… These are true gifts to me. I would like to thank to everyone who made it possible, of course starting with my family. I'm lucky to have a family who know that education is the biggest investment.

My brothers Mustafa Omer Kala, Veysel Bolluk, Dogukan Adiguzel and Ebubekir Cabuk for being around always, despite the distance; Suveyda Cengiz and Mehmet Bahadir Kirdan for their support; and Huseyin Hanli as my flatmate and best friend deserve to be remembered. All of my friends! I'm so lucky and happy to have you in my life and that we are sharing this life story. Thank you!

Last but not least, I would like to express my special gratitude to my supervisor Daniel Trabuchhi for providing me constructive feedbacks and guiding me along the process.

Ali Berk ICOZ

Milano, 2019

ABSTRACT

Interests of academics in two-sided markets are growing exponentially parallel to their growing economic values. Two-sided markets and their multi-homing phenomenon are investigated in this research. Multi-homing is the attitude of users of the platform to use more than one platform at the time. As it has considerable impact on pricing decisions, exclusivity, competition, antitrust issues etc. it is valuable to investigate and understand it better. To do that Online Food Delivery Market in Milan (with its known players Just Eat, UberEATS, Glovo and Deliveroo) is selected; and seller side (restaurants) multi-homing is studied by collecting data from Google Maps and websites of the platforms. Findings, based on the data of 622 restaurants, show that multi-homing is common among all four platforms with the rate between 70% and 80%. Platform usage rate (using at least one platform) is identified as 38%. As a second part of research, restaurants' characteristics' (such as quality, popularity, pricing and being a single entity or part of a chain) impact on multi-homing is analyzed by establishing a model with the data coming from popular platforms such as Google, Zomato, Facebook, TripAdvisor and Foursquare. Ratings, number of comments, likes, pricing index, and web-based research data is converted to useful data to be able to use in the model. Test is conducted with two different inputs of "Google, Zomato, Facebook, TripAdvisor, Foursquare" and of only "Google, Zomato and TripAdvisor" as these three platforms are more active and reliable in terms of restaurant evaluations. According to results, only "being a single or chain restaurant" has a significant impact on multihoming with saying that single restaurants (with the odds number of 0,269 and 0,244; respectively for the two sets of inputs identified) are more likely to use a smaller number of platforms at the same time compare to chain restaurants.

Keywords: two-sided markets, platforms, multi-homing, online food delivery market

RIASSUNTO

Gli interessi dei ricercatori nei *two-sided markets* stanno crescendo in modo esponenziale parallelamente ai loro crescenti valori economici. I *two-sided markets* e il loro fenomeno multihoming sono investigati in questa ricerca. Il multi-homing è l'atteggiamento degli utenti di utilizzare più di una piattaforma nello stesso momento. Poiché questo fenomeno ha un impatto considerevole sulle decisioni in materia di prezzi, esclusività, concorrenza, questioni legate all'antitrust, ecc., é importante indagarlo e comprenderlo meglio. Per fare ciò, é stato selezionato il mercato della distribuzione alimentare online a Milano (con i suoi noti *players* Just Eat, UberEATS, Glovo e Deliveroo); e il multi-homing del lato venditore (ristoranti) viene studiato raccogliendo dati da Google Maps e dai siti Web delle piattaforme. I risultati, basati sui dati di 622 ristoranti, mostrano che il multi-homing è comune tra tutte e quattro le piattaforme con un tasso compreso tra il 70% e l'80%. Il tasso di utilizzo della piattaforma (utilizzando almeno una piattaforma) è corrisponde al 38%. Come seconda parte della ricerca, l'impatto delle caratteristiche dei ristoranti (come la qualità, la popolarità, il prezzo e l'essere una singola entità o parte di una catena) sul multi-homing viene analizzato stabilendo un modello con i dati provenienti da piattaforme popolari come Google, Zomato, Facebook, TripAdvisor e Foursquare. Valutazioni, numero di commenti, *likes*, indice dei prezzi e dati di ricerca *Web-based* vengono convertiti in dati utili per poter essere utilizzati nel modello. Il test viene condotto con due diversi input: "Google, Zomato, Facebook, TripAdvisor, Foursquare" e solo "Google, Zomato e TripAdvisor" in quanto queste tre piattaforme sono più attive e affidabili in termini di valutazioni dei ristoranti. Secondo i risultati, solo "essere un ristorante singolo o di catena" ha un impatto significativo sul multi-homing; inoltre, i singoli ristoranti (con odds number di 0,269 e 0,244 rispettivamente per i due gruppi di input identificati) hanno maggiori probabilità di utilizzare un numero minore di piattaforme allo stesso tempo rispetto alle catene di ristoranti.

Parole chiave: *two-sided markets*, piattaforme, *multi-homing*, mercato della distribuzione alimentare online

INDEX

LIST OF FIGURES

LIST OF TABLES

1. Literature Review

1.1. Introduction

Two sided markets or multisided markets become very important topic among business world, entrepreneurs and also researchers recently. These two terminologies have the same meaning with just a slight difference. When Rochet and Tirole (2004) were working on their research they called it “two sided markets” for a matter of simplicity. These companies can have more than two sided and can called multisided companies (or platforms) but underlying theory wouldn’t change. Sometimes we also see them named as “platforms” instead of “markets”, both correspond to “companies” eventually.

According to Scopus.com number of researches made in this subject increased drastically in last 20 years. While there are only few researches done in 2000, in 2018 number of the researches done reaches to 133. If we consider how this companies are growing and ruling the global economy beside becoming substantial part of our daily lives, this drastic increase in the interest doesn’t seem like going to stop in upcoming years.

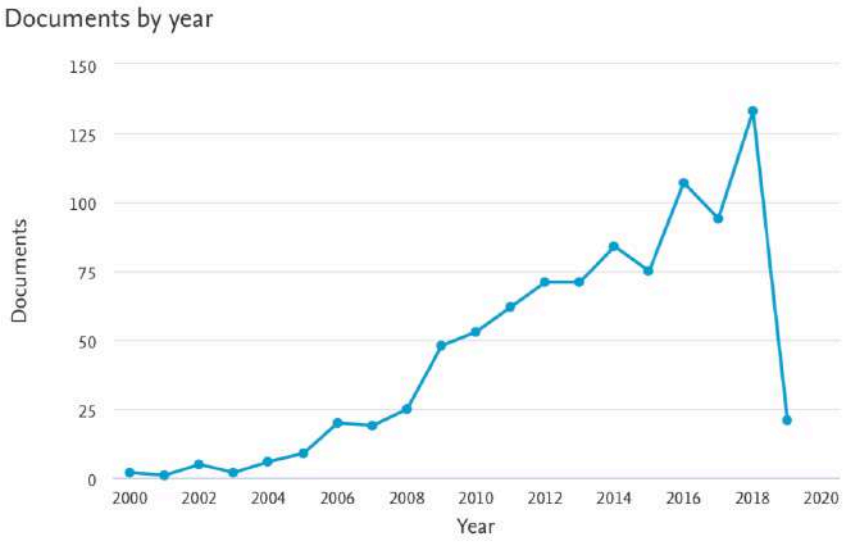

Figure 1 Number of the Documents by Years (2000-2019) (Source: Scopus.com)

Many global unicorns, over a billion dollars value startups emerged among two-sided market companies. Ali Baba, YouTube, Facebook, Google, Microsoft, Visa, Netflix, Uber, Airbnb, Blablacar, Sportify are just some of them. As we can see, what they do common is simply connecting one customer group to another one that normally wouldn't come together in this way. (Gawer, 2010)

According to Forbes, for 2018, top company for the market valuation is Apple with $926.9 Billions and followed by Amazon, Google's Alphabet, Microsoft, Facebook and eventually Ali Baba with $499.4 Billions. They are all MSP companies. Beside them there are unicorns such as Uber that has $72 Billion-dollar valuation, and while Airbnb has $30 billion. Considering the fact that they started to do business recently, and don't have any property on their own, it is very easy to see where their attractiveness is coming from. (https://www.cbinsights.com/research-unicorn-companies; https://www.forbes.com/global2000/list/)

Two-sided markets are simply intermediaries with some specific characteristics that will be explained along the literature review. As there is no certain and unique definition that everybody agreed for MSPs, going with examples and mentioning the theoretical background along the timeline is a reasonable structure.

Just imagine that you really want to visit Milano for the Fashion Week, but you cannot find any place in hotels, they are all booked out and the last ones have crazy prices. Then, you remember Airbnb, check the prices and see many reasonable offers but how Airbnb got that famous to offer thousands of rooms all around the world?

This can be explained by network effects. People go to Airbnb because they know that there are many options to find a place, and another type of customer "owners" are going to same place because they know that there are many people looking for a place on this website. This applies to all kind of two-sided market companies. In case of YouTube, video producers and people who goes to website to watch some entertaining videos. Sometimes it is not easy to see two-sided market characteristic as in fashion magazines. They are also two-sided market companies, with advertisers on one side and readers on the other side. Otherwise if it would be a

single sided market, the cost of each magazine wouldn't leave any profit for the company.

Six turbocharging technologies have driven innovations in two sided markets by reducing the cost, increasing the speed, and expanding the scope of connection between platform sides (Evans and Schmalensee, 2016)

-More powerful chips: Comparing the technology with the past, first computers and then first personal computers, today's small devices are much more powerful than huge computers of 30 years ago. All processes that we are doing with our smartphones requires this powerful chip technology that we didn't have before. Such as in using Uber, opening an app, searching for a driver, seeing their instant location and doing payment, leaving comment with just few clicks. We couldn't have Uber with 30 years ago's chip technology.

-The internet: This is substantial technology of today. Internet now is connecting billions of devices of all kinds that are using the same protocols. In the first place it was connecting computers that are on the same physical network, then networks to networks. Finally, in 1993 US government opened it to the whole world for commercial purposes. Nowadays from our personal social lives to companies' businesses, and also countries' public services are happening on or through the internet.

-The World Wide Web: Through the "www" contents are stored in there, available over internet and can be accessed by a browser. Many websites are offering contents and services. They are often mentioned as "edge providers" or "internet content providers" Many of these edge providers are two sided (or mostly multi sided) markets.

-Broadband communications: After powerful chips and internet technology broadband communication technology was needed to satisfy the need of mobile lifestyle. This technology made using internet over our smartphones possible and opened a space for applications of two-sided markets.

-Programming languages and operation systems: From the invention of C language to Java and many others there were many great innovations. According to one statistic, there were 11 million professional software developers in 90 countries in 2014. These languages and developers helped us to take maximum efficiency from computers and smartphones. Neither powerful chips nor internet itself is not enough without good operation systems built on those chips.

-The cloud: Clouds are the servers sitting on the edge of physical network of networks. Companies or even individual people are using them to store information and make it available when it is needed. High speed of internet removed the difference of working on your own personal computer or another computer on another continent. Many companies such as Amazon are giving computational services for the companies all around the world. In this way those companies don't need to buy and create their own servers, they can just rent it.

Developments in these six turbocharging technologies continuing without any expected slowdown. They are supporting each other, such as more powerful chips, more efficient operation systems, faster internet, increased amount of content, better cloud systems, better mobile internet technology. Specifically, we can mention about the fact that they are enabling the development of two foundational multisided platforms that support other multisided platforms: Internet service providers and operating system.

"Those technologies have also resulted in the creation of foundational multisided platforms on which other matchmakers can build. These "platforms-for-platforms" include fixed and mobile Internet service providers, which connect users and content providers, and computer operating systems, which, working on top of fixed and mobile computing devices, connect users and app developers.

These information technologies and the foundational platforms they power have turbocharged the ancient matchmaker model." David S. Evans. "Matchmakers: The New Economics of Multisided Platforms

1.2. Two-Sided Markets Literature

1.2.1. Definition and Main Examples

The terminology of “platforms” has been developed by management scholars in three overlapping waves of research, respectively focused on products, technological systems and transactions (Baldwin and Woodard, 2009) While in the first one “platform product” corresponds “easy modification” Volkswagen’s production line can be example for this, while meeting the needs of a core customer group allowing the company to make changes on it: similar but different models. In the second way, technology strategists identified platforms as control points in the industry. Microsoft’s approach compare to Netscape can be an example.

Third wave is related to industrial economics and my research. Platform terminology is used to explain mediator companies that brings two (or more) different customer groups together. (Baldwin and Woodard, 2009)

As mentioned above, there is no certain and single definition for two sided markets. Considering the literature, Van Raalte and Webers (1998) define them as a middleman. One type of agent is using this middleman to reach another type of agent. Successful matching rewards the agent with the commission fee while the agent still has to bear the transaction cost. On the other hand, different sides don’t have same willingness to pay for this agent. This brings us to innovative pricing methods to attract the sides.

Rochet and Tirole (2003) start to their paper with mentioning the fact that many if not all of the markets with network externalities are two-sided markets. Companies devote too much attention to their business models to court two sides and eventually to make money through this matching. They give the example of video game consoles and bank cards in the introduction. Game developers choose the consoles with many gamers on the other side and same applies to other way around. Nobody wants to buy a console with there are few games on it. Bank card

users and merchants have the similar relationship. Existence and numbers of other customer group play an important role in decision.

Caillaud and Jullien (2003) in their research for investigating chicken-egg problem for the competition among intermediation service providers, talk about the difference between traditional brick-and-mortar economy and “new economy”. While in the former one intermediary often buy and resell goods; in the latter with the innovations in the information and communication technology, informational intermediation came to forefront of the new economy.

“This is the case, for instance, for individuals visiting a matchmaking (e.g., dating) service, for sellers of goods and services participating in a marketplace, as well as for buyers, because a large number of sellers gives them access to more diversity. Indirect network externalities give rise to a “chicken & egg” problem: to attract buyers, an intermediary should have a large base of registered sellers, but these will be willing to register only if they expect many buyers to show up.”

According to Rochet and Tirole (2004) two sided markets (or more generally multi-sided markets) are the markets in which one of several platforms enable interactions between different user groups, end users. Charging right prices to each side is crucial for bringing two of them on board. Platform desires to make some money out of this interaction or at least not lose money.

In their research (2004) they criticize the common definition about them which is “bringing two sides on board”. Even though this is a useful characterization, not restrictive enough. With this wide definition any market could be called two sided since the buyers and sellers need to come together for the gains from the trade to be realized. In the same paper they relate the theory of two-sided market to the theory of network externalities and of (market or regulated) multi-product pricing.

Armstrong (2006) in his research investigates competition in two sided markets. According to him two-sided markets (it can be multi-sided as well) bring two or more agents together for creating surplus through indirect network externalities. He uses the examples of heterosexual dating agency or nightclub by showing the

fact that attracting one side of customers depends on the number of the other side customers. He also mentions about shopping malls and television channels as two-sided market examples. In case of shopping malls customer is more likely to visit a mall with a greater range on retailers while a retailer is willing to pay more to locate in a mall with a greater number of consumers passing through. For television channels viewers typically prefer to watch a channel with fewer commercials while an advertiser is prepared to pay more to place a commercial on a channel with more viewers.

Eisenmann, Parker and Van Alstyne (2006) investigate the strategies for two-sided markets. According to them product and services that bring different customer groups in two-sided networks are platforms and they differ from traditional value chain in a fundamental way. While in the traditional value chains value moves from left to right, in two-sided networks costs and revenues are both to the left and to the right as they have two distinctive customer groups on both sides. In their research, they mention three important challenges effecting the strategy of the two-sided markets are pricing structure, winner takes all dynamics and the threat of envelopment. Here are some examples of two-sided markets showing the sides and platform providers:

Table 1 Two-Sided Markets with Examples (Source: Eisenmann et al. 2006)

NETWORKED MARKET	SIDE 1	SIDE 2	PLATFORM PROVIDERS
			Rival Providers of Proprietary Platforms
PC operating systems	Consumers	Application developers*	Windows, Macintosh
Online recruitment	Job seekers*	Employers	Monster, CareerBuilder
Miami Yellow Pages	Consumers*	Advertisers	BellSouth, Verizon
Web search	Searchers*	Advertisers	Google, Yahoo
HMOs	Patients*	Doctors	Kaiser, WellPoint
Video games	Players*	Developers	PlayStation, Xbox
Minneapolis shopping malls	Shoppers*	Retailers	Mall of America, Southdale Center
			Rival Providers of Shared Platforms
Linux application servers	Enterprises	Application developers	IBM, Hewlett-Packard, Dell
Wi-Fi equipment	Laptop users	Access points	Linksys, Cisco, Dell
DVD	Consumers	Studios	Sony, Toshiba, Samsung
Phoenix Realtors Association	Home buyers*	Home sellers	100+ real estate brokerage firms
Gasoline-powered engines	Auto owners	Fueling stations	GM, Toyota, Exxon, Shell
Universal Product Code	Product suppliers	Retailers	NCR, Symbol Technologies

*Denotes network's subsidy side

Hagiu (2007) talks about the difference of traditional intermediaries (merchants) and modern intermediaries that emerged with the innovations in information technologies (two-sided markets). While in merchants, they take the possession of seller's goods, take full control over their sale to customers. By contrast on platforms (or two-sided markets) control is entirely on the sellers and buyer and seller affiliation happens on a common marketplace.

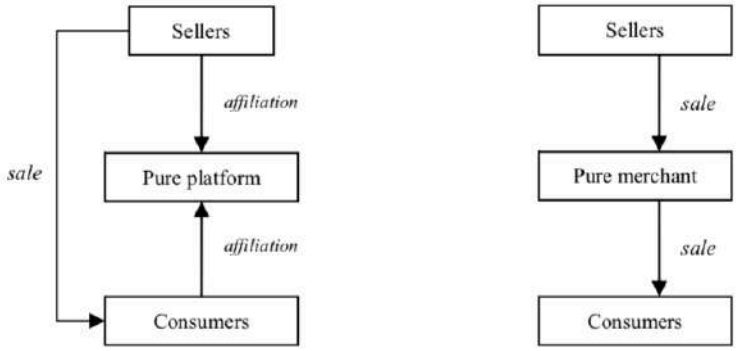

Figure 2 Difference of Two-Sided Markets and Traditional Intermediaries (Source: Hagiu, 2007)

Evans and Schmalensee (2008) mention two-sided markets' essential role as their act as intermediaries between two different customer groups and creation of efficiencies by lowering transactions costs and reducing duplication costs. They can be both traditional businesses and new economy businesses such as internet-based ones. In some cases, by eliminating potential frictions, platforms create opportunities for the emergence of new types of economic agents – app developers for smartphones, for instance. (Evans and Schmalensee, 2016)

Rysman (2009) approaches to this topic in the aspects of economics and defines two sided markets as:

"Broadly speaking, a two-sided market is one in which

1) two sets of agents interact through an intermediary or platform, and,

2) the decisions of each set of agents affects the outcomes of the other set of agents, typically through an externality."

He also talks about the externality that can involve usage or membership. For example, for the merchant it is not important that how many people have particular bank card. Number of the people using this card is important in their decision to accept it or not. For customer it is opposite, they don't care about the amount of transactions happening on the network but number of the member of the merchants on the same card network.

In the following research of Boudreau and Hagiu (2009) MSPs are described by interactions and interdependence between their multiple sides. According to them prior works of two-sided markets are done to answer the question of how to bring two sides on board and make maximum profit out of this interaction.

1.2.2. Network Externalities

Katz and Shapiro (1985) in their research about network externalities, define it as the change in utility of the good with the number of other agents using the same good. They mention three scenarios of positive consumption externalities.

1. Direct physical effect of the number of the purchasers such as utility that customer get from a telephone clearly depends on the number of other household or businesses that have joined the network.

2. Indirect effects such as in the purchase of a personal computer. Decision maker will be considered about the number of other agents who is buying the same hardware, as number of the software produced for this particular hardware system will depend on the number of hardware sold.

3. Effect related to availability of post-purchase service and size of the service network. Such as in the automobile industry, new or less popular brands' sales were really slow due to customers were aware of poor service networks.

Church and Gandal (1992) mention externalities related to supporting or complementary goods. Greater variety in compatible complementary goods, greater the value of the services derived by the capital good. They give the example of hardware and software systems, televisions, video cassette recorders, video games etc.

Bonardi and Durand (2003) in their research about network effects in high tech markets write:

"Many high-tech markets are characterized by network effects: situations where consumers make their decisions not simply based on the core product, but also on the quality and availability of its complements. These network effects enable the creation of a technological standard, which can lead to a strong competitive position for the core-product manufacturer."

As they mention the value that consumer drives from having a product changes by whether other consumers are using the same product. When it is a product that works with complements, consumer value is affected by availability, amount, and quality of complementary products and services. If nobody uses one particular good, we can expect that there will be no (or few) options for complements. (Bonardi and Durand, 2003). According to them evaluation of a product/technology in terms of network effects must be based on the matrix related to two aspects of them: “complements transferability” and “dependency of the core product on complements”.

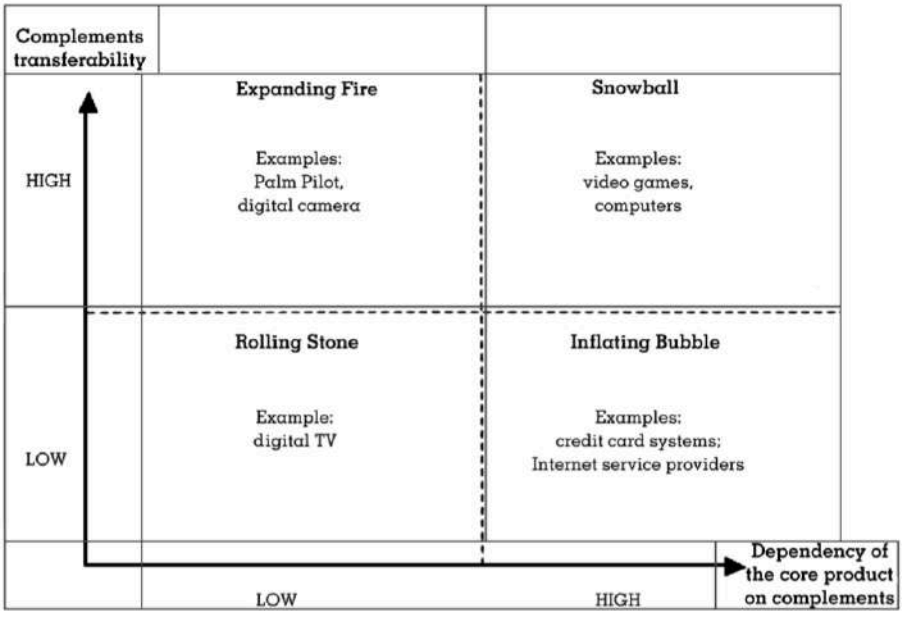

Figure 3 Evaluating the Potential of a Technology in Terms of Network Effects: The Network Effects Matrix (Source: Bonardi and Durand, 2003)

After positioning, companies can decide which direction to go to gain maximum return from their products and technologies. (Bonardi and Durand, 2003)

Caillaud and Jullien (2003) emphasize network effects as:

“…In these activities, users have larger expected gains, the larger the number of users on the other side of the market, a property referred to as indirect network externalities. This is the case, for instance, for individuals visiting a matchmaking (e.g., dating) service, for sellers of goods and services participating in a marketplace,

as well as for buyers, because a large number of sellers gives them access to more diversity"

Rochet and Tirole (2003) give examples of many different two-sided markets such as advertising, credit cards, software systems etc. and show network effects in these markets. One of the most important point that they mention is, in two sided markets externalities are not internalized by end users; unlike in the multiproduct literature. Famous example is the case with razor blades, that the buyer of a razor internalizes in his purchase decision the net surplus that he will derive from buying razor blades. For the theory of two-sided markets, it is opposite, end user does not internalize the welfare impact of his use of the platform on other end users.

Beside that Rochet and Tirole (2003) distinguish the membership and usage externalities:

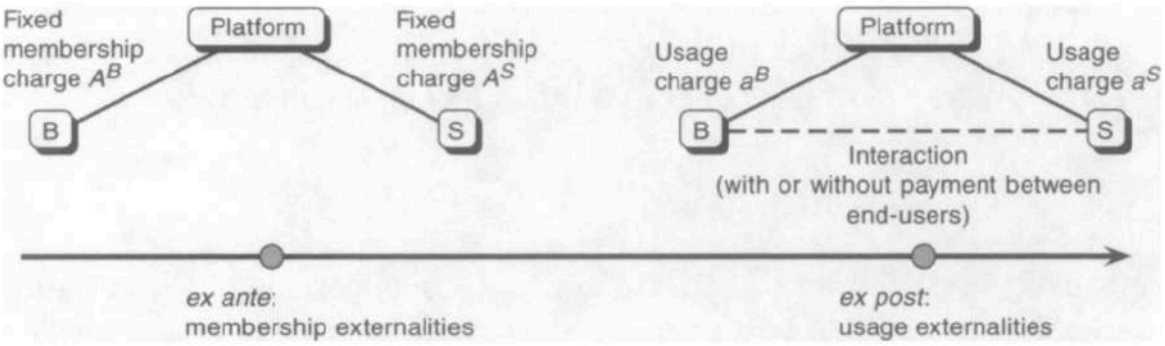

Figure 4 Membership and Usage Externalities (Source: Rochet and Tirole, 2003)

While in some markets, interaction means purchase itself such as in the purchase of a game; in some others it is related to usage such as in credit cards.

Rysman (2004), in his empirical research about yellow pages as a two-sided market, makes definition of network effects:

"Publishers of Yellow Pages directories face a "two-sided market": consumers value directories for information and retailers value directories as a way to advertise to consumers. More advertising leads to more consumer usage which in turn leads to more advertising, so consumer behavior and advertiser behavior together create a

positive network effect. In fact telephone company directories tend to have much higher prices, larger books and more usage than independent producers, suggesting that network effects are important in determining market structure. Because data is available on consumer usage as well as on prices and quantities of advertising, data is available on "both sides" of the feedback loop. This feature allows for the explicit estimation of a feedback loop in a way that has not been done before."

Parker and Van Alstyne (2005) call network effects as "demand interdependence" and offer a novel mechanism that explains firms' unbundled component sales and pricing strategies while mentioning its difference from traditional multimarket price discrimination.

Armstrong (2006) mention about externalities as they can be positive and negative. One group's benefit is related to other group's existence and it is called cross-group externalities. Relative size of the externalities are effecting pricing method of the companies.

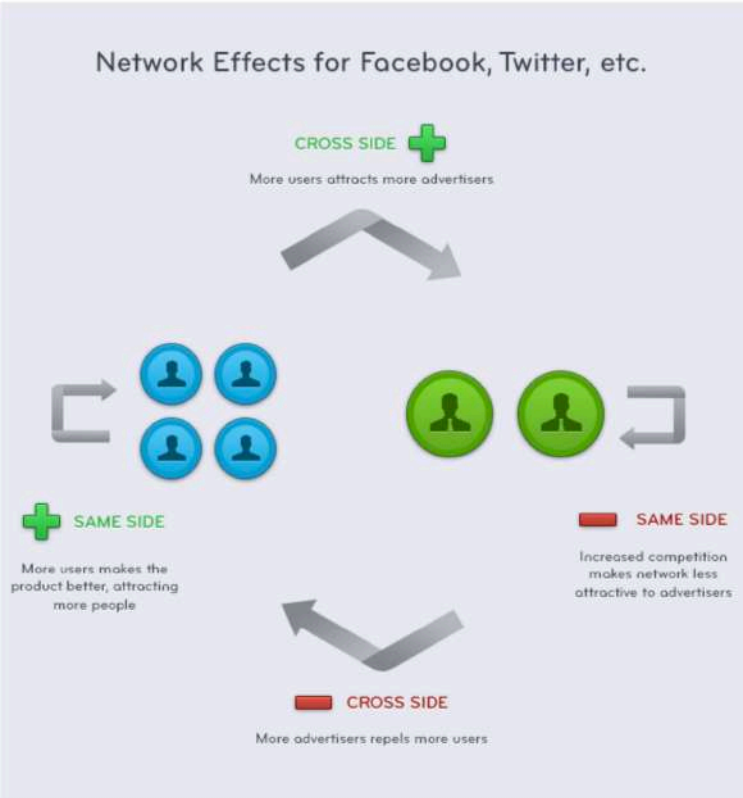

Figure 5 Direct and Indirect Network Effects Example for Facebook and Twitter (Source: https://blog.intercom.com)

McIntyre and Subramaniam (2009) investigate the network effects and related strategies in network industries in a competitive context:

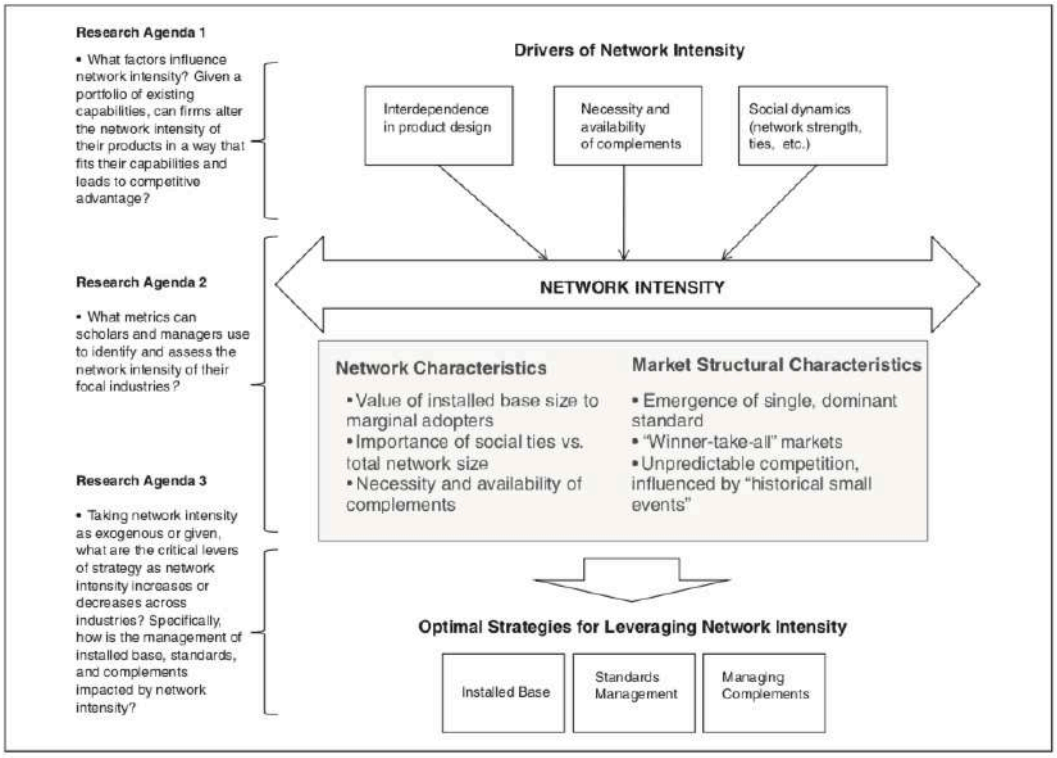

Figure 6 A Research Agenda for Strategy in Network Industries (Source: McIntyre and Subramaniam, 2009)

Evans and Schmalensee (2010) emphasize network effects as an impacting factor of critical mass challenge. They use direct and indirect network effects cases, in which examples respectively are social networking sites and payment card systems. In their book about two sided markets (2016) indirect network externalities are mentioned as one group's appreciation of interaction with the other group. In the book they introduced third type of externalities beside "membership" and "usage" categories: behavioral externality which means excluding abusing users to protect platform's value for other users.

Furthermore, McIntyre and Srinivasan (2017) investigate current perspectives and propose a future research related to networks. In their research they mention about few limitations coming from existing researches such as manipulation of network effects by some specific firms (McIntyre and Subramaniam, 2009); taking network effects just as if they exist or not and ignore their strength etc. (Afuah, 2013;

McIntyre and Subramaniam, 2009; Suarez, 2005). Focusing only on the numbers of complementary products is also a limitation to reach true results. (Srinivasan and Venkatraman, 2010)

1.2.3. Types and Features of Two-Sided Markets

Stabell and Fjeldstad (1998) categorize firms according to their value creation way such as value chain, value shop and value network. While in value chain, value is created by transforming inputs to outputs, in value shop it relies on intensive technology to solve customers' or clients' problem. Two sided markets fit into third category "value networks" with their mediating technology.

Ardolino et al. (2016) analyze two-sided markets' literature and show possible categorizations made by other researchers as following: According to Schiff (2003) classify them as matching services and platform services. Eisenmann (2008) sorts them according to number of platform providers which means mediator of users' interactions and platform sponsors who determine who may participate in the network.

Evans and Schmalensee (2008) cluster them in four types, depending on the relationship and function type. "Exchange" is the first type that creates transaction of the goods between two sides. Second type is "advertiser-supported media" and this brings advertisers and audience together. Third type is "transaction systems" that brings merchants and customers together and the last one is "hardware/software platform" that targets bringing software developers and installed base users.

Hagiu and Spulber (2013) distinct MSPs according to whether if they supply first-party contents beside contents provided by one of the sides. Hagiu and Wright (2015a) consider positioning of the organizations respect to three traditional alternatives: vertically integrated firms, resellers or input suppliers.

Filistrucchi et al. (2013) mention about "transactional" and "non-transactional" two-sided markets. Non-transactional two-sided markets, such as most media markets, characterized by having no transaction between two sides. Even if there is an interaction, it is usually not observable so per-transaction fee or per interaction fee or two-part tariff is not possible. While in transactional two-sided markets, such as in bank cards, transactions between two groups are present and observable. So, platform can charge usage fee, beside joining fee, which is called two-part tariff.

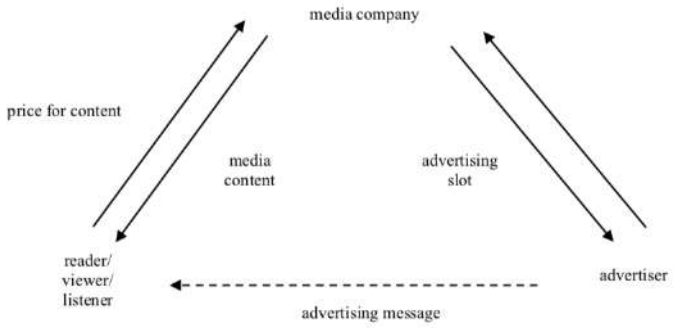

Figure 7 An Example of a Non-Transactional Two-Sided Market (Source: Filistrucchi et al. 2013)

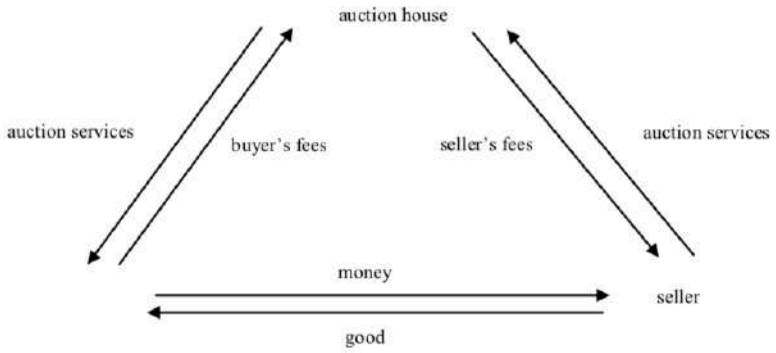

Figure 8 An Example of a Transactional Two-Sided Market (Source: Filistrucchi et al. 2013)

Trabucchi et al. (2017) define non-transactional two-sided markets as the intermediary platform offers its core product or service to one group of customers (one side) and sells "access to them" to another group (other side) Such as in newspaper advertising model.

Beside these approaches Campbell-Kelly et al. (2015) investigate two-sided markets in the specific context of mobile operating systems and classify them according to openness of the source code and vertical integration with handset makers. Ballon and Van Heesvelde (2011) categorize them related to existence of control over customers and assets.

Table 2 Typology of Platform Models (Source: Ballon and Van Heesvelde, 2011)

	No control over customers	**Control over customers**
No control over assets	Neutral Platform The platform owner is strongly reliant on the assets of other actors to create the value proposition, and does not control the customer relationship Examples: Google search, PayPal	Broker Platform The platform owner is strongly reliant on the assets of other actors to create the value proposition, but does control the customer relationship Examples: Facebook, eBay
Control over assets	Enabler Platform The platform owner controls many of the necessary assets to ensure the value proposition, but does not control the customer relationship Examples: Intel, IMS	Integrator Platform The platform owner controls many of the assets to ensure the value proposition, and establishes a relationship with end-users. Entry of 'third-party' service providers is actively encouraged Examples: Apple iPhone, Microsoft OS

In addition to approaches that is mentioned above, Ardolino et al. (2016) offered a new categorization based on Evans and Schmalensee's (2008) typology:

"Based on these arguments, we propose a typology grounded on the one introduced by Evans and Schmalensee (2008) and aimed at describing the interaction occurring between the sides of the platform.

- *Matchmaking Platform: enables the matching of request by (generally) two sides. Even when the matching leads to a transaction, it will be carried out outside the platform;*
- *Exchange Platform: facilitates a transaction of a product or a service between the sides;*
- *Maker Platform: facilitates the interaction between the sides (as the Exchange platform) and it provides the tools to make the contents of the platform (development side) and to use these contents (consumer side)"*

1.2.4. Platform Competition

Rochet and Tirole (2003) investigate platform competition in two-sided markets and reveals the determinants of price allocation and end-user surplus for different governance structures. According to them choice of business model seems to be key to platform success. Marquee buyers, installed bases/captive buyers, multihoming are the three important determinants of business model. Multihoming subject will be deeply analyzed separately at the end of the literature review.

Caillaud and Jullien (2003) mention about competition among intermediaries in their research. They analyze in detail the pricing and business strategies followed by intermediation service providers. Platforms can use sophisticated pricing methods such as registration fees and possibly transaction fees. According to them dominant firms better off charging transactions rather than registrations when deterring entry. Multihoming attitude is another factor that can create more intense competition.

Armstrong (2006) defines three different models of two-sided markets as following: a monopoly platform; a model of competing platforms where agents join a single platform; and “competitive bottlenecks” case where one group joins all platforms. He calculates equilibrium prices for these cases, and they are determined by: *“*

- *magnitude of cross group externalities*
- *whether fees are levied on a lump-sum or per-transaction basis*
- *whether agents join one platform or several platforms*”

Eisenmann et al. (2006) emphasize pricing, winner-take-all dynamics (related to multihoming) and threat of envelopment as determinants of platform strategy that will be analyzed in following chapters.

1.2.5. Pricing

As mentioned above pricing is one of the main tools and determinants of competitive advantage. Clement and Ohashi (2005); Evans, Hagiu and Schmalensee (2006); Parker and Van Alstyne (2005); Rochet and Tirole (2003, 2006) etc. are some of the researches that focus on pricing.

In competitive industries prices mostly determined by producing an extra unit and very little margins. If industry has high entry barriers then customers' willingness to pay play a crucial role on pricing decision, and it allows higher margins. (Eisenmann et al, 2006)

Eisenmann et al. (2006) investigate "pricing" for two sided markets. It is more complicated compare to traditional businesses as platform providers have to choose price for each side. In this process, they must consider the impact on the other side's growth and also willingness to pay. Usually, two-sided markets have "money side" and "subsidy side". Volume of subsidy side highly valued by money side due to strong indirect network effects. Because of that platform provider sets (for subsidy side) lower prices than they would normally charge if it would be an independent market. There are also direct network effects which make pricing more complicated. It can affect positively (snowballing pattern) or negatively according to specific case.

Beside mentioning this categorization, it is not always easy to see which side to subsidy and how much to charge. According to Eisenmann et al. (2006) for right pricing method, platform providers must look at some factors closely. They are "ability to capture cross-side network effects", "user sensitivity to price", "user sensitivity to quality", "output costs", "same side network effects" and "users' brand value". For example, platform's subsidy side can transact with rival's money side and in that case giveaway (subsidy) will be wasted.

Parker and Van Alstyne (2000) gives many examples of free information/product firms such as Microsoft, Adobe reader etc. Free strategic complements can increase the revenues coming from other goods of the same firm while the firm has to bear development costs of complements. Beside that free strategic substitutes can lower rival's profit and induce their exit from market, so

competition atmosphere becomes better for incumbent. Parker and Van Alstyne (2005) create an economic model to understand why firms waste their resources for a product that will be given for free. As a conclusion they suggest that firms can invest in giveaway products even in the absence of competition as they will cover the cost.

Kaiser and Wright (2006), in their empirical study, investigate German magazines as two sided markets. According to results readers are the subsidy side and advertisers are money side. Advertisers value readers more than readers value advertisers and results are parallel with this: Higher demand on readers' side increase ad rates but higher demand on advertisers' side decreases cover prices.

Evans and Schmalensee (2008) mention the difference of pricing approaches of single-sided businesses and multi-sided platforms. For a single-sided business, task is to select the output at which marginal revenue equals marginal cost and charging the corresponding price for this quantity from the demand curve. According to Evans and Schmalensee (2008) three results appear to be robust: *"*

1. *the optimal prices depend in a complex way on the price sensitivity of demand on both sides, the nature and intensity of the indirect network effects between the two sides, and the marginal costs that result from changing output of each side;*
2. *the profit-maximizing, nonpredatory price for either side may be below the marginal cost of supply for that side or even negative; and*
3. *the relationship between price and cost is complex, and the simple formulas that have been derived for single-sided markets do not apply."*

Evans and Schmalensee (2008) point out the different pricing methods such as access fee and usage fee. Decision of using the right one depends on many factors including the difficulty of monitoring usage, and the nature of externality between two sides. Caillaud and Jullien (2003) also mention about sophisticated pricing methods (registration fees and transaction fees) and show that dominant firms are better off charging transactions rather than registrations when deterring entry.

Table 3 Examples of Two-Sided Pricing Structures (Source: Evans and Schmalensee, 2008)

Industry	*Side*	*Access*	*Usage*
Heterosexual Dating Clubs	Men	√	√
	Women	√	√
DoCoMo i-Mode	User	√	√
	Content-Provider	Ø	√
U.S. Real Estate Brokers	Seller	Ø	√
	Buyer	Ø	Ø
Magazines	Reader	√ (≤MC)	Ø
	Advertiser	Ø	√
Shopping Malls	Shopper	—	Ø
	Store	√	Ø
PC Operating Systems	User	√	Ø
	Developer	√ (<MC)	Ø
Video Game Consoles	Player	√ (≤MC)	Ø
	Game Developer	√ (<MC)	√
Payment Card Systems	Merchant	Ø	√
	Cardholder	√ (<MC)	Ø

Note: √ and Ø indicate that the entity either pays or does not pay, respectively, for either access or usage of the two-sided platform. Items in parentheses indicate where marginal cost or below marginal cost pricing is prevalent for a particular side of a two-sided platform.

Pricing is a very relevant issue for multihoming, and it will be investigated in detail in the last chapter of the literature.

1.2.6. Multisided Platform Ecosystem

Van Alstyne et al. (2016) in their research, compare platform ecosystems with traditional pipeline businesses. According to this research all platform ecosystems have four common players and similar structure.

"The owners of platforms control their intellectual property and governance. Providers serve as the platforms' interface with users. Producers create their offerings, and consumers use those offerings."

Following illustration is very useful to understand them easily. It is also important to note that these positions can change in time.

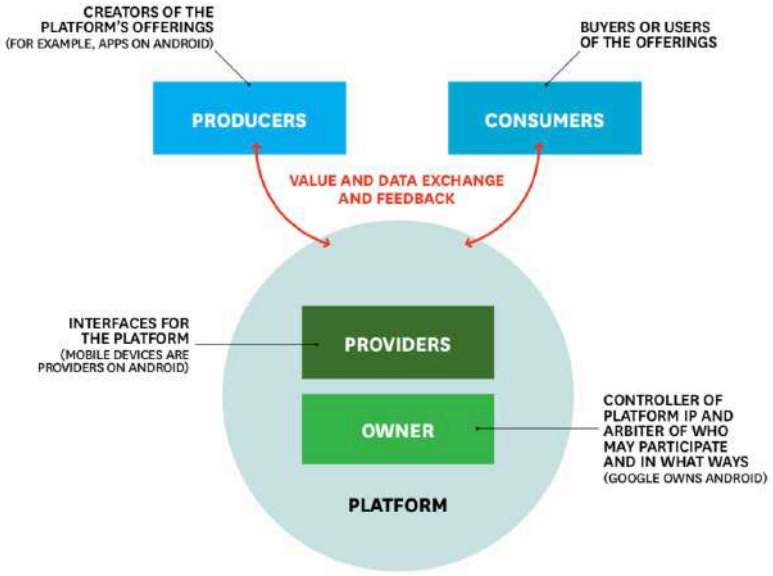

Figure 9 Platforms and Its Players (Source: Van Alstyne et al. 2016)

Platforms are not something new, as mentioned before, malls, newspapers etc. are also platforms. Recent innovations in information technologies reduced the need of physical asset and infrastructure so some startups became billion dollars value companies in few years. IT of today make creation and scaling so easy and with the help of network effects firms can show significant growth rate.

Pipeline businesses are traditional competitive industries and value is created through series of activities, classic value chain model: inputs are on the left and outputs are on the right. While Apple's handset business fall into this category, Apple's App Store is a platform. So, firms don't have to choose only one of these options, they can have both at the same time. As network effects give substantial advantage to platform companies, when a platform enters the market of pipeline business, platform always win. Because of that traditional companies such as Nike, GE, Walmart are looking for ways to integrate platforms into their model.

Three main shifts mentioned in the same research (Van Alstyne et al, 2016) are: *"*

1. From resource control to resource orchestration.

2. From internal optimization to external interaction.

3. From a focus on customer value to a focus on ecosystem value."

In the traditional resource-based view of competition, scarce and valuable (possibly inimitable) assets are the source of competitive advantage. These can be natural resources, real estates or intellectual property. For platforms as assets are usually owned by members, chief assets are networks of producers and consumers.

Again, in pipeline businesses main task is organizing internal activities to optimize value creation while ecosystems create value through facilitating interaction between its members. So, focus shifts from dictating processes to persuading participants and platform governance.

While pipelines try to maximize lifetime value of customer of their product, platforms focus on maximizing total value of ecosystem in a circular, iterative and feedback driven process.

Eisenmann et al. (2006) mention about traditional value chain companies and platform companies too. While in traditional value chains value moves from left to right (to the left is company's cost, to the right is company's revenue), in platforms

cost and revenue are both to the right or to do left. As mentioned in the research, one side can be subsidized so cost doesn't have to be same for different sides.

Van Alstyne et al. (2016) mention that these three shifts in the industry makes competition more complicated than before. Five competitive forces defined by Porter (the threat of new entrants and substitutes, the bargaining power of customer and suppliers, the intensity of competitive rivalry) behave differently.

In the industrial economy, supply side economies of scale play the main role in the competitive advantage of the firm and build a fence around the firm. Controlling resources, increasing efficiency are main tools to do that. This is suggesting that considering massive fixed costs and low marginal costs of industry, firms with higher sales volume have lower average cost. So, they can decrease the price and increase the sales volume and finally repeating loop of this process strengthen their competitive advantage. (Van Alstyne et al, 2016)

In platform economy or internet economy, demand side economies of scale or "network effects" plays the main role in competitive advantage. Firms that persuade more participants offer higher average value per transaction because of the larger network and data that allow better matches. More value attracts more participants and this loop continues until it creates monopolies such as Alibaba, Google and Facebook. So, focus of the businesses is not sales, profits or revenues; as opposite to pipeline businesses. Focus is "interaction". (Van Alstyne et al, 2016)

According to Van Alstyne et al. (2016) Porter's five forces model doesn't factor in network effects and the value they create. While in the model external forces are extracting value from a company, in demand-side economies external forces can be value adding. Therefore, power of suppliers and customers may be viewed as an asset for platforms, instead of a threat.

Considering the platform strategy Van Alstyne et al. (2016) suggest that main challenge for platforms is understanding the forces and whether if they are accretive or depletive. Monitoring participants' activities and encouraging accretive ones are important. Beside this, forces that ecosystems bring into play is another important aspect. Pipeline businesses can find many firms unrelated to their business and

ignore the possibility to compete with them in the future. Examples show us platforms “actually” can abruptly transform an incumbent’s set of competitors. In the paper they give the example competition of Swatch and Apple’s watch; Siemens and Google’s Nest.

Van Alstyne et al. (2016) mention that there are three different patterns that the competition threat can come from a platform company. The first one is the pattern of “established platform with superior network effects”, such as Google and its huge customer base allow them to enter home-automation market and eventually become a competitor of Siemens. The second pattern is targeting overlapping customer base like in the examples of Uber and Airbnb. Finally, the last pattern is data collection, having same data type can allow platform to become a competitor of an established firm.

Van Alstyne et al. (2016) suggest pipeline businesses to adapt themselves according to changes that platforms brought into the business environment. Otherwise they can disappear in time.

1.2.7. Public Policy, Anti-Trust and Regulations

As mentioned, platforms have many distinct characteristics compare to traditional one-sided firms. Size and economic value of platforms draw attention of regulators. The differences require different approaches in considering anti-trust cases and regulations related to platforms.

Baker and Bresnahan (2006) in their research mention antitrust law, policy and practice as the product of a long a fruitful interdisciplinary collaboration between law and economics. It is mechanism that prohibits variety of practices to promote fair competition in business.

There were some law cases related to antitrust issues, and market giants had to pay billions of dollars. Rochet and Tirole (2005) for "Advances in the Economics of Competition Law Conference" mention four important points to consider while analyzing anti-trust issues for two-sided markets: *"*

- *High price-cost margin on one side does not imply market power (even with low fixed costs)*

- *Conversely price below cost on one side does not imply predatory behavior.*

- *Merger on one side increases competition on other side.*

- *Tying has rebalancing benefits."*

Evans (2003) investigates antitrust economics of platform companies in his research and mention four main differences from the economics of single-sided markets:

1. Individual prices charged on each side doesn't track costs or demand on that side. Benefits and cost exist together in multiple sides so there is no meaningful relationship between them, considering each side alone.
2. One shouldn't consider the prices on each side separately. Any change in demand or cost on one side eventually affect the level and relationship of prices on all sides.

3. Multi-sided markets have to bring all sides on board, otherwise product may not be able to exist. This brings novel pricing and investment strategies for platform companies; it may not apply to other companies.
4. Social welfare analysis account for the pricing level, the pricing structure and feasible alternatives for getting all sides involved

In his research, Evans (2003) highlights the importance of considering these differences to avoid error of condemning procompetitive behavior. Still the complexity makes it difficult for courts to distinguish procompetitive and anticompetitive actions.

According to Rysman (2009) determining the relevant market is a crucial ingredient in constructing most anti-trust cases and anti-trust authorities typically use cross-price elasticity to determine what products should be included in a relevant market.

Parker and Van Alstyne (2014) mention the need of regulations for platforms since “they facilitate exchange” even though they have different characteristics from single-sided firms. So, regulations can help to prevent market failures due to information asymmetry, uninsured risks, congestion, network effects etc.

1.2.8. Governance

Van Alstyne et al. (2016) emphasize access and governance topics related to pipeline companies and platforms. While in pipeline world, strategy is about building barriers; for platforms, the focus of strategy is eliminating barriers to production and consumption in order to maximize value creation. Of course, guarding against threats is still important. Platform owners/managers have to be careful about decisions related to access and governance.

- Decisions about access: Whom to let onto platform
- Decisions about governance: What participants and even competitors allowed to do there

Van Alstyne et al. (2016) define platforms as consist of rules and architecture. Their openness level is a critical issue for owners to decide. Open architecture allows players to access platform resources and open governance allows players to shape the rules of trade and reward sharing on the platform. Regardless of these decisions, fair reward system is key. These decisions balance the incentives and abilities.

In the same research, Van Alstyne et al. (2016), show that these decisions can change in time. Platforms can start with closed architecture and open up in time as they define new types of interaction and sources of value. Platform governance includes of creating atmosphere that producers and consumers interact and share their ideas and resources. As in the example of Zynga, they wouldn't bring Farmville onto Facebook unless they would trust to Facebook.

Allowing permissionless innovations from producers and supporting it by guaranteeing sharing the value created is a one kind of governance to consider. Incentives and trust to platform encourage producers to create high value offerings. Google's recent success with its Android platform can be an example as it has very open structure at the provider level. (Van Alstyne et al, 2016)

On the other hand, free and random access can reduce the value of platform, because of misbehavior or excess or low-quality content that inhibits interaction. Platforms try to prevent this by filtering users (Chatroulette), establishing rating system (Airbnb and Uber), insuring some participants (Airbnb and Uber), filtering

products according to their quality (Apple's App Store and Google's Play Store) or providing tools to prevent stalking (Twitter and Facebook) etc. (Van Alstyne et al, 2016)

Hein et al. (2016) analyze the governance mechanisms of multi-sided platforms according to the literature; and investigate multiple cases of multi-sided platforms according to findings from their analysis. Results from the literature are aggregated and classified as following:

Table 4 Governance Mechanisms of Multi-Sided Platforms (Source: Hein et al. 2016)

Dimensions	Mechanisms	Description	Source
Governance structure	• Governance structure • Decision rights • Ownership status	Centralized or diffused governance. Platform governance then entails how the authority and responsibility for each class of decisions is divided between the platform owner and module developers. Ownership declares whether a platform itself is proprietary to a single firm or is shared by multiple owners.	(Nambisan 2013; Tiwana et al. 2010)
Resources & documentation	• Platform transparency • Platform boundary resources	Documentation ensures easy understanding and usability of the platform. Transparency of the platform. Governance decisions concerning the platform's marketplace are easy to follow and understand. Application programming interfaces (APIs) for cultivating platform ecosystems through third-party development.	(Benlian et al. 2015; Ghazawneh and Henfridsson 2013)
Accessibility & control	• Output control & monitoring	The platform governance pre-specifies the principles by which outputs are evaluated, penalized, or rewarded.	(Tiwana et al. 2010)
	• Input control • Securing	Controlling which products or services are allowed. Assess quality of services or products as a gatekeeping mechanism.	(Tiwana et al. 2010; Ghazawneh and Henfridsson 2013)
	• Platform accessibility • Process control • Platform openness	Who has access to the platform and are there any restrictions on participation? Who controls the process and is in charge for setting up regulations? Is the platform open or closed? Constraints: Technical performance cost of required equipment, and cost of selling.	(Benlian et al. 2015; Eisenmann et al. 2006; Tiwana et al. 2010; Tilson et al. 2010; Boudreau 2010)
Trust & perceived risk	• Strengthen trust • Reduce perceived risk	Platform enhances trust. Perceived risk of platform participants is minimized.	(Nambisan 2013)
Pricing	• Pricing	Pricing is depended on who is setting the price, who decides on participation, who is paying and who values.	(Bakos and Katsamakas 2008; Tan et al. 2015; Caillaud and Jullien 2003; Armstrong 2006)
External Relationships	• External relationship management	Management of inter-firm dependencies. Architecture of participation. Firm's ability to manage the relationships between its IT function and external stakeholders. The platform allows technical interoperability between other systems.	(Benlian et al. 2015; Tan et al. 2015; Selander et al. 2013)

Six different dimensions of governance, related mechanisms for each of them, descriptions and sources from the literature are shown respectively. In the next step they analyze some platform companies from real life such as Alibaba, Facebook, Uber etc. In the conclusion part, Hein et al. (2016) mention the "changeability" of

governance decision along the timeline of the platform. For example, in the early stage low restrictions or low input control (decentralized governance) can help to grow faster but in the maturity phase centralized governance can be desired.

1.2.9. Metrics

Metrics to track are different for pipeline businesses and platforms. Van Alstyne et al. (2016) introduce new metrics to consider for platforms. For traditional pipeline businesses optimizing processes and opening bottlenecks are the goal; so, inventory turnover as a metric can help to company to measure its position and reach its goals. More goods pass through, more margins are created and as a result: successful rate of return.

According to Alstyne et al. (2016) for platforms monitoring and boosting the performance of core interaction is the focus and these metrics can help to do that:

- Interaction failure: If somebody comes onto platform and couldn't do any successful match, it will create a loop of leaving the platform from both sides as network effects theory suggests. For example, if a user goes on "UberEATS" but cannot find any restaurant in that moment, the idea of this platform will be "useless"

- Engagement: Users' participation level is an important metric for platforms, such as number of likes, number of watches, number of orders, number of posts etc. in the certain period. These number can help to track if platform is on the right direction.

- Match quality: If matches are poor, not satisfactory, then network effects will weaken. So, quality of match is also important.

- Negative network effects: Poor governance of a platform can discourage people to join that platform and it can create negative feedback loops and reduce value of the platform.

So, platforms must understand the change and value of their communities and their network effects. Facebook's or Uber's values are measured based on these new metrics.

1.3. Multihoming Literature

Multihoming is defined as the choice of an agent in a platform to use more than one platform. Respectively, singlehoming refers to the choice of an agent to use only one platform. They are logical opposites of each other (Landsman and Stremersch, 2011)

According to Landsman and Stremersch (2011) literature related to multi-homing can be distinguished as two different types. First type is that multihoming option exist for user group without the existence of exclusive contracts (Armstrong 2006; Caillaud and Jullien 2003; Choi 2007; Doganoglu and Wright 2006; Rochet and Tirole 2003, 2006) Second type is that if there is an offer of an exclusive contract from the platform owner, to encourage singlehoming for this agent, in an environment where multihoming option exist (Armstrong and Wright 2007; Balto 1999; Carrillo and Tan 2006; Doganoglu and Wright 2010; Mantena, Sankaranarayanan, and Viswanathan 2007; Shapiro 1999)

Exclusive contracts are useful only in the scenario where sellers would otherwise opt to multihome or singlehome on a competing platform. Still there is a debate on exclusive contracts whether if they bring superior or inferior welfare consequences. Armstrong and Wright (2007) propose that exclusive deals can be welfare enhancing for both sides (under certain circumstances); while in contrast, Doganoglu and Wright (2010) find that exclusive deals are inefficient when it is offered by incumbent firms to dominate market in the entry situations, and primary beneficiary of these deals is seller side.

Rochet and Tirole (2003) mention multihoming related to competition between platforms. In many markets, users can connect to several platforms at the same time such as in bank cards. Many merchants accept both Amex and Visa (or Master and Visa); on the other hand, many consumers have both cards in their pocket. Again, many consumers have Internet explorer and the Netscape browsers (nowadays different browsers maybe) at the same time and many websites are configured optimally for both browsers. Also markets of real estate agencies or newspapers etc.

can help us to understand the multihoming concept. Rochet and Tirole (2003) emphasize the role of multihoming in competitive pricing as following:

"Competitive prices on one market then depend on the extent of multihoming on the other side of the market. For example, when Visa reduces the (transaction-proportional) charge paid by the merchants, merchants become more tempted to turn down the more costly Amex card as long as a large fraction of Amex customers also owns a Visa card. More generally, multihoming on one side intensifies price competition on the other side as platforms use low prices in an attempt to "steer" end users on the latter side toward an exclusive relationship"

This can be interpreted simply as increase in multihoming on the buyer side facilitates steering on the seller side and results in better prices for sellers.

Caillaud and Jullien (2003), in their research, investigate an imperfect competition and mention about multihoming. They analyze for exclusive and nonexclusive services. Nonexclusive services are the services that users can have their request proceeded by from "several intermediaries" at the same time. This behavior is called "multihoming". The situation where both intermediaries are serving all users (with the help of nonexclusive technologies and low costs) is called "global multihoming"

According to Caillaud and Jullien (2003) informational platforms on the internet are usually nonexclusive so users from both sides register to several platforms to increase the chances of finding a match. There can be some cases with exclusivity too. For example, when platforms "want to ensure the transaction" or "need a specific effort to register users" (as platform may consider it proprietary). These two are both related to competition with other nonexclusive services.

On the other hand, platforms have incentives to propose non-exclusive services as they moderate the competition and allow them to exert market power. So, it is very important to understand the role of exclusivity to understand electronic platforms.

Doganoglu and Wright (2006) investigate multihoming and compatibility in their research. They mention the specific role of multihoming as a poor substitute of compatibility. When firms don't make their services compatible, consumers can multihome and realize the compatibility benefits. They suggest that multihoming weakens competition and introduces costs that firms do not internalize.

According to their research, in the presence of widespread multihoming, firms don't have serious consideration for compatibility. For instance, in the merger of AOL and Time Warner, consumers' multihoming was an argument to explain incompatibility between social networks. Findings reveal that possibility of multihoming increases the chance of compatibility problem; and firms are unlikely to choose to become compatible. Nevertheless, Doganoglu and Wright (2006) mention that multihoming is not always a good substitute for compatibility so firms shouldn't use "widespread multihoming" as a justification to ignore compatibility.

They find it surprising that existing literature related to compatibility and standards don't mention multihoming issue, except De Palma et al. (1999) who show that double purchases drastically affect the product market equilibrium as well as compatibility choices made by the firms.

Doganoglu and Wright (2006) concludes as that in the absence of multihoming firms will have strong incentives to choose compatibility. They will choose compatibility even though it is not socially desirable, but they will not choose incompatibility when it is inefficient. Social planners' preference can be opposite of firms.

In two-sided markets, at least one side appears to multihome. Under the two-sided market structure buyers enjoy greater network benefits when they use dominant platform so for them multihoming is not relevant issue. Still, there is a pricing disadvantage that can affect buyers in case of single dominant firm in the market.

Rochet and Tirole (2006) emphasize multihoming as it stems from users' desire to get network benefits in an environment of noninterconnected platforms. Such as in videogame developers' case, they may multihome to several disconnected platforms to realize higher network benefits. In the situation where both sides can multihome costlessly, the side that gets to choose the platform which transaction will occur on, can create some disadvantages for this side. So, to avoid letting this side use its privilege, the other side may single home on the platform it prefers.

According to this research, factors that cause more buyer multihoming may increase the competition for buyers. If buyers can easily multihome, platforms may try to steer sellers and have higher seller single homing index to induce buyers to leave competing platforms. While platform competition decreases the prices for both sides, relative changes of prices is ambiguous.

Eisenmann et al. (2006) investigates multihoming related to platform strategy, under the winner takes all dynamics. Platforms must understand whether they are going to share the platform with its rivals, or it is fight to death. If they understand it wrong, they may disappear from the market.

Existence of high multihoming cost for at least one side of users, existence of strong and positive network effects (at least for the user side that has high multihoming costs), and neither side's users' having a strong preference are the determinants of "winner takes all" structure. High multihoming cost can be for both sides, for example for the users of Windows OS, using a second operation system would be costly in terms of additional hardware, software and knowledge. For movie studios, inventory and distribution costs can be mentioned in case of multihoming to multiple incompatible standards(formats).

Armstrong (2006) while analyzing competition in two-sided markets defines three different scenarios related to singlehoming and multihoming. The first scenario is where both sides singlehome, the second is where one side multihomes but other side singlehomes, and the last one is both sides multihome. Considering the role of two-sided markets which is allowing the interaction with other side, third scenario is

less likely to happen as if one sides joins to all platforms then other side doesn't need to join all platforms to realize expected network benefits.

Second scenario is called competitive bottleneck, and platforms can exert monopoly power over multihoming side as their (multihoming side's) ultimate goal is to access singlehoming users on that specific platform. This monopoly power leads to higher prices for multihoming side and there will be too few agents on this side from a social point of view. On the other hand, competition will exist for singlehoming side and it will encourage lower prices on this side (or even zero prices). If singlehoming side appreciates having many agents on the other side, the high prices charged to multihoming side will disadvantage the platform when it tries to attract singlehomers; so, tendency towards higher prices will be tempered. (Armstrong, 2006)

Caillaud and Jullien (2003) investigates competitive bottleneck case under the "mixed equilibria". They find that singlehoming side is treated favorably as its price is necessarily no higher than its cost, while multihoming side has all its surplus extracted. Rochet and Tirole's (2003) use credit card market to investigate two-sided markets and they analyze competitive bottleneck case as a part of it.

Rysman (2009) mentions competitive bottleneck situation under the pricing. According to him many two-sided markets often evolve to that market situation, such as in payment cards, newspaper markets etc. For example, in the markets with multiple newspapers consumers read only one of them but advertisers appear in all of them. Rysman points out the importance of this issue as it effects pricing levels charged to each side. For multihoming side, using this specific platform is the only way to reach singlehoming side and this allows this platform to exert monopoly power on multihoming side. So, competition between platforms can have strong effects on the prices charged to singlehoming side and little or no effect on the multihoming side.

Sun and Tse (2009) use resource-based view to analyze competitive advantage in two-sided markets. As mentioned, cross group network effects of two-sided markets can make participants of the platform turn into critical resources. In the

research they distinguish singlehoming markets from multihoming markets as they have different characteristics.

Resource heterogeneity is a source of sustained competitive advantage for both singlehoming and multihoming contexts, although its impact on long-term system dynamics is quite different. In multihoming markets small networks may position themselves as market followers (or niche player) and survive. It is hard to sustain “follower” position in singlehoming markets as the market is more likely to evolve “winner takes all” structure. (Sun and Tse, 2009)

Choi (2010) investigates effects of tying in the platform competition under the situation where multihoming is allowed to both sides. He mentions that existing literature on tying (until him) doesn’t include the possibility of multihoming. He builds a model of platform competition that explicitly incorporates the possibility of multihoming for both sides. According to his conclusion, multihoming has potential to counteract the tendency towards tipping and lock-in effects. In the existence of multihoming possibility, tying is welfare enhancing; while in the absence of multihoming possibility, tying is welfare diminishing. These findings can be useful when considering multihoming in antitrust analysis.

Belleflamme and Peitz (2018) in their research analyze platform competition under the possibility of multihoming. According to them it is true that platforms can exert monopoly power over the multihoming side, participants of this side still can benefit from multihoming; and platforms can may do better under two-sided singlehoming structure than in the competitive bottleneck. As Evans and Schmalensee (2012) show, price structure in software platforms appears to be opposite of what competitive bottleneck theory would predict. In this example, computer users singlehome while most developers multihome and software providers make their platforms available for free or at low costs to the application providers (multihoming side) and earn profit from singlehoming user side.

Their findings suggest that when moving from singlehoming to multihoming on one side, prices on both sides always move in opposite direction. So, it is not mandatory that singlehoming side will get pricing benefits, it can be opposite too. It is mentioned that buyers, sellers and platforms all better off when sellers are allowed to

multihome. Secondly, whenever platform finds it beneficial to impose exclusivity, it may hurt or benefit the side that initially multihomes, but it will definitely hurt the singlehoming side (In their model they assume that seller side is the potential side that can multihome, while buyers always singlehome) As a result, if platform wants to maximize buyers' surplus, it should prohibit the use of exclusivity for seller side. Third and last finding is that whenever buyers suffer from seller multihoming, platform and sellers benefit from it.

Landsman and Stremersch (2011) in their empirical study, analyze the video game console market in the aspect of multihoming. According to them, the (negative) effect of platform-platform level multihoming on the platform sales is larger than the (positive) effect of the number of applications on platform sales. This negative effect is stronger for nascent platforms and platforms with a small market share, but it disappears as platform matures and gain market share. It is also mentioned that the larger the market share of a mature platform among buyers, the more applications for it will be multihomed. On the other hand, the larger the market share of the nascent platform, the fewer applications for it will be multihomed.

There are also some other empirical researches related to multihoming by Binken and Stremersch (2009); Corts and Lederman (2009); Rysman (2004) etc. and they can be reviewed for deeper understanding of this subject.

2. Empirical Analysis

2.1. Research Gap

Considering the importance of two-sided markets in our life and also their size and economic value, it is worth to understand the dynamics better. So called "multihoming" phenomenon, as mentioned in the literature, deserves special interest to understand them better. It is a relevant topic in pricing, competition, strategy, antitrust etc. Empirical studies such Landsman and Stremersch (2011); Hyrynsalmi et al. (2012); Liu et al. (2017) investigate different examples of the two-sided markets while analyzing multihoming attitude. Landsman and Stremersch (2011) focus on video game console industry, Hyrynsalmi et al. (2012) focus on App Store as a two-sided market, and Liu et al. (2017) focus on transportation market such as Uber, Lyft etc.

Some researches focus on the factors effecting multihoming decisions; while some others focus on the impact of multihoming on platform sales, competition or some other results. In the following section, results of the research on Milan's OFD (online food delivery) market as two-sided market (with its known players, Just Eat, UberEATS, Deliveroo and Glovo) are proposed. I selected this market due to many different reasons. First of all, it is possible to collect relevant information through the web. Secondly, market size is growing rapidly with the changes in the customers' habits (as on-demand economies are becoming more attractive for everyone, day by day). And, in the current situation there is no market winner yet and players are competing to gain higher shares in the market. So, we are able to observe intense competition. This competition is becoming more intense with the increasing amount of the money that investors are putting into them, so eventually these companies valuated with the number "billions". As other areas such as App Market, or Uber and Lyft market, video game consoles are already investigated by fellow researchers, it is exciting to dig into online food delivery market in Milan. I focused on the seller side multihoming attitude in this research, which is restaurants' side.

My goal is presenting the overall picture of the multihoming attitude of restaurants and answering following research question:

Do restaurants' characteristics of quality, popularity, pricing and being a single/chain restaurant have an impact(effect) on multihoming decision?

2.2. Research Methods

I chose a quantitative research method to study the phenomenon of multihoming in online food delivery market in Milano. First, I selected the area to analyze and collected the names of the restaurants in this area. This data is used to create the excel file and collect secondary (complementary) data to analyze multihoming attitudes of restaurants. Complementary data includes which online delivery platform are they on, and some other data from Google Maps, Zomato, Facebook pages, Tripadvisor and Foursquare platforms. These will be explained in the following sections.

After the collection of data according to the model that I established for testing my hypothesis, similar to Landsman and Stremersch (2011), I analyzed the results with statistical test to see if there is any significant influence of the restaurant's characteristics (quality, popularity, pricing level, being a single or chain restaurant) on the multihoming decision.

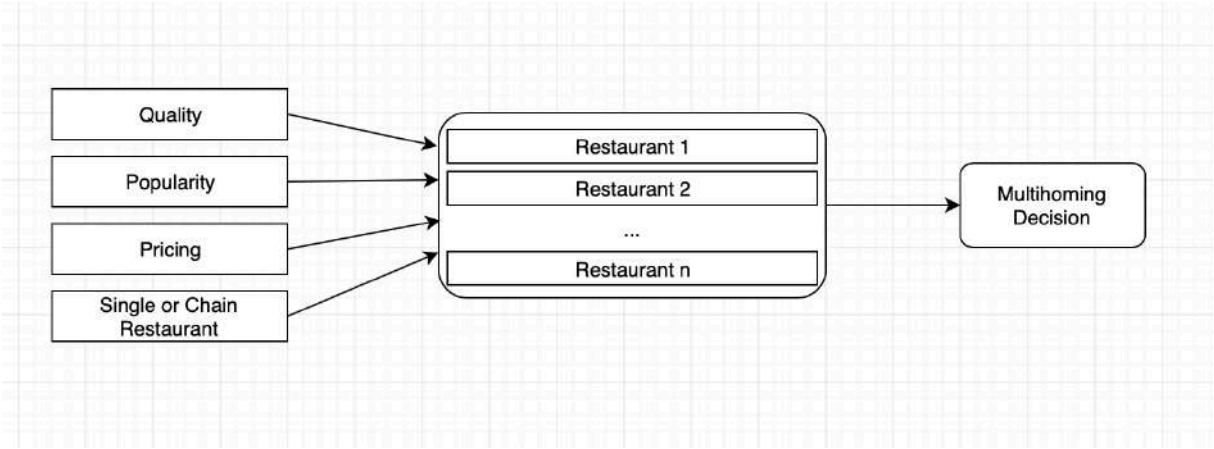

Figure 10 Research Model (Original Elaboration)

In the area selection, I considered the consistency of the sample. The coordinates I selected are "45.489374, 9.186276"; "45.462053, 9.235179" and rectangular area in between. As it includes the center of Milan, touristic and shopping districts, business and student areas, shows homogeneity. Variety of restaurants, from small kebab places to Michelin star restaurants, support the homogeneity of the sample.

Figure 11 Map of a Selected Area (Original Elaboration)

To collect primary data, Google Maps' API is used. As Google shows only few (limited to 60) restaurants for each search act, selected area divided into smaller pieces to solve this problem. Search is renewed for each defined point in between and repeating restaurants listed only once. Google Maps' API supplied the relevant data of:

-Name of the restaurant
-Address
-Pricing index (from 1 to 4)
-Rating of the place
-How many people voted (and commented)

As some of the restaurants didn't have pricing information, they are eliminated and eventually the sample become the size of 650 restaurants. In the next phases while collecting the information some of the are also eliminated manually due to not having a clear information or repeating or being closed. Final sample that I used to conduct my tests, consists of 622 restaurants.

In the following step, all the relevant information from Zomato, Facebook, TripAdvisor and Foursquare collected to use in the model as inputs. Restaurant's names being noted different on different platforms removed the chances of practical solutions such as using coding and matching them. So, process is done manually by visiting each website.

Another data that will be used in the model "single or chain" restaurant is gathered by visiting websites of the places or/and using google maps (street view function and comparison of logos needed in specific cases).

As it is study of multihoming on the seller side (restaurant side), data of being (or not being) on delivery platforms (Just Eat, UberEATS, Deliveroo, Glovo) collected manually through platforms' websites and Google's advanced search option. This data is a substantial part of the analysis. All these data are collected in the February/March of 2019 period.

After the collection of data, interpreting them was needed to be able to use in the statistical test. For example, for quality input each platform (Zomato, Facebook, Google, TripAdvisor) has rating system "out of 5", only foursquare has "out of 10". These ratings represent the satisfaction of the customer so it can give an idea about quality of the place. Higher the rating, higher the quality.

Pricing data represents how expensive is the place (1 is very cheap and 4 is very expensive) and gathered data for the being single or chain (0 or 1) explains another attribute of the restaurant.

Popularity is based on the number of the comments and number of the people who voted for Zomato and Foursquare (as they have this data available); number of the Facebook page likes for Facebook; and number of the people who voted for Google and TripAdvisor. As data used for calculation popularity score is different for each platform (as a scale), normalization is needed before taking the average. So first, values are calculated if needed (only for Zomato and Foursquare), then outliers are eliminated, and finally data is normalized to have values between 1 and 10. After

this process, average score of popularity for each restaurant is calculated. Normalization formula is this:

Equation 1 Normalization Formula

$$X' = a + \frac{(X - X_{\min})(b - a)}{X_{\max} - X_{\min}}$$

Another important issue to consider was the number of the comments that are available on Zomato and Foursquare, beside the number of the people who voted. Relative importance of having a written comment is higher than having just a vote. So, in the formula I considered both of them with their relative importance:

$$= \frac{Number\ of\ the\ people\ who\ voted + (Number\ of\ the\ people\ who\ commmented)^2}{2}$$

This formula gave primary numbers to use for Zomato and Foursquare, and following steps are the same with the other platforms. Eliminating outliers, normalizing values and reaching to one single number for each restaurant on each platform (Zomato, Google etc.) that is on the same scale (1 to 10). Then, average of these numbers is calculated to reach “one single popularity score” for each restaurant.

Output data, which and how many delivery platforms are restaurants on is represented with “0” and “1”. For example, if restaurant A is working with only Just Eat, in Just Eat column it is written “1”; and “0” for UberEATS, Glovo and Deliveroo. Beside these columns, another column is created “multihoming”. It represents the total number of the platforms that each restaurant is using. So, the number is between “0” (none) and “4” (all of them)

Data collection process showed that some platforms such as Foursquare and Facebook are not very active recently; compare to Zomato, TripAdvisor and Google. Also considering the characteristics and popularity of the platforms, it is easy to see that neither Facebook nor Foursquare are the first places to go to learn (or search) about a new restaurant. This difference in considered while conducting the statistical test and two cases are created:

- Using data from Google, Zomato, Facebook, TripAdvisor and Foursquare with the sample size of 327 (As some pages doesn't have any information, intersection of available information is used so sample size got smaller)
- Using data from Google, Zomato and TripAdvisor with the sample size of 476 (intersection is greater as it is expected)

It is important to note that popularity scores are calculated after final sample selections of 327 and 476; due to normalization process. When sample changes, normalization results changes.

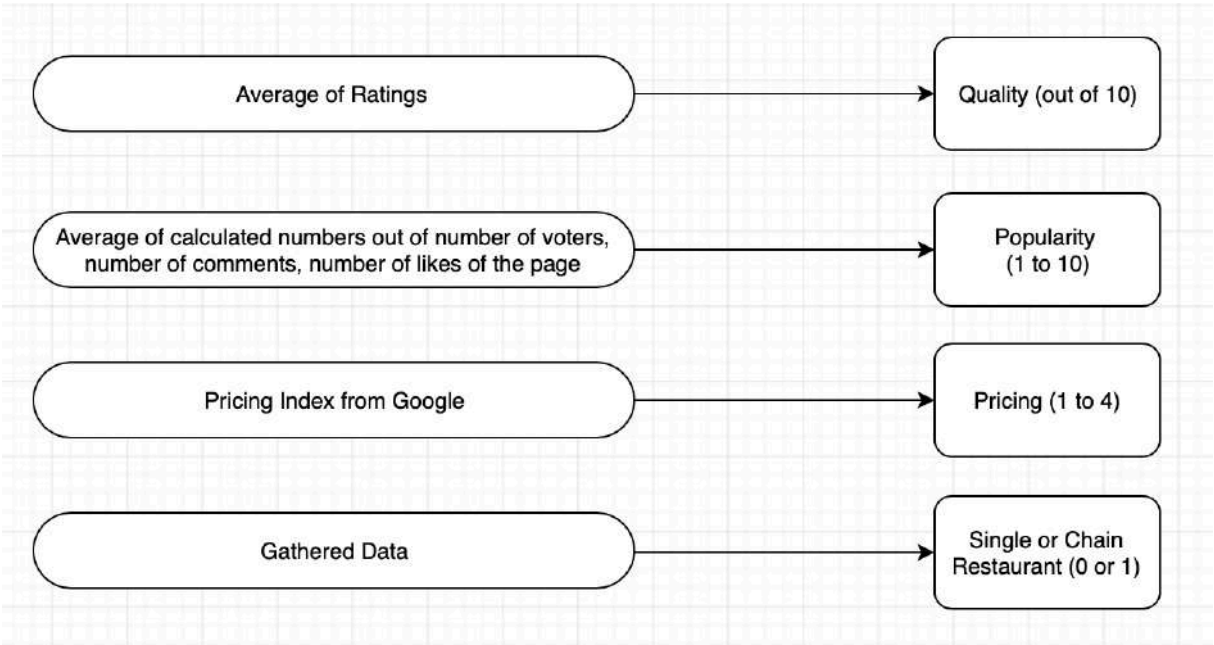

Figure 12 Sources of Inputs of the Model (Original Elaboration)

In the following phase IBM's SPSS is used to test my hypotheses. Dependent variable "multihoming" has five different possible values. They are respectively 0, 1, 2, 3, 4 and considering it as an ordinal variable is a reasonable approach. Another approach would be taking it as scale variable (ratio/interval) and applying multiple linear regression test, but assumptions of this test wouldn't meet. Having few options in dependent variable doesn't allow us to test homoscedasticity. As it is said, taking it as an ordinal data (and applying ordinal regression test) is the most reasonable approach.

Independent variables are pricing index (ordinal data), single or chain (categorical data), quality and popularity scores. Test is conducted for two cases that are defined above. To meet the assumptions of ordinal regression test; output data is merged into three groups as "0" (none); "1" only one platform; "2" multiple platforms (multihoming). Also, small group of pricing class "4" is added to class "3" if it is needed. Results will be illustrated in the following section.

2.3 Results

First thing to represent is the network of the restaurants' platform preference. This map is coming from the sample of 622 restaurants.

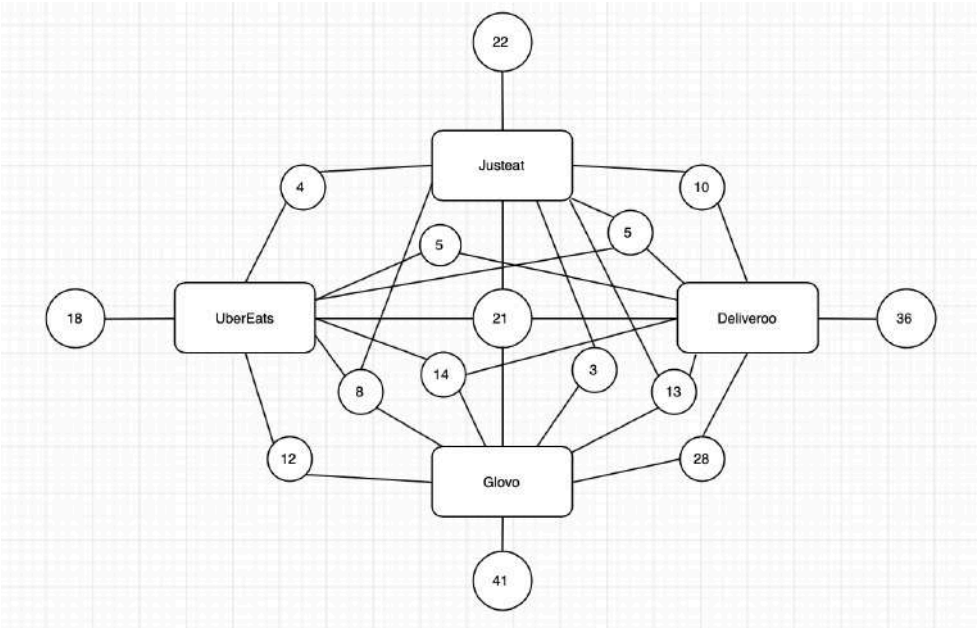

Figure 13 Platform Usage Map of the Restaurants (Original Elaboration)

Following table is showing multihoming rates of the restaurants on these platforms. Multihoming rates are, similar, between 70% and 80%.

Table 5 Multihoming Rates on Platforms (Original Elaboration)

Number	Platform Name	# Restaurants	# Multihoming Restaurants	Percentage
1	UberEATS	87	69	0,79310345
2	Deliveroo	132	96	0,72727273
3	Just Eat	86	64	0,74418605
4	Glovo	140	99	0,70714286

2.3.1. Statistical Test Results for 5 Platforms

Following results are representing test results of using five platforms' data (Google, Zomato, Facebook, TripAdvisor, and Foursquare). Sample size is 327. Pricing and multihoming is accepted as ordinal data. Pricing group 4 merged to pricing group 3 as its sample is small and multihoming 3 and 4 merged with 2.

Table 6 SPSS Case Processing Summary and Model Fitting Information for 5 Platforms Case (Original Elaboration)

Case Processing Summary

		N	Marginal Percentage
Multihoming	.0	196	60.9%
	1.0	68	21.1%
	2.0	58	18.0%
Pricing Index from Google	1	59	18.3%
	2	230	71.4%
	3	33	10.2%
Chain/Single Restaurant	0	242	75.2%
	1	80	24.8%
Valid		322	100.0%
Missing		5	
Total		327	

Model Fitting Information

Model	−2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	604.926			
Final	568.915	36.011	5	.000

Link function: Logit.

Table 7 SPSS Goodness-of-Fit and Pseudo R-Square Results for 5 Platforms Case (Original Elaboration)

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	636.600	637	.497
Deviance	568.915	637	.975

Link function: Logit.

Pseudo R-Square

Cox and Snell	.106
Nagelkerke	.125
McFadden	.060

Link function: Logit.

Table 8 SPSS Parameter Estimates for 5 Platforms Case (Original Elaboration)

Parameter Estimates

							95% Confidence Interval	
		Estimate	Std. Error	Wald	df	Sig.	Lower Bound	Upper Bound
Threshold	[Multihoming = .0]	-2.360	1.828	1.667	1	.197	-5.943	1.223
	[Multihoming = 1.0]	-1.174	1.824	.414	1	.520	-4.749	2.402
Location	PopularityTEXT	.245	.161	2.331	1	.127	-.070	.560
	QualityTEXT	-.313	.225	1.929	1	.165	-.754	.129
	[PricingIndexfromGoogle =1]	.225	.482	.217	1	.641	-.720	1.170
	[PricingIndexfromGoogle =2]	.241	.405	.354	1	.552	-.553	1.035
	[PricingIndexfromGoogle =3]	0[a]	.	.	0	.	.	.
	[ChainSingleRestaurant= 0]	-1.314	.257	26.216	1	.000	-1.817	-.811
	[ChainSingleRestaurant= 1]	0[a]	.	.	0	.	.	.

Link function: Logit.

a. This parameter is set to zero because it is redundant.

Table 9 SPSS Test of Parallel Lines for 5 Platforms Case (Original Elaboration)

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	568.915			
General	563.482	5.433	5	.365

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

a. Link function: Logit.

For meeting the assumptions of test, we want test of parallel lines' significance greater than 0.05; model fitting lower than 0.05; and Pearson and Deviance greater than 0.05. As we see they all meet. Nagelkerke is telling that our model is explaining 12,5% of the variance in the dependent variable.

Parameter estimates table is showing that only Chain/Single restaurant "0" has significance lower than 0.05. Chain restaurants (1) accepted as a reference category:

Odds of single restaurants using multiple (or more) platforms is 0,269 times (95% CI, 0,162 to 0,445) that of chain restaurants, a statistically significant effect (Wald x^2=26,216, p<0,001)

This means single restaurants (with an odd number 0,269) are more likely to use a smaller number of the platforms at the same time, compare to chain restaurants.

2.3.2. Statistical Test Results for 3 Platforms (Google, Zomato and TripAdvisor)

Following results are representing test results of using three platforms' data (Google, Zomato, TripAdvisor). Sample size is 327. Pricing and multihoming is accepted as ordinal data. Pricing group 4 merged to pricing group 3 as its sample is small and multihoming 3 and 4 merged with 2.

Table 10 SPSS Case Processing Summary for 3 Platforms Case (Original Elaboration)

Case Processing Summary

		N	Marginal Percentage
Multihoming arranged	.0	293	63.0%
	1.0	87	18.7%
	2.0	85	18.3%
Pricing Index from Google	1	127	27.3%
	2	295	63.4%
	3	43	9.2%
Chain/Single Restaurant	0	350	75.3%
	1	115	24.7%
Valid		465	100.0%
Missing		11	
Total		476	

Table 11 SPPS Model Fitting Information, Goodness-of-Fit, Pseudo R-Square for 3 Platforms Case (Original Elaboration)

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	851.195			
Final	801.775	49.420	5	.000

Link function: Logit.

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	931.525	915	.345
Deviance	801.775	915	.997

Link function: Logit.

Pseudo R-Square

Cox and Snell	.101
Nagelkerke	.120
McFadden	.058

Link function: Logit.

Table 12 SPSS Parameter Estimates for 3 Platforms Case (Original Elaboration)

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Threshold	[Multihomingarranged = .0]	.127	1.437	.008	1	.929	-2.689	2.943
	[Multihomingarranged = 1.0]	1.191	1.438	.686	1	.407	-1.627	4.009
Location	PopularityforTEXT	.100	.149	.453	1	.501	-.191	.392
	QualityRankingTEXT	.012	.179	.004	1	.947	-.339	.363
	[PricingIndexfromGoogle =1]	.326	.411	.629	1	.428	-.479	1.131
	[PricingIndexfromGoogle =2]	.445	.371	1.441	1	.230	-.282	1.172
	[PricingIndexfromGoogle =3]	0[a]	.	.	0	.	.	.
	[ChainSingleRestaurant= 0]	-1.409	.219	41.428	1	.000	-1.838	-.980
	[ChainSingleRestaurant= 1]	0[a]	.	.	0	.	.	.

Link function: Logit.

a. This parameter is set to zero because it is redundant.

Table 13 SPSS Test of Parallel Lines for 3 Platforms Case (Original Elaboration)

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	801.775			
General	797.200	4.574	5	.470

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

a. Link function: Logit.

For meeting the assumptions of test, we want test of parallel lines' significance greater than 0.05; model fitting lower than 0.05; and Pearson and Deviance greater than 0.05. As we see they all meet. Nagelkerke is telling that our model is explaining 12% of the variance in the dependent variable.

Parameter estimates table is showing that only Chain/Single restaurant "0" has significance lower than 0.05. Chain restaurants (1) accepted as a reference category:

Odds of single restaurants using multiple (or more) platforms is 0,244 times (95% CI, 0,159 to 0,375) that of chain restaurants, a statistically significant effect (Wald x^2=41,428, p<0,001)

This means single restaurants (with an odd number 0,244) are more likely to use a smaller number of the platforms at the same time, compare to chain restaurants.

As we see results are parallel for both cases.

3. Discussion

Italian market size for online and offline food delivery (gross market value) was around 2,5 billion Euros in 2016 (Source: prioridata and dealroom.co.) with online penetration rate of 5%. Compare to other countries of Europe, this percentage is very small and there is a huge potential for delivery platforms to grow. For example, UK has approximately %50 penetration rate and Netherlands 32,7%. This huge potential that is mentioned, bringing many global players into Italian market and now, market is shared by four big players.

According to results, it was interesting to see that incumbent player Just Eat had the smallest number of the restaurants on it with 86. In 2016, it had more than half of the market share of the Italian market by itself. After the entrance of global players such as UberEATS and Glovo, market competition became intense. Glovo by acquisitions of Foodinho and Foodora grew its fleet and UberEATS enjoyed the advantage of its known brand image to grow.

While prices charged to restaurants differs according to platform models of “accumulator” and “delivery platforms” with the emerged intense competition, all of these four platforms started to compete as “delivery platforms” (with recent adaption of Just Eat by introducing JE delivery). Again, the number 86 is too small including both accumulator purpose and delivery purpose usage. It is clear that extra cost of using second platform (%12 normal and %18 for using extra platform for Just Eat) didn’t stop restaurants to multihome or even quit Just Eat totally. Restaurants may find it unnecessary to hire a person to deliver orders after increased saturation of the delivery market. Just Eat looks like it lost its competitive advantage as accumulator origin platform and it is behind other players in the market as a delivery platform.

Beside that along the information collection, it was observed that chains show similar decisions among its branches, while there can be few extraordinary examples. For example, while all branches in the center using Deliveroo, one branch may not use it. Some famous fast-food chains, or piadinerias show that their preference about platform may be supported with exclusive contracts. Platforms’

effort with exclusive contracts is to stop some customers from multihoming and differentiate themselves by having these unique customers. As there is an ongoing debate on exclusive contracts of whether they are welfare enhancing or welfare diminishing, it must be analyzed by establishing economic model and doing further researches in this market. For example, in McDonald's case, UberEATS doesn't charge anything for the customer who orders through the app, and in this specific exclusive contract case both sellers and buyers are the primary beneficiaries, and as UberEATS is not the incumbent firm, this situation is more likely to be welfare enhancing. (Armstrong and Wright 2007; Doganoglu and Wright, 2010)

McKinsey's report about online food delivery market is crucial to understand the dynamics of the market as it mentions that buyer side (customers) have high loyalty towards platforms, we can expect them to use single platform. While for platforms, using exclusive contracts to differentiate themselves (according to resource-based view theory from Sun, Tse 2009) and attracting more customers is a good strategy; for restaurants it is valuable to be on more platforms at the same time. When customers are single-homing, using particular platform to reach them is mandatory; so multihoming increases the customer base for restaurants parallel with Rysman's (2009) inference. Liu et al.'s (2017) conclusion applies here too, as multihoming restaurants benefit themselves at the cost of singlehoming restaurants (as they can reach to desired capacity in a shorter period of time or easier). Beside these benefits of multihoming, being on multiple platforms can bring some advantages related to marketing as being more popular.

Relatively high commission fees charged to restaurants (over 30% of the order value in average) can be justified with the Rochet and Tirole's (2003); Armstrong's (2006); Caillaud and Jullien's (2003) reasonings which suggest single-homing side to have more favorable offer (theory for competitive bottleneck structure). For delivery services customers are paying really small prices compare to restaurants. For example, when a customer orders from UberEATS, he/she pays around 2,5 euros delivery fee (or even "zero" price for McDonalds etc.); and restaurants pay %30+ commission fee.

According to 622 restaurants' platform usage network, 240 restaurants are using at least one platform and 117 of them are using a single platform (18, 22, 36, 41) Number of the restaurants on each platform are 86, 87, 132,140 and there is no dominant player in the market. Emerging dominant player could create unfavorable pricing for both sides while under the current structure of competition (with the help of high multihoming rate between 70% and 80%) prices decrease. As Eisenmann et al. (2006) mention low multihoming cost is relevant to this result.

Beside the monetary cost of multi-homing, there can be another type of costs as well. For example, cost of learning the system is really small for restaurants as all of these systems have similar structure. Still, cost of technology management must be considered as a multihoming cost. Following orders from many different apps requires much more effort as number of the platforms increase. Also, capacity of the restaurant to serve many people at the same time, especially with the physical customers requires attention. Priority of orders problem can emerge, and unsatisfied customers can create a bad reputation for the restaurant. Low cost (acceptable) of multihoming and easiness increase the attractiveness for restaurants and in turn this reduce the platform differentiation as in the Hyrynesalmi et al. (2012) suggests. Platforms can try to differentiate their offerings by selecting particular cuisine, or category and support it with exclusive contracts. Another research can be done to analyze this attribute (cuisine type etc.) of restaurants on the platforms.

In the second part of research I tried to see if the quality, popularity, pricing and single/chain characteristics have an impact on multihoming decision. I expected popular and high-quality restaurants to have higher number of platforms at the same time as in the Mobile Software Ecosystems research of Hyrynesalmi et al. (2012) but results were insignificant. Only single/chain characteristic was relevant on multihoming and suggesting that chains are more likely to multihome compare to single platforms. This can be explained by their professional approach to business or decisions from the center etc. Another survey type of research can sustain the underlying reasons of these findings.

3.1. Conclusion

Success of two-sided markets rely on different factors than traditional businesses. For two-side markets it is more related to its network and orchestration capability and for traditional ones it is more related to internal factors. Empirical studies related to two-sided markets cover many topics related to literature such as pricing, competition etc. among platforms. Still, number of the empirical studies related to multihoming is very few. Considering the importance of multihoming in determining the competitive structure of the market, more studies are needed to be done in different markets. As Landsman and Stremersch (2011) mention in their work, most of the academics and market analysts focus on mere network size of the sellers to determine competitive structure, however focus must move to other aspects such as multihoming attitude for better understanding and evaluation. This research tries to fill this gap by examining online food delivery market in Milan

Online food delivery market with its known players Just Eat, UberEATS, Deliveroo, Glovo etc. playing bigger role every day, in our daily lives and economies. Economic valuations of these companies are over hundreds of million dollars (Just Eat, Deliveroo and UberEATS have valuation higher than billion dollars). These companies had different business models but now they can be seen as total substitutes of each other. (Still, there are slight differences as Glovo is “anything delivery” company and Just Eat -now- has two functions at the same time) Just Eat was only an accumulator in the past and the rest were delivery platforms with its own fleets. So, we can say that Just Eat was only an order management system. Recent changes in the market and harsh competition made Just Eat change its idea and now they have “JE delivery” similar to other platforms. Results show that incumbent and former market leader firm Just Eat is behind its competitors according to number of the restaurants. The reason can be restaurants’ quick adaptation to delivery systems and stopping the usage of accumulator platforms due to unnecessary work of hiring a person and managing deliveries.

Italian market’s low saturation for online food delivery (around %5 in 2016 according to data from prioridata and dealroom.co) is attracting more players to come and invest here as they expect market size to grow drastically. Another reason that

encourage platforms is the fact that restaurants' market is a local market, and customers care about the number of the restaurants in the particular city (for each platform) rather than total number of the restaurants around the world. So, even though Just Eat is a market leader in many countries, new entrant Glovo can have chance to compete with Just Eat in Milan. This is different for Airbnb as it is a global market.

Following reason that we see many platforms sharing the market in Milan is platforms' inability or unwillingness to deter multihoming (70% to 80% multihoming rate for each platform; so, expected benefits of multihoming overcome the expected costs for restaurants). As Eisenmann et al. (2006) suggest, this allows some platforms to stay in the market as a follower at least. Otherwise, due to strong cross side network effects we would see a single platform dominating the market. On the other hand, singlehoming attitude of the customers make platforms compete for them as it is defined in the competitive bottleneck situation in the literature. Beside low prices and promotions for customers, platforms must try to acquire more restaurants onto them as customers evaluate this substantially. Differentiation strategy does not seem very useful (or applicable) under the current structure of the market.

Researches related to multihoming can be classified in two main categories: factors' impact on multihoming and multihoming's impact on competition related factors such as pricing, sales etc. This research focuses on the multihoming attitude's change based on the characteristics of the restaurants such as quality, popularity, pricing and being a single/chain restaurant. It is important to overlook to the restaurants on the platform and observe if there is any relevant pattern of behavior. Here, restaurants characteristics are measured based on the combined data from Google, Zomato, Facebook, TripAdvisor and Foursquare. Results suggest that only single/chain character has statistically significant impact on multihoming attitude. Chains are more likely to use more platforms at the same time compare to single platforms. This can be justified by their professional approach to business, central decisions etc. According to these findings, platforms can adapt their strategy to focus on the chain restaurants to acquire in the first place, as they are more likely to multihome. Still, single restaurants shouldn't be neglected.

3.2. Limitations and Further Researches

As my sample represents only Milan and even some part of it, this research can be extended to larger and different areas. Results of further researches can be compared with the findings here. Another important aspect to consider is that statistical analysis gives result, but this result must be supported with another studies, especially with the survey type of research to understand the dynamics better. Also, other characteristics such as cuisine type etc. can be added to test.

In this research I focused on the factors that are (may be) affecting multihoming, so following researches can be done to analyze the impact of multihoming on sales, number of the customers, revenues etc. Survey conducted with restaurant owners can help to reach some results. Combining both studies can give comprehensive view of multihoming phenomenon in online food delivery market as two-sided markets.

References

Afuah, A. (2013). Are network effects really all about size? The role of structure and conduct. *Strategic Management Journal*, *34*(3), 257-273.

Ardolino, M., Saccani, N., & Perona, M. (2016). THE ANALYSIS OF MULTISIDED PLATFORMS: RESULTS FROM A LITERATURE REVIEW. In *Spring Servitization Conference*.

Armstrong, M. (2006). Competition in two-sided markets. *RAND Journal of Economics, 37*(3), 668-691. doi:10.1111/j.1756-2171.2006.tb00037.x

Armstrong, M., & Wright, J. (2007). Two-sided markets, competitive bottlenecks and exclusive contracts. *Economic Theory, 32*(2), 353-380. doi:10.1007/s00199-006-0114-6

Baker, J. B., & Bresnahan, T. (2006). Economic evidence in antitrust: defining markets and measuring market power.

Ballon, P., & Van Heesvelde, E. (2011). ICT platforms and regulatory concerns in europe. *Telecommunications Policy, 35*(8), 702-714. doi:10.1016/j.telpol.2011.06.009

Balto, D. A. (1998). Networks and exclusivity: Antitrust analysis to promote network competition. *Geo. Mason L. Rev.*, *7*, 523.

Belleflamme, P., & Peitz, M. (2018). Platform competition: Who benefits from multihoming? *International Journal of Industrial Organization,* doi:10.1016/j.ijindorg.2018.03.014

Binken, J. L. G., & Stremersch, S. (2009). The effect of superstar software on hardware sales in system markets. *Journal of Marketing, 73*(2), 88-104. doi:10.1509/jmkg.73.2.88

Bonardi, J. -., & Durand, R. (2003). Managing network effects in high-tech markets. *Academy of Management Executive, 17*(4), 40-52. doi:10.5465/AME.2003.11851827

Boudreau, K. J., & Hagiu, A. (2009). Platform rules: Multi-sided platforms as regulators. *Platforms, markets and innovation* (pp. 163-191) Retrieved from www.scopus.com

Caillaud, B., & Jullien, B. (2003). Chicken & egg: Competition among intermediation service providers. *RAND Journal of Economics, 34*(2), 309-328. doi:10.2307/1593720

Campbell-Kelly, M., Garcia-Swartz, D., Lam, R., & Yang, Y. (2015). Economic and business perspectives on smartphones as multi-sided platforms. *Telecommunications Policy, 39*(8), 717-734. doi:10.1016/j.telpol.2014.11.001

Carrillo, J. D. (2006). Platform competition: The role of multi-homing and complementors.

Choi, J. P. (2007), "Tying in Two-Sided Markets with Multi- homing," CESifo Working Paper No. 2073.

Choi, J. P. (2010). Tying in two-sided markets with multi-homing. *Journal of Industrial Economics, 58*(3), 607-626. doi:10.1111/j.1467-6451.2010.00426.x

Church, J., & Gandal, N. (1992). Network effects, software provision, and standardization. *The journal of industrial economics*, 85-103.

Clements, M. T., & Ohashi, H. (2005). Indirect network effects and the product cycle: video games in the US, 1994–2002. *The Journal of Industrial Economics*, *53*(4), 515-542.

Corts, K. S., & Lederman, M. (2009). Software exclusivity and the scope of indirect network effects in the U.S. home video game market. *International Journal of Industrial Organization, 27*(2), 121-136. doi:10.1016/j.ijindorg.2008.08.002

De Palma, A., Leruth, L., & Regibeau, P. (1999). Partial compatibility with network externalities and double purchase. *Information Economics and Policy, 11*(2), 209-227. doi:10.1016/S0167-6245(99)00006-2

Doganoglu, T., & Wright, J. (2010). Exclusive dealing with network effects. *International Journal of Industrial Organization, 28*(2), 145-154. doi:10.1016/j.ijindorg.2009.07.006

Doganoglu, T., & Wright, J. (2006). Multihoming and compatibility. *International Journal of Industrial Organization, 24*(1), 45-67. doi:10.1016/j.ijindorg.2005.07.004

Eisenmann, T., Parker, G., & Van Alstyne, M. W. (2006). Strategies for two-sided markets. *Harvard Business Review, 84*(10), 92-101+149. Retrieved from www.scopus.com

Eisenmann, T. R. (2008). Managing proprietary and shared platforms. *California Management Review, 50*(4), 31-53. doi:10.2307/41166455

Evans, D. S. (2003). The antitrust economics of multi-sided platform markets. *Yale J. on Reg.*, *20*, 325.

Evans, D. S., Hagiu, A., & Schmalensee, R. (2006). Software platforms. *Industrial Organization and the Digital Economy*, *31*.

Evans, D. S., & Schmalensee, R. (2008). Markets with two-sided platforms.

Evans, D. S., & Schmalensee, R. (2010). Failure to launch: Critical mass in platform businesses. *Review of Network Economics, 9*(4) doi:10.2202/1446-9022.1256

Evans, D. S., & Schmalensee, R. (2016). *Matchmakers: the new economics of multisided platforms*. Harvard Business Review Press.

Filistrucchi, L., Geradin, D., & Damme, E. V. (2013). Identifying two-sided markets. *World Competition*, *36*(1), 33-59.

Gawer, A. (2010). The organization of technological platforms. In *Technology and organization: essays in honour of Joan Woodward* (pp. 287-296). Emerald Group Publishing Limited

Hagiu, A. (2007). Merchant or two-sided platform?. *Review of Network Economics*, *6*(2)

Hagiu, A., & Spulber, D. (2013). First-party content and coordination in two-sided markets. *Management Science, 59*(4), 933-949. doi:10.1287/mnsc.1120.1577

Hagiu, A., & Wright, J. (2015). Multi-sided platforms. *International Journal of Industrial Organization, 43*, 162-174. doi:10.1016/j.ijindorg.2015.03.003

Hein, A., Schreieck, M., Wiesche, M., & Krcmar, H. (2016). Multiple-case analysis on governance mechanism of multi-sided platforms. Paper presented at the *Multikonferenz Wirtschaftsinformatik, MKWI 2016, , 3* 1613-1624. Retrieved from www.scopus.com

Hirschberg, C., Rajko, A., Schumacher, T., & Wrulich, M. The changing market for food delivery *McKinsey & Company*

Hyrynsalmi, S., Mäkilä, T., Järvi, A., Suominen, A., Seppänen, M., & Knuutila, T. (2012). App store, marketplace, play! an analysis of multi-homing in mobile software ecosystems. Paper presented at the *CEUR Workshop Proceedings, , 879* 59-72. Retrieved from www.scopus.com

Kaiser, U., & Wright, J. (2006). Price structure in two-sided markets: Evidence from the magazine industry. *International Journal of Industrial Organization, 24*(1), 1-28. doi:10.1016/j.ijindorg.2005.06.002

Katz, M. L., & Shapiro, C. (1985). Network externalities, competition, and compatibility. *American Economic Review, 75*(3), 424-440. Retrieved from www.scopus.com

Landsman, V., & Stremersch, S. (2011). Multihoming in two-sided markets: An empirical inquiry in the video game console industry. *Journal of Marketing, 75*(6), 39-54. doi:10.1509/jm.09.0199

Liu, Q., Loginova, O., & Wang, X. H. (2017). The Impact of Multi-Homing in a Ride-Hailing Market.

Mantena, R., Sankaranarayanan, R., & Viswanathan, S. (2007). Exclusive licensing in complementary network industries. SSRN.

McIntyre, D. P., & Srinivasan, A. (2017). Networks, platforms, and strategy: Emerging views and next steps. *Strategic Management Journal, 38*(1), 141-160. doi:10.1002/smj.2596

McIntyre, D. P., & Subramaniam, M. (2009). Strategy in network industries: A review and research agenda. *Journal of Management, 35*(6), 1494-1517. doi:10.1177/0149206309346734

Parker, G., & Van Alstyne, M. W. (2000). Information complements, substitutes, and strategic product design. *Substitutes, and Strategic Product Design (November 8, 2000)*.

Parker, G. G., & Van Alstyne, M. W. (2005). Two-sided network effects: A theory of information product design. *Management Science, 51*(10), 1494-1504. doi:10.1287/mnsc.1050.0400

Parker, G., & Van Alstyne, M. W. (2014). Platform strategy. *Boston U. School of Management Research Paper*, (2439323).

Rochet, J. C., & Tirole, J. (2008). Tying in two-sided markets and the honor all cards rule. *International Journal of Industrial Organization, 26*(6), 1333-1347. doi:10.1016/j.ijindorg.2008.01.002

Rochet, J. -., & Tirole, J. (2003). Platform competition in two-sided markets. *Journal of the European Economic Association, 1*(4), 990-1029. doi:10.1162/154247603322493212

Rochet, J. C., & Tirole, J. (2004). Defining two-sided markets. *Toulouse, France: IDEI, mimeo, January*.

Rochet, J. C., & Tirole, J. (2005). Competition policy in two-sided markets. *Advances in the Economics of Competition Law, MIT Press, Cambridge, MA, USA*.

Rochet, J. -., & Tirole, J. (2006). Two-sided markets: A progress report. *RAND Journal of Economics, 37*(3), 645-667. doi:10.1111/j.1756-2171.2006.tb00036.x

Rysman, M. (2004). Competition between networks: A study of the market for yellow pages. *Review of Economic Studies, 71*(2), 483-512. doi:10.1111/0034-6527.00512

Rysman, M. (2009). The economics of two-sided markets. *Journal of Economic Perspectives, 23*(3), 125-143. doi:10.1257/jep.23.3.125

Shapiro, Carl (1999), "Exclusivity in Network Industries," *George Mason Law Review, 7 (3)*, 673–84.

Schiff, A. (2003). Open and closed systems of two-sided networks. *Information Economics and Policy, 15*(4), 425-442. doi:10.1016/S0167-6245(03)00006-4

Srinivasan, A., & Venkatraman, N. (2010). Indirect network effects and platform dominance in the video game industry: A network perspective. *IEEE Transactions on Engineering Management, 57*(4), 661-673. doi:10.1109/TEM.2009.2037738

Stabell, C. B., & Fjeldstad, Ø. D. (1998). Configuring value for competitive advantage: On chains, shops, and networks. *Strategic Management Journal, 19*(5), 413-437. Retrieved from www.scopus.com

Suarez, F. F. (2005). Network effects revisited: The role of strong ties in technology selection. *Academy of Management Journal, 48*(4), 710-720. doi:10.5465/AMJ.2005.17843947

Sun, M., & Tse, E. (2009). The resource-based view of competitive advantage in two-sded markets. *Journal of Management Studies, 46*(1), 45-64. doi:10.1111/j.1467-6486.2008.00796.x

Trabucchi, D., Buganza, T., & Pellizzoni, E. (2017). Give away your digital services: Leveraging big data to capture value. *Research Technology Management, 60*(2), 43-52. doi:10.1080/08956308.2017.1276390

Van Alstyne, M. W., Parker, G. G., & Paul Choudary, S. (2016). Pipelines, platforms, and the new rules of strategy. *Harvard Business Review, 2016*(April) Retrieved from www.scopus.com