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# Perceptions Of Network Effects: Positive Or Negative Externalities?

Seyfi Top[a], Serkan Dilek[b*], Nurdan Çolakoğlu[c]

[a]Beykent University, Beylikduzu Campus, B.Çekmece, İstanbul
[b]Beykent University, Beylikduzu Campus, B.Çekmece, İstanbul
[c]Beykent University, Beylikduzu Campus, B.Çekmece, İstanbul

**Abstract**

The purpose of this study is to search if consumers are aware of network effects. If consumers are rational, they will make their consumption decisions by thinking about maximization of their utility without paying too much. The quality of a good does not only depend on producer's decisions in network markets. Also the number of other customers, affect the quality of a good. First we reviewed literature about network externalities and effects. Secondly, we analyzed the survey which is conducted to measure network externalities perceptions. The survey is conducted on Beykent University Vocational School pupils. As a result we reached interesting results about the network perceptions of pupils.



Keywords: *Network, New Economy, Network Externality, Network Perceptions, Network Markets*

## 1. Introduction

The improvements in Information and Communication Technology (ICT) is thought to be the reason of the transformation in economics (Dilek and others, 2009; Çolakoğlu and Dilek; 2010). Networks are occupying an important place in today's markets, therefore many research have been done since the second half of 1980's (Katz and Shapiro;1985; Farrell and Saloner;1986). New economic models including networks have been studied in economic literature (Shapiro and Varian, 1999; Liebowitz and Margolis, 1994; Kelly, 1998; Matutes and Regibeaue, 1988; Economides, 1989; Economides,1996; Farrell and Klemperer, 2006, Brynjolfsson and Kemerer, 1996; Stoneman, 1987). Although we are

* Corresponding Author: Tel: 0090 535 3842872
E-mail Adres:Serkan.dilek@gmail.com


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witnessing large literature about network externalities in foreign economy research books, we can not see enough data about it in Turkish economics. Therefore we have suspicion whether pupils have enough information about networks and their externalities. Externalities can be defined as a situation in which one agent is effected directly by another's production or consumption decision. Generally network externality occurs when the last consumer increases the utility of all consumers by participating network. This increase is called as positive network externalities. But when the capacity of network is limited, the last consumer decreases the utility of all consumers. We call this decrease as a negative network externality.

The aim of our study is to reveal how Vocational School pupils perceive the network effects. Do they see positive or negative aspect of network effect? In the first part of our study we summarized the economic literature related with the network externalities. Then in the second part we investigated the result of the survey which is conducted in Beykent University Vocational School pupils.

## 2. Literature Review

Computers and internet are the sources of great transformation of social and economic system (Çinko;2003:157). One of their contribution is the increasing share of networks in business and economy. Today many markets such as web sites, communication vehicles are consist of networks. Also they have occupied a great place in daily life. For that reason many scholars called this environment as network society and called the new economy as a network economy (Castells;2006:6; Özgüler, 2003:2). Some huge companies such as Microsoft, Intel, Walmart etc. are thought to be the part of networks.

Consumers generally think about the size of networks, when they are making their decisions. Because the size of the network is independent variable of consumer's utility function. As the size of network enlarges, the utility of consumer by participating to this network increases. Especially in communication technologies this economy rule is valid (Katz and Shapiro;1985; Farrell and Saloner;1986;Liebowitz and Margolis,1994; Kelly, 1998; Matutes and Regibeaue, 1988; Economides, 1989; Economides,1996). The topic of network externalities has been studied for almost two decades (Chiaravutthi;2006:27). Varian (2006:658) defines network externality with these words.

"*Network Externalities are a special kind of externalities in which persons's utility for a good depends on the number of other people who consume this good*".

There are many other definitions about network externality in literature (Katz and Shapiro;1985:823; Farrell and Saloner;1986:941;Liebowitz and Margolis,1994:134). Also there are many academic and empirical studies about network externalities in economic literature (Chiaravuthi;2006:29).

When the utility of a good increases with the consumption of others economists call this situation as positive network externalities. There are three possible sources of positive externalities. First when someone buy telephone, faximile or similar communication goods other persons can communicate with one more people by using this communication tool. Secondly consumer can find complementary goods easily if the good is sold widely in a market. Third it is easier to reach postpurchase service if the good is popular in a market. In all of these cases the utility of a consumer depends on the number of other consumers.

Reversely, the utility of a good can decrease when total consumption of it, increase and this time economists call this situation as negative network externalities (Katz and Shapiro; 1985:424-425). Also friends' influences, which may be called network spillovers, is an alternative source of network externalities. A person may decide to use a product because he wants to use what his friends are currently using or because he can seek some assistance from his friends regarding how to use that product (Chiaravuthi;2006:28).

If there is a capacity limit in network, then we can talk about negative consumption externalities. In this situation consumers suffer from the crowded in network (Katz and Shapiro;1985). This time consumers avoid to use a leader product because of it's not useful for consumer anymore. For example, a

telephone or computer network becomes overloaded, the effect on an individual subscriber will be negative (Liebowitz and Margolis;1994:134).

The sources of network externalities are searched in two aspects which are direct and indirect effects. Indirect effects are about the complementary products, spare parts and equipments. Consumers think that the variety, availability and number of complementary products, spare parts and equipments are positively related with the market share of products. Direct network externalities occur when the utility of a consumer depends directly on the total number of compatible services (Gandal, 1995;600). In other words consumers prefer the product which is sold in a market because of both direct and indirect network effects. Early in the product life cycle, most consumers see little utility in the product, as there are few adopters, and so they may take a "wait-and-see" approach until there are more adopters. In the case of competing standards, early adopters take the risk of adopting the wrong standard, so many wait until the winning standard is clear, and more importantly, which standard or platform will no longer be supported. The thoughts of consumers obliged firms to think about network externalities (Bental and Spiegel;1995:197). Many markets such as software industry have interesting experiences about network externalities (Brynjolfsson and Kemerer;1996:1627; David; 1985:332; Gallaugher and Wang;2002:303; Karnik:2000;2950; Spinello;2005:344). But empirical studies in Western economies confirm the hypothesis "Browser software exhibits direct network externalities, and direct network externalities exist in market leader's product" (Chiaravuthi;2006:33).

## 3.Methods

We collected necessary data by conducting survey to pupils who are educated in Beykent University Vocational School. Items in this survey were prepared by the help of previous studies that are about the network externalities (Liebowitz and Margolis, 1994; Kelly, 1998; Matutes and Regibeaue, 1988; Economides, 1989; Economides,1996; Katz and Shapiro;1985; Farrell and Saloner;1986). In other words our study is the follower of these previous studies. The results are evaluated with SPSS 16.00 Statistical Package Programme. We applied necessary econometric, reliability tests to measure the awareness about the network externalities of pupils (Nakip;2006; Orhunbilge;1997; Newbold;2006). This survey is conducted to 100 pupils who are registered in Beykent University Cooking, Banking and Insurance, Securities and Capital Market, Accounting and Taxing Applications, Textile Technology programmes second classes.

In our survey there are two parts. In the first part the questions are about demographic characteristics of pupils. In the second part We used Five Likert Scale to learn if pupils perceive positive externalities of networks. During our search we used Independent T test and Mann Whitney test to reveal the answers of questions.

## 4.Findings

Today, competition rules can not be understood without analyzing new economy (Tirole;1989:11). Many economics have studied about the networks and network effects while doing micro analysis. Economic literature has contained many models which are used to explain networks, network competitions and firm behaviours in these networks. We wanted to find university pupils perceive network externalities negatively or positively and make consumption decisions by caring about positive and negative network externalities.

We applied reliability tests (Orhunbilge;2010:11) and find Cronbach's Alpha coefficient as 0,84. So our tests are interpreted as very reliable according to Nakip (2006:146). %60 of the pupils who are participated to this survey is female and %40 of them are male. Also %60 of the participants are in Technical Programmes, %40 of them are in Economical and Administrative programmes. The distribution of the participants according to their age and education areas are shown in Table 1 and Table 2.

**Table1. Age and Education Areas**

| *Age* | **Percentage** |
|---|---|
| <20 | %40 |
| 21-29 | %56 |
| **30+** | %4 |

The average age is 21,4 and it can be seen from Table 1 that %56 of pupils are between 21-29 age group.

**Table 2. Education Areas (Programmes)**

| ***Programmes*** | **Percentage** |
|---|---|
| Technical Programmes (Cooking, Textile Technology) | 60 |
| **Economical and Administrative Programmes (Banking and Insurance, Securities and Capital Markets, Accounting and Taxing Applications)** | 40 |

The results of the demographic questions are shown in Table 3. %64 of the participants have worked but only %18 of them are still working. So pupils don't prefer working while they are graduating. Although %40 of pupils took course about economics, only %24 of them heard about network externalities. Because microeconomic theory don't give enough importance to networks and other new concepts in economic literature. The most important reason of this result is the limited lesson hours for microeconomics. However, microeconomics build necessary fundamentals to understand and daily life and other branches such as management, organization etc. Another result is that pupils generally prefer leader firms and products in market, so they contribute network externalities. %58 of the participants use leader mobile phone operator; %74 of them use leader software. So, some of the participants, who chose leader software, don't prefer leader mobile phone operator. Most probably one reason is that some participants prefer leader software because they think that it is easy to find anyone who knows about this software when they are in difficulty. But using mobile phone is easier than software, so they don't give importance to find anyone who knows about mobile phone operator services.

**Table 3. Demographic Questions**

| *Questions* | *Yes* | **No** |
|---|---|---|
| 1-) Have you ever worked? | 64 | 36 |
| 2-) Are you still working? | 18 | 82 |
| 3-) Have you ever heard about network externalities? | 24 | 76 |
| 4-) Have you ever learned about Economics? | 40 | 60 |
| 5-) Do you prefer the mobile phone operator that has more subscriber? | 58 | 42 |
| 6-) Do you prefer the software that is used in your environment widely? | 74 | 26 |
| 7-) Have you ever read about "Internet Economics", "Computer Economics", "New Economics"? | 30 | 70 |

| | | |
|---|---|---|
| 8-) Are you registered in Personal sharing sites such as Facebook, twitter, Orkut etc? | 80 | 20 |
| 9-) Do you have a faximile machine? | 28 | 72 |
| **10-) Do you remember the days your family used video player?** | 70 | 30 |

Internet has large share in pupil's daily life. We can understand it from the fact that %80 of participants are registered in personal sharing sites such as Facebook, Twitter or Orkut. On the other hand, Faximile (fax) technology is old technology, so it is not used widely by pupils. Video Technology is old technology but %70 of participants remembers the days with video player. Last three questions are important because they show whether pupils can answer the questions with the usage of Video player, faximile (fax) or being registered to networks.

Also we asked the type of keyboard they use and the browser type they use when connecting to internet and mail system. The results are given in Table 4. Most of the pupils (%86) use Q keyboard, while only %14 use F keyboard. This result is the contradiction because academical studies generally show that F type keyboard is more usable, faster and provide time saving when we compare with Q type keyboard. One of the reason of widely usage of Q keyboard is network effect (Yılmaz;2009:34). Also %54 of participants prefers to use Explorer. Competition strategies and the results in browser market are found attractive subject by many searchers and there are many studies dealing with this market. Academical searches show that Explorer got %87 of the market share in 1996 by taking advantage of network effects (Spinello;2005:344). %73 of participants prefer Hotmail system. Emprical studies found that e-mail services are one of the market that shows network effects (Gallaugher and Wang;2002:304). But these results don't mean that the participants are aware of network effects.

**Table 4. Usage and Registration to Networks**

| | **Percentage** |
|---|---|
| **Which type of Keyboard do you use?** | |
| Q type | 86 |
| F type | 14 |
| Total | 100 |
| **How do you connect to Internet?** | |
| Explorer | 54 |
| Mozilla | 30 |
| Netscape Navigator | 1 |
| Other | 15 |
| Total | 100 |
| **Which e-mail System do you use?** | |
| Gmail | 22 |
| Yahoo | 2 |
| Hotmail | 73 |
| Other | 3 |
| **Total** | 100 |

Second part of the survey is prepared to reveal the network effect awareness and Positive-negative network effect bias of pupils. We want from the participants to give number according to their answers. In other words we use five likert scale. The questions and averages of the answers are shown in Table 5.

1: I never accept
2: I Don't accept
3: Neither I agree nor I don't agree
4:I agree
5: I always agree.

First 10 questions are for measuring positive effects of networks, while second ten questions are for measuring negative effects. The means and standard deviations of the answers are given in Table 5. As it is seen from this table means of the first ten questions are between 2,65 and 3,37 in other words they are near 3. The whole average of these ten questions is 3,11. So they are not agreed or disagreed with positive network effects. If the results were higher than 3.5 we could say that pupils were agree with the positive network effects. Reversely, If the results were lower than 2.5 we could say that pupils were not agree with positive network effects or agree with negative network effects.

The results of second ten questions are between 2,54 and 3,29 and the whole average of the second ten questions is 2,91. Therefore they are not agreed or disagreed with negative network effects, too. If the results were higher than 3.5 we could say that pupils were agree with negative network effects. Reversely, If the results were lower than 2.5 we could say that pupils were not agree with negative network effects or agree with positive network effects. Shortly, participants chose leader products such as software, mobile phone operator, keyboard type although they don't know the reason, really. Both the first and second ten questions are near three, thus averagely participants are "Neither agree nor don't agree" about the questions that measure the awareness about the positive and negative effects of networks.

**Table 5. Second part of Survey**

| | ***Mean*** | **Stan. Deviation** |
|---|---|---|
| 1-) As the customer of mobile phone operator increases, I utilized more effectively from the service of the operator. | **3,33** | **1,181** |
| 2-) As the people who knows about software which is used by me increases, I utilized more from this software. | **3,37** | **1,125** |
| 3-) As the members of internet personal sharing sites increase, I get more benefit by being member to this site. | **3,28** | **1,181** |
| 4-) As the user of internet increase, the benefit of internet to me increases. | **3,26** | **1,228** |
| 5-) As the user of e-mail increase, the benefit of me from these services increase. | **3,13** | **1,169** |
| 6-) As the user of railway increases, I get more benefit from using railway. | **3,25** | **1,351** |
| 7-) As the user of video player type (VHS or Beta type) increase, I get more benefit from using this type of video player. | **2,65** | **1,132** |
| 8-) As the user of keyboard type (QWERTY or F type) I use increase, I get more benefit from using this type of keyboard type. | **2,89** | **1,302** |
| 9-) As the number of user of Faximile (fax) machine I use increase, I get more benefit from using faximile (fax) machine. | **2,9** | **1,185** |
| 10-) As the number of people that use the same shop with me increase, I get more benefit from using this shop. | **3,05** | **1,201** |
| 11-) As the customer of the mobile phone operator increase, I get less benefit because of the system bottleneck. | **3,25** | **1,158** |
| 12-) As the user of software I use increase, the benefits of this software decrease for me. | **2,87** | **1,236** |
| 13-) As the members of internet personal sharing sites increase, I get less benefit from being registered to them decrease because of the bottleneck. | **3,05** | **1,218** |

| | | |
|---|---|---|
| 14-) As the user of internet increase, the benefit of internet to me decrease because of slow working. | **3,29** | **1,166** |
| 15-) As the user of e-mail increase, I get less quality and late e-mail service. | **2,76** | **1,288** |
| 16-) As the user of railway increases, I travel in a less quality standards because of crowd and bad conditions. | **3,11** | **1,262** |
| 17-) As the user of video player type (VHS or Beta type) increase, I get less benefit from using this type of video player. | **2,86** | **1,239** |
| 18-) As the user of keyboard type (QWERTY or F type) I use increase, I get less benefit from using this type of keyboard type. | **2,54** | **1,096** |
| 19-) As the number of user of Faximile (fax) machine I use increase, I get less benefit from using faximile (fax) machine. | **2,56** | **1,095** |
| **20-) As the number of people that use the same shop with me increase, I get less benefit from using this shop.** | **2,86** | **1,206** |

We used these results to test our Hypotheses below. The aim of these hypotheses is to search any group that has different awareness of network effects. The results of these hypotheses, the test methods used in these hypotheses are given in Table 6.

**Table 6. Hypotheses**

| | ***Test*** | ***Sig (2-Tailed)*** | **Decision** |
|---|---|---|---|
| Network externality awareness according to the education area is different. | Chi-Square=11,086 | 0,780 | No. |
| Network externality awareness of working people and non-working people are different. | Mann Whitney U=658,5 | 0,522 | No |
| Network externality awareness of people who learnt about economics and didn't learn economics are different. | t=1,134 | 0,259 | No |
| Network externality awareness of people who read about "Internet Economics", "Computer Economics", "New Economics" are different. | t=0,759 | 0,450 | No |
| Network externality awareness of people who were registered in Social Sharing sites and who were not, are different. | t=-0,331 | 0,741 | No |
| Network externality awareness of people who chose widely used internet browser (explorer) and who chose less widely used internet browser (Mozilla) are different. | t=0,020 | 0,984 | No |
| Network externality awareness of people who used much preferred e-mail system (Hotmail) and who used less preferred e-mail system (gmail) are different. | Mann Whitney U= 712 | 0,421 | No |
| **Network externality awareness of people who used much preferred Keyboard type (QWERTY) and who used less preferred Keyboard type (F type) are different.** | Mann Whitney U= 520 | 0,451 | No |

H1: Network externality awareness according to the education area is different.

The pupils who are taught in Economical and Administrative Sciences are more informed about economics and externality than pupils in Technical Programmes. All of Economical and Administrative Programmes include lessons whose name is Economics I. Also many programmes include lessons such as

Money and Banking, Money Policy, Economics II. But Technical Programmes have no lessons about economics. So it is normal for Economical and Administrative pupils to be more informed about network externalities. But Chi square test results denied this hypothesis and our expectations (Sig 2-tailed score 0,780; Chi Square= 11,086).

H2: Network externality awareness of working people and non-working people are different.

Working pupils are more informed about the realities of life than non working pupils. Therefore we thought that the awareness of working pupils may be higher than non working pupils. We used non parametric test Mann Whitney, because only 18 sample are still working (Table 3). But test results don't confirm this hypothesis. Both groups have low awareness degree (Sig 2-tailed score 0,522, Mann Whitney U=658,5).

H3: Network externality awareness of people who learnt about economics and didn't learn economics are different.

As we stated in H1 hypothesis, while Economical and Administrative Programmes include Economics lessons, Technical programmes don't include economics. But some of pupils who registered in Technical programmes have registered in Anadolu University Open Education Faculty Economical and Administrative Programmes and some of them have learned Economics in Lycee. So we decided to test if network awareness of pupils who learnt about economics are different than pupils didn't learn economics. The scores of T test does not confirm our hypothesis (Sig 2-tailed score 0,780 and T=1,134).

H4: Network externality awareness of people who read about "Internet Economics", "Computer Economics", "New Economics" are different.

Network externality is one of the main issue of new economy. Although micro economics don't give necessary importance to network externality, books about new economy, internet economy include network externalities. For this reason we expected that pupils who read or interested about "New Economy" will be more informed about network externality. But the scores of T test does not confirm our expectation (Sig 2-tailed score 0,450 and T=0,759).

H5: Network externality awareness of people who were registered in Social Sharing sites and who were not, are different.

Social Sharing sites such as Facebook, Twitter facilitate the communication of people. People, who registered in these sites, spend important part of their time in internet. Also if they choose popular social sharing sites, they may get more benefit by getting more chance to find friends. We thought that most of people are aware of this advantage of popular social sharing sites, so they may be more informed or conscious about network externality. But the scores of T test does not confirm our hypothesis (Sig 2-tailed score 0,741 and T=-0,331).

H6: Network externality awareness of people who chose widely used internet browser (explorer) and who chose less widely used internet browser (Mozilla) are different.

Browser market is one of the classical example in which we can witness network externality (Spinello; 2005:343, Chiaravuthi; 2006:28-29). Consumers are willing to pay more for office related software others are using and that is compatible with other software. Using popular internet browser, provide many facilitations like finding compatible hardware and software, knowing people who uses this kind of browser etc. From Table 4, we saw that %54 of pupils choose explorer instead of other browsers such as Mozilla, Netscape Navigator. Our expectation is that pupils, who choose popular internet browser (explorer), are more conscious about network externality. But the scores of T test does not confirm our hypothesis (Sig 2-tailed score 0,984 and T=0,020).

H7: Network externality awareness of people who used much preferred e-mail system (Hotmail) and who used less preferred e-mail system (gmail) are different.

We saw that %73 of pupils prefer Hotmail system. Choosing popular e-mail system probably make possible to communicate with more young people, in other words network externality is one of the reason of preferring popular e-mail services. Therefore we expected to find pupils, who choose hotmail services, are more informed and conscious about network externality. The number of pupils, who use gmail e-mail system, are smaller than 30 (from table 4, you can see that it is 22). Because of that reason we prefer to use Mann-Whitney (non parametric test). The scores of Mann-Whitney test does not confirm our hypothesis (Sig 2-tailed score 0,421 and Mann Whitney=712).

H8: Network externality awareness of people who used much preferred Keyboard type (QWERTY) and who used less preferred Keyboard types (F type) are different.

Keyboard types are most classical examples in which we saw in literature about network externality (David;1985:334). We hoped to find that pupils, who use QWERTY type keyboards, are more conscious about network externality. The number of pupils, who use F type Keyboard, are smaller than 30 (from table 4, you can see that it is 14). Because of that reason we prefer to use Mann-Whitney (non parametric test). The scores of Mann-Whitney test does not confirm our hypothesis (Sig 2-tailed score 0,451 and Mann Whitney=520).

As a result all groups have average between 2.5 and 3.5, near 3. From this result we can say that the generality of pupils neither agree nor don't agree with network effects and have neutral bias about network externality. They don't see the positive effects nor negative effects of networks. But empirical studies in Western economies confirm the hypothesis "Browser software exhibits direct network externalities, and direct network externalities exist in market leader's product"

## 5.Conclusion

Economists have been widely interested with networks and network effects since pioneer studies (Katz and Shapiro;1985 and 1986). However micro economics, academical books have not much interested with networks. Also there is difficulty in finding empirical academic studies about network and network effects. Our aim is to contribute literature about Turkish economic searches. We applied survey on pupils, who registered in Beykent University Vocational School to measure perceptions about network effects. After statistical tests we revealed that pupils are neutral about network effects. They don't think networks have positive nor negative effects on consumers. At first this result is surprising to us. But "network externality" books are not in the center of economics curriculum. Especially the hours of economics in Vocational Schools are limited and lecturers prefer to mention about more important subjects in lessons. Therefore there is no different perception between pupils who learnt economics and who didn't learn economics. All lessons should be ended in two years period, but in this period Vocational schools should give both main lessons such as "Economics", "Enterprise Management", "Atatürk Principles and Revolution", "Turkish Literature" and vocational lessons. Two years period is not enough for effective education of main and vocational lessons. Also we revealed that pupils, who read books about new economy, internet economy and interested with computer economics, are not aware of networks and network effects. These results may be two reasons. First these books may not contain network effects or give less importance to it, second pupils may not find network effects as interesting subject and forgot they read about networks easily. Although pupils prefer most popular Keyboard type (%86 use QWERTY see Table 4), most popular Internet browser (%54 use Explorer see Table 4) they don't know the advantages or disadvantages of using them. They just use them. This result shows that pupils are not conscious consumers who search about goods, although new Information Technology provides facilities to learn more about goods (Dilek, 2010:64-65).

This is also true for micro economics in faculties. Micro economic student books and curriculum concern about new economics, internet economics and networks (Varian;2006:650-669) but critical

questions are “Do the hours of microeconomics in a week enough?”, “Do lecturers find enough time to mention about new economy and networks in Micro economy lectures?”. These questions may be subject of other researches.

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