MARKET EQUILIBRIUM OF NETWORK INDUSTRIES IN THE NEW ECONOMY*

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Abstract

In this paper we analysed network externality as very important phenomenon in the ICT industry. The press has produced endless discussions of the high-tech industries, the dot.com revolution, and the "new economy". We argue that knowledge-intensive industries are a fact of life and that their economic characteristics have significant and enduring implications. We acknowledge that microelectronisc has had a powerful impact on the nature of competition through commoditisation of products, and innovation in distribution channels.

In contemporary world, informational goods are very important and they value depend on information that they give. Network externality are characteristic of informational goods. We argue that the dynamics of network externalities create new situations for our traditional industrial economy such that new types of economies of scale are emerging and new business strategies are becoming prevalent.

The World Wide Web - Internet becomes far more useful as more poeople use it. This phenomenon, in which a goods value to an individual is greater when many other people own or use the same good, is common in technology-driven sectors of the economy. This is called a network externality because the most obvious versions occur when the goods involved form some kind of communications or transportation network.

The first part introduces the idea of network externalities and explores the workings of a market for a good that becomes more valuable to everyone as more people purchase it. The second part feature fierce battles for market supremacy between competing computer operating systems, in an environment where the strong are likely to devour the weak.

Hence, in this paper we discuss two propositions: the supply and demand of knowledge, and network externalities. We outline the characteristics that distinguish knowledge-intensive industries from the general run of manufacturing and service businesses. Knowledge intensity and knowledge specialisation has developed as markets and globalisation have grown, leading to progressive incentives to outsource and for industries to deconstruct. The outcome has been more intensive competition. The paper looks at what is potentially the most powerful economic mechanism: positive feedback, alternatively known as demand-side increasing returns, network effects, or network externalities. We present alternative demand curves that incorporate positive feedback and discuss their potential economic and strategic consequences. We argue that knowledge supply and demand, and the dynamics of network externalities create new situations for our traditional industrial economy such that new types of economies of scale are emerging and "winner takes all" strategies are having more influence.

Key words: *network externality, ICT industry, new economy, informational goods, new competitive model, demand, supply, equilibrium, profit*

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Introduction

In the past fifty years, the world has witnessed the rise of information and communication technologies (ICT). It has changed the nature of the commercial environment and has increased the speed of operation, driven by the increase in connectivity between companies, and between companies and their customers. Network industries, such as telecommunications, the Internet, computing and software, have had a significant role in shaping the corporate environment into a new network economy.

The question: Do the same economic "laws" hold for the new network economy as for the traditional industrial economy? has attracted much attention in business and in academia. The popular press has been excited by the possibility of a New World in which the old economics is somehow stood on its head. Academic economists have generally been more cautious. Shapiro and Varian (1999) in their excellent book on the information economy recognise these dynamics but assert "Technology changes. Economic laws do not". The impact of the Internet and computer networks nevertheless has created a new type of market failure driven by technology, high-risk network externalities, and zero marginal costs.[1]

According a new commercial scenario, networks no longer belong to a single firm. Strategy goes beyond the efficient use of network structure and the relevant allocation of cost. Collaboration between firms has become mandatory for intra-network compatibility, a feature that is crucial in telecommunications. Collaboration and antimonopoly pressures have led to a shift towards fragmented ownership and oligopolistic circumstances. Underpinning networks and the growth of collaboration are the following well-known characteristics of information goods, such as digitised information as in recorded music, software, football scores, encyclopaedias and telephone directories:

1. High fixed costs but low to vanishing marginal costs, thus high costs of creating intellectual property, but low costs of reproduction.
2. Low costs of copying intellectual property.
3. Information is an experience good every time it is consumed.
4. With easy access to information, there is information overload – value arises from location, filtering and communicating what is useful. Search engines facilitate this.
5. An extensive, expensive technology infrastructure is required to produce and distribute information.
6. Pricing is value-based, rather than cost-based.[2]

However, these characteristics do result in an emphasis on volume and a tendency in certain circumstances, for example in fragmented markets, for price to fall precipitously towards marginal cost, i.e. to zero. But information products are susceptible to differentiation to convey quality signals and endorsement. Such products are customised through timing or individual customer data in the form of personalised web sites. At the same time the low marginal cost characteristics of information goods make it attractive to create dedicated distribution channels for information transfer (one-way or two-way) through which information differentiation can also be attempted. This differentiation has provided the basis for ecommerce and the growth of the Internet.

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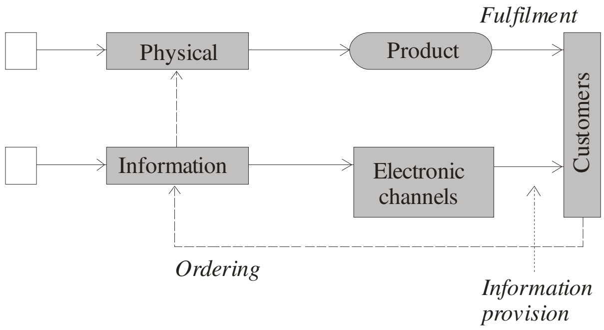
[1] For details see: Dumont B. (2000) Book Review: Carl Shapiro and Hal R. Varian, Information Rules: A Strategic Guide to the Network Economy. *Journal of Network Industries*.

[2] McGee, J., Sammut Bonnici, T. A. (2002) "Network Industries in the New Economy", *European Business Journal,* p. 117.

On the basis of these characteristics, there has been a systematic and ever-increasing shift from the traditional industrial economy to a knowledge based or information economy. It is created a new competitive model by splitting the information flows from the physical flows. Thus, the success of business hinges on two levels of transaction: the traditional flow of products to the supply channels, and the flow of information from the company to the customer, via channels such as the Internet. Scheme 1 illustrates these two levels.



Scheme 1. The New Competitive Model

Source: McGee, J., Sammut Bonnici, T. A. (2002) "Network Industries in the New Economy", *European Business Journal*, p. 119.

1. Concept and Effects of Network Externalities

"This phenomenon, in which a good's value to an individual is greater when many other people own or use the same good, is common in technology-driven sectors of the economy. This is called a network externality because the most obvious versions of the "fax machine effect" occur when the goods involved form some kind of communications or transportation network. But the phenomenon is considerably more widespread than that".[3] In this context, networks are defined as a set membership of economic entities with an underlying physical or economic linkage. The empirical literature on markets with network effects has increased in the past years such as PC spreadsheets (Gandal, 1995; Brynjolfsson and Kemerer, 1996), video cassette recorders (Ohashi, 2003), CD players and disks (Gandal et al., 2000), DVD players (Dranove and Gandal, 2003), and operating systems (Economides, 2000; Kretschmer, 2004). Let us take for example Picture Phones market. These are telephones that send and receive pictures of the conversing parties. You can talk on a Picture Phone with someone only if both of you have Picture Phones. Your Buyer Value for a Picture Phone therefore depends on the number of other people who also have these phones. Network Externalities Initial Value is given in advance. Your Buyer Value will depend both on your Initial Value and on the total number of phones sold, according to the formula:

Buyer Value = Initial Value * Network Externality Factor;

where the Network Externality Factor depends on the total number of demanders who buy a Picture Phone. Buyer Value will be determined by the total number of people who bought Picture Phones. Profit (or loss) will be Buyer Value minus the price you paid.

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[3] Suing Children, S., "Technology, Innovation, and Network Externalities", in Krugman P., and Wells R., *Microeconomics*, Worth Publishers, 2004, p. 526.

Hence, network effect is achieved when consumption of goods by other people increase marginal utility of this good for other users. The purpose of network externalities is to gain effect of accumulate bundle of positive and negative effects, inside or outside of network, on every member of network. For better understanding these effects, we will show, shortly, direct and indirect effects.

Direct network effects are caused by demand side user externalities. Positive direct network effects result in an immediate utility gain for the participants, with an increasing number of users operating the same (compatible) system commodity.[4] A classical example is the telephone system, a more recent one is electronic mail (e-mail). A significant factors in the occurrence of direct network effects are definition of standards as well as creation of mechanisms for access to products and services of other producers (e.g. converters and adapters).[5]

Indirect network effects are caused by supply side user externalities. "Positive indirect network effects occur from the realization of returns to scale (i.e. falling unit costs in mass production, learning by doing, learning by using) which are passed on to users in the form of price cuts or quality increases".[6] Further sources of indirect network effects are complementary goods and services ("hardware-software paradigm").[7]

2. Buyers' and Sellers' Profit in the Case of Network Externality

For better explanation of origination and effects of network externalities, we will consider example of operating systems. Demanders must decide which operating system to buy. Buyers will have network externalities only with people who buy the same operating system. People with different operating systems are not able to exchange files and other information as cheaply and easily as those with the same operating system. Buyer Values for each operating system are related to the number of persons who purchase the product.

2.1. Buyers' Profit Information

Effect of network externalities, from the point of buyer of operating systems, attempt in: existence of other users with who we can exchange experience and files (direct effects), existence of programs for concrete operating system (indirect effects) and interoperability between PCs, laptops, PDA and smart phones (indirect effects). We can emphasize example of MS Windows and MS Office in PC computers: if we have larger number of users of current program platform, the larger is number of new applications developed for this platform. This leads to development of compatible product (laptops, PDA, and phones) with possibility for data exchange with Windows systems, review of Office documents or synchronization of e-mail clients. There are other sources of effects of network externalities on buyers side, however, in this paper we will analyse profit of buyer.

When you first buy an operating system, you have to pay not only the price charged by the seller but also a learning cost. As you may know from experience, learning to use a new operating system is time-consuming and costly. In subsequent rounds of this experiment, you must either buy an updated version of your current system from the seller who sold it to you or switch to another system. If you update the operating system that you had in the previous round,

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[4] For details see: Farrell, J. and Saloner, G. (1985) and (1986)

[5] For details see: Schoder, D. (2000)

[6] Schoder, D. (2000) "Forecasting the Success of Telecommunication Services in the Presence of Network Effects", *Information Economics and Policy*, 12, p. 182.

[7] For details see: Katz, M. L., Shapiro, C. (1994) "Systems Competition and Network Effects", *Journal of Economic Perspectives*, 8(2), pp. 93-115.

you won't have to pay the learning cost. But if you change operating systems from one round to another, you will have to pay the learning cost as well as the price charged by the supplier. To find your profits, subtract the sum of the price you pay for the operating system and your learning cost (if any) from your Buyer Value.

2.2. Sellers' Profit Information

From the point of seller, effects of network externalities, by selection of operating systems attempt in: increase of knowledge during creation of operating system, increase of number of sold systems can lead to larger investments in system improvement or development of new applications, cooperation with other producers can spread of operating system on compatible systems like PDA, and success which operating system realize on large markets (like Chinese) can reflect on success on other markets ("China effect").

Started example must be extended with added data. Sellers of operating systems have a marginal cost for each unit they sell. When they first open for business, they must pay a fixed cost. At the end of each round, sellers will have the option of going out of business. After the first round, for each round that they remain in business, sellers must pay an additional fixed cost, for advertising and promotion, regardless of how many units they sell.

In any round, if a seller's market share falls below determinated value, she will have to declare bankruptcy. Firms that have been declared bankrupt must leave the market and they will lose in the best case fixed cost from their misadventure. At the end of the last round of play, those sellers who are still in business will each receive an additional payment for each customer that they sold to in the final round. This payment represents the value to the seller of an installed customer base.

Sellers can vary their prices or offer discounts as they wish throughout this session. Sellers are allowed to sell at less than marginal cost or even to bribe buyers to use their operating system by selling at a negative price. At the beginning of each new round, each seller can decide whether to drop out or continue into the next round.

3. The Sources of Network Externalities

A product is said to exhibit network externalities if its Buyer Value for those who consume it is higher, the greater the number of other consumers who also consume the product. Some of the most striking instances of network externalities occur with products that aid communications. The value to you of a device that sends and receives messages will be larger, the greater the number of people who can receive your messages and send messages to you. For this reason, communications devices like the telegraph, telephone, fax machine, and computers connected to the internet all exhibit strong network externalities. Each of these technologies enjoyed a period of explosive growth as the value of being connected to the network increased at the same time that the network grew.

Another source of network externalities is the development of shared support facilities, which are known as infrastructure. On example, if only a few people own high-definition television sets, they will not be of much use because broadcasting companies will not produce many television shows in that format. If only a few people in your country have automobiles, then it is difficult to find gasoline stations, repair shops, and good roads. As more people acquire automobiles, the shared infrastructure grows and owning an automobile becomes more attractive. Sony's Beta system for showing videos lost out to the VHS system as the number of VHS users increased and the number of movies available for VHS exceeded the number available for the Beta system. Consumers' willingness to pay for CD players increased drastically as more CD players were sold, because a large installed base of CD players induced record companies to record more music on CDs.

4. Network Externalities and the Demand Curve

The demand curve is a powerful tool for studying markets without network externalities. The question is will this tool also work when there are network externalities?

Before we draw a demand curve with network externalities, let us take a second look at the demand curve for the familiar case where there are no network externalities. Instead of finding the quantity demanded at each price, we find the highest price at which each quantity will be demanded.

In the case where each demander can buy up to one unit of the good, finding the highest price at which q units will be demanded is straightforward. To sell q units you will need to find q buyers, each of whom has a Buyer Value that is at least as high as the price you are asking. So how high can you set your price and still find q buyers? If you set your price equal to the qth highest Buyer Value in the market, then there will be q buyers who are willing to buy at that price. Moreover, if you try to raise the price any higher, the qth buyer will no longer want to buy, and you will not be able to sell all q units. That is, the highest price at which q units will be demanded is the qth highest Buyer Value. If we define a function $P(.)$ such that $P(q)$ is the qth highest Buyer Value, then it will always be the case that q units will be demanded at the price $P(q)$. Economists sometimes call this function the inverse demand function.

4.1. The No-Regrets Demand Curve with Network Externalities

When we draw a demand curve for a good with network externalities, it is convenient to do so by finding the price(s) at which each quantity will be demanded. For each quantity q, let us define $P(q)$ to be the qth highest Buyer Value <u>when exactly q units are sold</u>. The phrase is needed because when there are network externalities, each demander's Buyer Value depends on the total number of units that are sold. It is useful to think of $P(q)$ as defining a “no-regrets" demand curve. Suppose that at the price $p = P(q)$, the q demanders with the largest Buyer Values all buy the good and the remaining demanders with lower Buyer Values do not buy it. In this case, no demander will have regrets about his decision to buy or not buy. Since the lowest Buyer Value of the q buyers is $P(q)$, each of them has a Buyer Value that is at least as high as the price. Therefore none of the q buyers will regret buying at price $P(q)$. The remaining demanders that did not buy all have Buyer Values that are no larger than $P(q)$, and therefore none of them would make a profit by buying given that the total number of items sold is q. It follows that at the price $P(q)$ none of these demanders will regret their decision not to buy.[8]

To fix this idea, let us work with an example. Consider a group of 100 companies that interact occasionally with each other. They are given an opportunity to join a video conferencing network. The value to each firm of joining the network is proportional to the total number of firms that join. We will number the firms 1, 2, ..., 100, where Firm q is the qth largest of these firms. Larger firms find it more valuable to belong to the network than smaller firms. Firm q's Buyer Value is equal to $\$(100-q)$ times the total number of firms that are in the network. If k

[8] The careful reader will notice that if one of the demanders that are currently not buying decides to buy (and the others continue to buy) then the number of buyers would become $q + 1$, so that the demander with the $q + 1$st highest Buyer Value may find it profitable to buy. The function $P(q)$, as we have defined it, is the no-regrets demand curve that applies either when demanders are too unimaginative to notice that if they buy they will increase the total number of users by one, or when there are so many buyers that a single additional buyer has a negligible effect on the Buyer Value of any one individual.

firms join the network, Firm *q*'s Buyer Value will be *$(100-q)k*. If Firm *q* expects exactly *q* firms to join the network, its Buyer Value will be $\$(100-q)q = \$100q - q^2$. Since Firm *q* always has the *q*th highest Buyer Value, and since its Buyer Value when exactly *q* firms join the network is $\$100q - q^2$, it follows that $P(q) = \$100q - q^2$, for *q* ranging from 0 to 100.

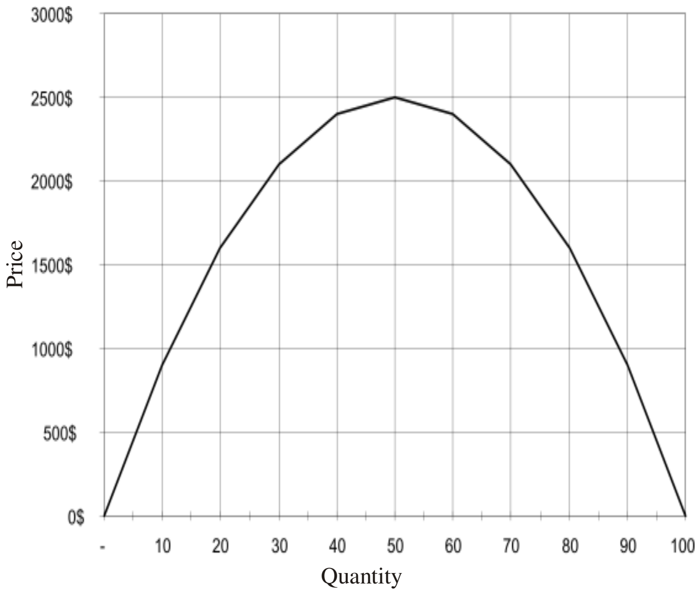

Figure 1. A No-Regrets Demand Curve

In addition to the parabola $P(q) = \$100q - q^2$, the no-regrets demand curve includes a vertical line segment extending upward from the origin. This line segment is included because if firms believe that the number of firms in the network will be zero, then every firm's Buyer Value will be 0 and no firms will want to join the network.

5. Equilibrium with Network Externalities

Now that we have drawn a demand curve, we can add a supply curve and find competitive equilibrium. Let us assume that the cost of adding each additional firm to the network is $2,100. Then the supply curve for connections to the network is a horizontal line segment running across the graph at a height of $2,100, as shown in Figure 2. The supply curve crosses the demand curve at three points, which we have labeled *B, C,* and *D*, corresponding to outcomes in which the number of firms connected to the network is 0, 30, and 70. Each of these outcomes is an equilibrium quantity when the cost of joining the network is $2,100. If everyone believes that no firms will join the network, then nobody will want to join; if everybody believes that exactly 30 firms will join the network, then exactly 30 firms will want to join; and if everybody believes that exactly 70 firms will join the network, then exactly 70 firms will want to join.

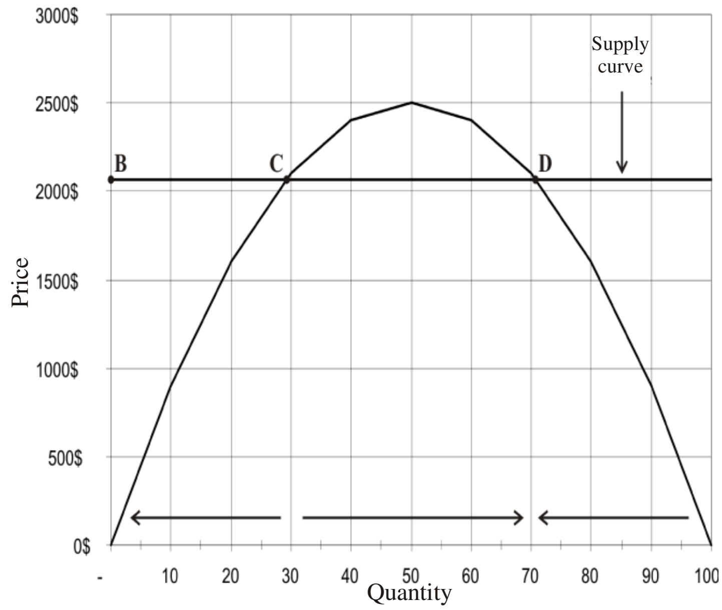

Figure 2. Network Supply and Demand

5.1. Stable and Unstable Equilibria

When a market has more than one equilbrium, it is often useful to investigate the dynamics of that market. The dynamics of any economic system describes the movement of the variables in that system over time when it is out of equilibrium. By studying the dynamics, we can often determine whether an equilibrium is likely to persist, even if the market is subject to small shocks and surprises. A stable equilibrium is an equilibrium such that after small movements away from equilibrium the system will return to (or very close to) the equilibrium. An unstable equilibrium is an equilibrium such that after very small movements away from equilibrium, the system will move even further away.

The dynamic issue that concerns us is whether the number of firms in the network will increase or decrease if it starts out at some arbitrary quantity q. Let us assume that firms will leave the network if they are losing money and that firms will join the network if, given the current number of members, they could make a profit by joining. Suppose that the initial number of members is q. If $P(q) <\$2,100$, then Firm q, which has a Buyer Value of $P(q)$, is paying a higher price than its Buyer Value, so it will leave the network, causing q to decrease. If we look at Figure 2 we see that $P(q) <\$2,100$ when $0 < q < 30$ and when $70 < q \leq 100$. Therefore if q is in either of these ranges, q will decrease over time. In Figure 2, we have drawn leftward-pointing arrows just above the horizontal axis to show that q will decrease whenever it is in these regions.

Looking at Figure 2, we see that $P(30) =\$2,100$ and $P(31) >\$2,100$. Therefore if Firms 1 through 30 initially belongs to the network, they will all be willing to stay. Then, since $P(31) >\$2,100$, Firm 31 would make a profit by joining the network, which would now have 31 members. We see from the graph that $P(32) >\$2,100$ and so if the network attracts 31 members, Firm 32 will join. Since $P(q) \geq \$2,100$ for all q ranging from 30 to 70, if the network gets larger than 30, it will grow until it has 70 members. In Figure 2, we have drawn a rightward-pointing arrow just above the horizontal axis to show that q will increase whenever it is between 30 and 70.

We can now see which of the equilibria are stable and which are unstable by looking at the arrows in Figure 2. If the initial quantity q is smaller than 30, the arrow points to the left and the quantity will decrease over time until it reaches 0. If the initial quantity is between 30 and 70, the arrow points to the right and the quantity will increase over time until it reaches 70. If the initial quantity is between 70 and 100, the arrow points to the left and the quantity will decrease over time until it reaches 70. Therefore the equilibrium in which 0 firms join the network and the equilibrium in which 70 firms join are both stable.

The equilibrium with 30 firms, on the other hand, is unstable. A small change in either direction will move q further away from 30. Suppose that initially, Firms 1 through 30 belong to the network. If by some accident one firm drops out of the network, then at least one of the remaining 29 firms will find it unprofitable to belong and will leave. But when this happens, the Buyer Values of the remaining firms will fall once again and another firm will leave, and so on until the network has no remaining members.[9] If, on the other hand, Firm 31 decides to join Firms 1 through 30 in the network, then not only will Firm 31 make a profit, but Firm 32 can make a profit by joining Firms 1 through 31, and so on, until the network has 70 members.

Of the two stable equilibria, the high-level equilibrium has greater total profits. The equilibrium with no firms in the network results in zero profits for everyone, while in the 70 firm equilibrium, Firms 1 through 69 all make positive profits and the other firms make zero profits. Clearly Firms 1 through 69 would prefer the high-level equilibrium if they could reach it. Suppose that the network starts out at the equilibrium with no members. If Firms 1 through 70 all believed that the others will join, then it would be profitable for each of them to join.[10] When we study the dynamics, we see something very interesting. To get to the high-level equilibrium from the zero equilibrium, it would not be necessary for all 70 firms to agree in advance to join. All that would be needed is to achieve a critical mass of 31 members. That is, the number needed to get just beyond the unstable equilibrium at 30. If Firm 31 joins, then it will be profitable for Firm 32 to join. At this point, the dominoes begin to fall. Firm *33* will be attracted by the other 32 members, and then 34, and so it goes all the way up to 70.

In large markets, where information about what others are doing is not as good, this coordination is harder to achieve. Sellers of network goods may try to reach critical mass by offering special promotions in which early purchasers get price discounts and by advertising that is intended to convince potential buyers that there are many other users of their product.

5.2. Gaps Between Buyer Values

When there are a small number of types, we have a slightly more complicated demand curve with steps corresponding to gaps between the Buyer Values of one type and the next. It will be helpful to work out an example that is similar to the market for Picture Phones in session 1 of this paper.

In this example, there are 5 types of demanders and 6 demanders of each type. Demanders of Type 1 have Initial Values of 1, demanders of Type 2 have Initial Values of 2, and so on up to Type 5. The Buyer Value of each demander is equal to his Initial Value multiplied by a "Network Externality Factor" that depends on the total number of units sold. Table 1. specifies the way that Network Externality Factors are determined by the total number of units sold.

[9] Group health insurance plans occasionally fail in this way, as healthy people drop out of the plan. Such a collapse is known in the insurance industry as a "death spiral".

[10] Firm 70 would be just indifferent.

Table 1. Network Externality Factors

If Number of Units Sold is in Range	Network Externality Factor is
1-6	1
7-12	2
13-18	3
19-24	4
25-30	5

For this market, a no-regrets demand curve is drawn in Figure 3. To construct this curve, we first graph *P(q)*, which is the *q*th highest Buyer Value when the number of units sold is *q*. We complete the demand curve by drawing vertical lines to fill in the gaps.[11]

If *q* is any number from 1 to 6, the Network Externality Factor is 1. Since there are 6 demanders of each type, the demander with the *q*th highest Buyer Value must be a Type 5 with an Initial Value of *$5*. Since *P(q)* is equal to the Initial Value of a Type 5 times the Network Externality Factor, it follows that *P(q) = $5 * 1 = $5* for all *q* from 1 to 6. If we assume that buyers can buy fractional units, then we can "fill in the line" so that the graph of *P(q)* includes the horizontal line segment running from (0; 5) to (6; 5).

If *q* is any number from 7 to 12, the Network Externality Factor is 2. For *q* in this range, the demander with the *q*th highest Buyer Value must be a Type 4, with Initial Value 4. Therefore for *q* ranging from 7 to 12, *P(q) = $4 * 2 = $8*. Assuming, again, that demanders can buy fractional units, the graph of *P(q)* includes the horizontal line segment running from (6; 8) to (12; 8). Similar reasoning will show that for *q* in the range from 13 to 18, *P(q) = $3*3 = $9*; for *q* in the range from 19 to 24, *P(q) = $2*4 = $8*; and for *q* in the range from 25 to 30, *P(q) = $1*5 = $5*. This explains the 5 horizontal line segments on the demand curve.

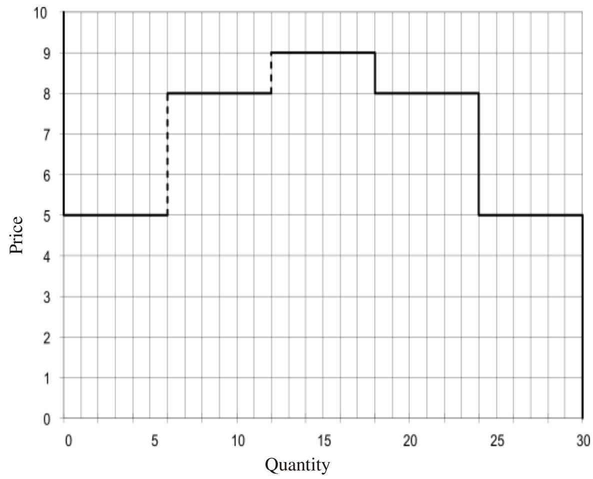

Figure 3. A Network Demand Curve

[11] We have drawn the vertical lines for the "upward" jumps as dashed lines, because they are not actually on the no-regrets demand curve. However, we don't really need to explore these "bits" of the demand curve, since they are never stable equilibria.

We also need to show that the solid vertical line segments drawn in Figure 3 really belong on the demand curve. If the price is greater than $5 and nobody buys the product, then the Network Externality Factor is 1 and the highest Buyer Value is only $5, so that nobody will want to buy the good. Therefore the demand curve includes the vertical line segment that extends upward from (0; 5). Next let us show that the vertical line segment from (30; 0) to (30; 5) belongs to the demand curve. If the quantity is 30, the Network Externality Factor is 5, which implies that the lowest Buyer Value (that of the Type 1s) is $5 = $1*5. Therefore at any price below $5, all 30 demanders will make a profit by buying the product, and hence the demand curve should include all points at which the quantity is 30 and the price is less than 5. The vertical line segment running from (24; 5) to (24; 8) also belongs to the demand curve. If q = 24, then the Network Externality Factor is 4, and therefore at prices between $5 and $8, the 24 demanders of Types 2, 3, 4, and 5 would want to buy since their Buyer Values are at least $2*4 = $8. At these prices with q = 24, demanders of Type 1 are not willing to pay more than $5. Therefore, if the price is between $5 and $8, and the 24 demanders of Types 2-5 buy the product, each of them will make a profit while the 6 Type 1s will not want to buy. Finally, we show that the vertical line segment running from (18; 8) to (18; 9) belongs to the demand curve. If q = 18 the Network Externality Factor is 3. At prices between $8 and $9, the 18 demanders of Types 5, 4, and 3 will all want to buy since their Buyer Values are at least $3*3 = $9. At these prices the Type 2s and Type 1s will not want to buy. Thus we have shown that each of the solid vertical line segments in Figure 3 belongs to the demand curve.

Conclusion

The concept of network externalities is in original introduced in literature about communication technologies (telegraph, phone, fax machine etc.) Basically, this represent effect of increase value of good for users by increasing number of other users of this good. Most studies in this literature consider effect of externality by existing of monopoly on market. This theory is today mainly implemented in information-communication technologies (ICT) world, and particularly in computer technologies. Peculiarity of these markets is existence of lower number of players, and these goods belong in network goods.

In order to reach competitive equilibrium on product market with network externality, we should analyse demand and supply curves. Conclusion is that positive aspects of network externalities work if critical mass of consumers of current product, in this case operating systems, is reached. Achieving of consumers critical mass, the number of new consumers will increase while demand curve is above supply curve. Further, from intersection point of supply and demand curves will not be new members of network, because their costs of joining network are higher than their revenues, so their profits decrease. Because of that, stable equilibria are those in which 0 firms belong to the network (point B) and where point of intersection of supply and demand curves is on higher level (70 firms – point D). Of the two stable equilibria, the high-level equilibrium has greater total profits. The equilibrium with no firms in the network results in zero profits for everyone, while in the 70 firm equilibrium, Firms 1 through 69 all make positive profits and the other firms make zero profits. Because of that, it is very important for sellers and buyers of product with network externalities to know relationship between supply and demand on market, in order to determinate adequate price and number of consumers of these goods, and those are important determinants for realizing profit of all market actors.

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