

Social Networks and Human Behaviour

Soumik Banerjee, Department of Economics, University of Calcutta, Kolkata, India
Shubhashrita Basu, Department of Economics, Jadavpur University, Kolkata, India

Abstract—Social networking – the new language of 21st century – is the theme of our ensuing discussion. We take a look into the varied facets of social networking, along with its different types, pros and dimensions. In this paper we have highlighted how social networking has spread its branches in the field of welfare economics. Inter – relationship among the different members of a society, forming a proper network, group or a committee, for the betterment of society at large, is the field of study of this notion. It has been supplemented by a game – theoretic approach to the provision of a public good, which gives the pay-off of an individual in accordance with his contribution, & whether the pay-off depends on the number of individuals in the game. Social networking has also got shelter under the umbrella of behavioral economics. The behaviour of the agents of the ‘circular flow’ in response to each other’s actions has been looked upon based on this view. Here, the result has been duly supported by a sample survey, conducted by us, based on which a regression exercise has been carried out. We have constructed a mathematical model which shows that it is more profitable for the producers to campaign for their products through e-networking, rather than through traditional media. Finally, just as everything, social networking has its flip side as well. We take a deeper look into the cons of social networking, in the process; prescribing certain policies that we think can be adopted to curb the different ill effects of social networking.

Index Terms—social networking, welfare economics, behavioral economics, game theory, sample survey, regression analysis, mathematical model.

1 INTRODUCTION

Social Networking – the new language of the 21st. century – is a social structure made up of individuals (or organizations) called "nodes", which are tied (connected) by one or more specific types of interdependency, such as friendship, kinship, common interest, financial exchange, dislike, sexual relationships, or relationships of beliefs, knowledge or prestige. It is defined as establishment of relationships with individuals who have similar social or professional interests for the purposes of expanding knowledge and professional / social interaction.

In his “Five Types of Ethical Theory”, Prof. Broad says that the rightness or wrongness of an action taken by the individuals (nodes) can be either deontological or teleological and it is this very action between the different nodes in the society that forms the social networking. Thus despite being a “fashion” of the GenNext, social networking, per se, has always been a part of mankind. For example, even men’s hunting in groups is a form of social networking that was prevalent especially in the earlier days. With the evolution of civilization, social networking has gradually taken the most important position in the life of man. Today it consists of the interaction between buyer and seller in a market, the relation between a teacher and his student, even our daily interactions with our friends, colleagues and parents. International trade forms the best example of where social networking has gone today. As Adam Smith said,

human beings are self-interest maximizers. Thus, his social-networking depends on this basic trait. However, he himself said that one must look for greater societal welfare. And this very social networking among individuals leads to the betterment of the society. Of course in the latter case, there is a role for the government to play. And herein comes the concept of behavioral and welfare economics as has been analyzed latter in this paper.

At present though there are various forms of social networking, it has the Internet still at the edge of its seat due to its popularity with people. Bringing every kind of social group together in one place and letting them interact is really a big thing indeed. Through it one can make friends, do business transactions, buy commodities of one’s choice, have online tutorials, and can even chose one’s life partner!!! One has the whole world at the mercy of one’s finger!! So, let us now look at the pros that social networking presents.

2 A FEW ADVANTAGES OF SOCIAL NETWORKING

The main advantage of social networking is that it brings peo-

ple together – and this invariably leads to self-interest maximization and greater societal welfare. One can get connected with a number of people to form a web of connections that gives one leverage as long as one gives as well as receives. And establishing a social network benefits one in a host of ways – it helps build personal reputation, find a job, showcase one's talents, enhance business contacts and share information. From the business perspective, an entrepreneur can establish a brand and get the wind of the market through social networking. Of course, e-networking, in particular, and, social networking, in general, provides a greater dimension. There are additional advantages through e-networking. One can display one's resume in details (e.g.: LinkedIn). Awareness can be raised about a brand and a product can be marketed in a more interactive, human way (e.g.: creating a YouTube video that entertains and informs). It drives traffic to one's website, blogs, etc., helps spy on the competition, get customer feedback and strengthen customer service. It builds credibility as one can connect with people in a more personal and professional way. This way, it builds loyalty and long-term relation. Also it helps in a greater rate of diffusion of information (even our sample survey showcases this result). And definitely, it's cheaper to use online social networking for both personal and business use because most of it is usually free – social media could be easily utilized to **create cost effective strategies and campaigns** that can create viral results.

Finally, to get an idea of the usefulness of social networking...consider you marooned in an island, alone, without any means of communication!!!

2.2 Case Studies

2.2.1 Network Samaritans

Amit Gupta, a 32-year-old social media entrepreneur, was diagnosed with acute myeloid leukemia (AML) in September and needs an immediate bone marrow transplant. So, he reached out through social media. His friends have organized close to 100 donor drives across the US with the help of social networking sites like Facebook, Google Plus and Twitter. Though the online buzz has not helped him locate a match as yet, but it is slowly building up a bone marrow databank for others in need. Donors, registered for two other such patients, have saved over 250 lives in two years. (Source: 'Stanford Knowledgebase'). It is remarkable how networking sites, mostly started as dating sites, have now evolved to become life saving platforms!!

2.2.2 Dateline Beijing

While everyone has been talking about the 'Arab Spring' and 'Occupy Wall Street', and how the internet played a pivotal role in spreading the revolutions, let us take up a case which can be perhaps of greater significance later. In China, in October this year, when thousands of Dalian took to the streets demanding closure of a chemical plant which was poisoning

their water, the government quickly agrees to shut it down – a significant change in its people-government power equation. Moreover, in 2011, millions of Weibo users exposed corruption scams involving Communist Party officials; and a nascent civil society demanded political reform after prominent artist Ai Weiwei was arrested for pro-democracy utterances. Thus, clearly there is a national furor in China which has been possible only due to formation of social networks and its relation to human behaviour. The strong network has even made the 'Socialist' government in China sit up and take notice.

2.2.3 Unexpected Rage

When Anirudh and Dhanush came up with *Kolaveri Di* not even in their wildest dreams would they have thought of such a success??? There were 3 million hits on YouTube two days after its release, an MTV premiere and even interest shown by viewers from Russia, the Middle East and Pakistan. A tweet says that it has done even more than paneerdosa in bridging the gap between north and south India. Now, that is the power of Social Network!!!

3 THE PATH TRAVERSED: HISTORY OF SOCIAL NETWORKING ANALYSIS

Precursors of social networks in the late 1800s include Émile Durkheim and Ferdinand Tönnies. Tönnies argued that social groups can exist as personal and direct social ties that either link individuals who share values and belief (*gemeinschaft*) or impersonal, formal, and instrumental social links (*gesellschaft*). Durkheim distinguished between a traditional society – "mechanical solidarity" – which prevails if individual differences are minimized, and the modern society – "organic solidarity" – that develops out of cooperation between differentiated individuals with independent roles. After a hiatus in the first decades of the twentieth century, three main traditions in social networks appeared. In the 1930s, J.L. Moreno pioneered the systematic recording and analysis of social interaction in small groups, especially classrooms and work groups (sociometry), while a Harvard group led by W. Lloyd Warner and Elton Mayo explored interpersonal relations at work. In 1940, A.R. Radcliffe-Brown's presidential address to British anthropologists urged the systematic study of networks. However, it took about 15 years before this call was followed-up systematically. A substantively-oriented University of Toronto sociology group developed in the 1970s, centered on former students of Harrison White: S.D. Berkowitz, Harriet Friedmann, Nancy Leslie Howard, Nancy Howell, Lorne Tepperman and Barry Wellman, and also including noted modeler and game theorist Anatol Rapoport. In terms of theory, it critiqued methodologi-

cal individualism and group-based analyses, arguing that seeing the world as social networks offered more analytic leverage. There were two further papers of note that were important early bridges between the sociology literature and the economics literature. These were studies, by Boorman (1975) and Montgomery (1991), which examined the strength of weak ties in labor contact networks.

A good example of the insights that economic modeling can yield behind why networks exhibit certain features concerns seminal experiments of Milgram (1967) who found that the chains of acquaintances needed to connect individuals who might be quite geographically and professionally distant is remarkably low. More recent works include those by Carayol and Roux (2003), Jackson and Rogers (2005), Hojman and Szeidl (2006), and Galeotti, Goyal, and Kamphorst (2006). Another good example is the work of Kranton and Minehart concerning supplier networks.

Clearly, the very concept and even history suggests that social networking as a topic can get shade under the umbrella of both welfare and behavioral economics. We take up the cases in the next sections of our paper.

4 SOCIAL NETWORKING UNDER WELFARE ECONOMICS

One might expect that if agents are free to make promises or transfers of goods, favours, or services to each other, then that could help reconcile individual incentives with societal objectives and thus lead efficient networks to emerge. The basic idea is that the efficient network results in the highest level of total resources or utility, and so if these are appropriately redistributed, then everyone should be better off than at some inefficient network. Thus, the very nature of humans to maximize self interest leads to greater social welfare through social networks. There are ample evidences in this regard, though at a micro-level, around us. People in a locality 'club' together to form committees that organizes cultural functions to charitable work, albeit at a smaller scale. Even the various housing complexes have different such committees. This very notion can be extended to a larger scale, and social networking, especially e-networking, forms the basis of such. These include networks of collaboration among firms, the formation of job contact networks, international trading alliances among countries, information networks, risk-sharing networks, etc. Even the government can step in certain situations like giving subsidies or to use taxes to promote an efficient network to emerge. There are some very basic situations where in order to lead self-interested individuals to form an efficient network one either has to treat identical individuals (who sit in structurally equivalent positions) very differently, or one has to make transfers away from groups that are producing benefits and give it to individuals who are not contributing at all to the

productive value. Thus, there can be tension between stability and efficiency due to the presence of externalities in network. The ensuing game-theoretic approach analyses the same.

4.1 A GAME-THEORETIC APPROACH TO PROVISION OF PUBLIC GOODS

An efficient means of creating social welfare is by providing Public Goods. It is generally provided by some authority, mainly the government. However, people of a locality may form a committee and provide the same. We take a game theoretic approach to see how this works. We make the following assumptions:

- A Public Good is provided if at least one person is willing to pay the cost of the good.
- There are 'n' individuals.
- Cost of the good is $c (>0)$
- If the good is provided, individual i 's pay-off is v_i . Each individual knows her own valuation v_i . She also knows that all valuations are at least v_0 , and at most v_1 ; $0 < v_0 < c < v_1$
- Probability that one individual's valuation is at most ' v ' is $F(v)$, $F' > 0$.
- All 'n' individuals simultaneously submit envelopes – the envelope of any individual may contain either ' c ' or 0 (no intermediate contribution is allowed)
- If at least one individual submit ' c ', the good is provided. All players are better off if the good is provided.

Thus, the Bayesian game is as follows –

Players: the set of 'n' individuals

States: the set of all profiles (v_1, v_2, \dots, v_n) of valuations; where $v_0 \leq v_i \leq v_1, \forall i = 1(1)n$

Actions: each player's set of actions is $\{0, c\}$

Signals: the set of signals that each player may observe is the set of possible valuations. The signal function

$\mu_i(v_1, v_2, \dots, v_n) = v_i$

Beliefs: every player i assigns probability $F(v_1)F(v_2) \dots F(v_{i-1})F(v_{i+1}) \dots F(v_n)$ to the event that the valuation of every other player j is at most v_j .

Pay-off function: Player i 's Bernoulli pay-off in state (v_1, v_2, \dots, v_n) is

$$\begin{cases} 0, \\ v_i \text{ according as who contributes.} \\ v_1 - c \end{cases}$$

In this game, there exists a symmetric Nash equilibrium in which every player contributes if and only if her valuation

exceeds some critical amount v^* . Let us consider player i . Let us also suppose that every other player contributes if and only if her valuation is at least v^* . The probability that at least one of the other player's valuation is at least v^* , which is $(1 - (F(v^*))^{n-1})$. $((F(v^*))^{n-1})$ is the probability that all other valuations are at most v^* . Thus, if player i 's valuation is v_i , her expected pay-off is $(1 - (F(v^*))^{n-1})v_i$ if she does not contribute, and $v_i - c$ if she does contribute. Hence, the conditions for player i to optimally not contribute when $v_i < v^*$ and optimally contribute when $v_i \geq v^*$ are

$$\begin{aligned} (F(v^*))^{n-1}v_i &\leq c, & \text{if } v_i < v^* \\ (F(v^*))^{n-1}v_i &\geq c, & \text{if } v_i \geq v^* \end{aligned}$$

If these inequalities are satisfied, then

$$(F(v^*))^{n-1}v_i = c \dots \dots \dots (1)$$

Thus, the game has a Nash equilibrium in which every player contributes whenever her valuation is at least v^* if and only if v^* satisfies equation (1).

Now, the probability that the good is provided is the probability that at least one player's valuation is at least v^* , which equals $(1 - (F(v^*))^n)$. $((F(v^*))^n)$ is the probability that every player's valuation is less than v^* . From (1), this probability is equal to $1 - \frac{cF(v^*)}{v^*}$. For any given value of v^* , the value of

$(F(v^*))^{n-1}v^*$ decreases as n increases. Thus, to maintain the equality (1), the value of v^* must increase as n increases. We conclude that as n increases, the change in the probability that the good is provided depends on the change in $\frac{F(v^*)}{v^*}$ as v^*

increases: the probability increases if $\frac{F(v^*)}{v^*}$ is a decreasing function of v^* , whereas it decreases if $\frac{F(v^*)}{v^*}$ is an increasing function of v^* . Thus, increasing social network does not always lead to more stable results. Clearly there is a tension between stability and efficiency as mentioned earlier. However, this phenomenon can be attributed to the clash between individual incentive and societal welfare, as has been discussed latter in this paper.

However, individual incentives differ according to the behavioral patterns of different individuals. We take up this notion in the next section.

5 SOCIAL NETWORKING UNDER BEHAVIORAL ECONOMICS

In Economics, we are concerned with the Economic Man who makes logical, rational, self-interested decisions that weigh costs against benefits and maximize value and profit to him. Economic Man is an intelligent, analytic, selfish creature who has perfect self-regulation in pursuit of his future goals and is un-swayed by bodily states and feelings. And Economic Man

is a marvelously convenient pawn for building academic theories. But Economic Man has one fatal flaw: he does not exist!!

When we turn to actual human beings, we find, instead of robot-like logic, all manner of irrational, self-sabotaging, and even altruistic behaviour. This is such a routine observation that it has been made for centuries; indeed, Adam Smith "saw psychology as a part of decision-making," says assistant professor of business administration Nava Ashraf. "He saw a conflict between the passions and the impartial spectator." The very notion of forming social networks depends on human behaviour. Thus, we turn to the sub-discipline called behavioral economics—the study of how real people actually make choices, which draws on insights from both psychology and economics. This field of study can be used to diagnose the advertising and marketing pattern of producers, and how consumers react to such practices.

Looking at the social media marketing vehicle as a "participant" on the social marketplace, it may help illuminate patterns that help the marketing vehicle navigate uncharted 'mind fields' with their experimental partners (read customers). While this perspective should not be news to skilled brand managers, the key here would be developing patterns and tools that help brand managers make more effective decisions.

These theories could be used to:

1. Create markets with specific incentives (watch out for unintended consequences),
2. Make decisions that drive the market entity's/ brand vehicle's behaviour within a marketplace,
3. Leverage various market players' behaviour in a marketplace to one's market entity's/ brand vehicle's advantage.

Hereby, we undertake a sample survey, followed by a regression analysis to look at how the consumers behave in response to marketing strategies of various enterprises.

5.1 Regression Analysis

Using the results of our sample survey, we undertake a regression analysis between **the proportion of annual real income spent and whether one is influenced by advertisements in the internet and advertisements in the traditional media such as newspaper, television, etc.; and real yearly family income.**

Let Y denote the proportion of annual real income spent. X_1 denotes whether one is influenced by advertisements in the internet, X_2 denotes whether one is influenced by advertisements in the traditional media, and X_3 denotes the real yearly family income. Clearly, both X_1 and X_2 are dummy variables. X_1 and X_2 has been allotted the value **1 if the answer is 'yes'** and the value **0 if the answer is 'no'**.

Here, we want to estimate the regression line:

$$y = \alpha + \beta_1x_1 + \beta_2x_2 + \beta_3x_3$$

From the **Regression Statistics table** in the excel sheet we find **$R^2 = 0.395995$** . This means that 39.5995% of the variation of y ,

around \bar{y} (its mean) is explained by the regressors x_i . From the **Regression Co-efficient table** we get the **t-stat** of the variable X_1 is **3.769**, while that of X_2 is **-0.484**, and that of X_3 is **-2.6052**. Thus, the variable X_1 is significant while the variable X_2 is insignificant (since as a 'rule of thumb', if $-2 < t\text{-stat} < 2$, the parameter is not significant), that is to say that if people influenced more by advertisements in the internet significantly spend a greater proportion of their income than those who are influenced by advertisements in the traditional media. However, consumption expenditure depends on other factors also as is clear from the t-stat(9.204) of the intercept term. Thus, we get the fitted line as (the figures in the parenthesis denote the respective standard error):

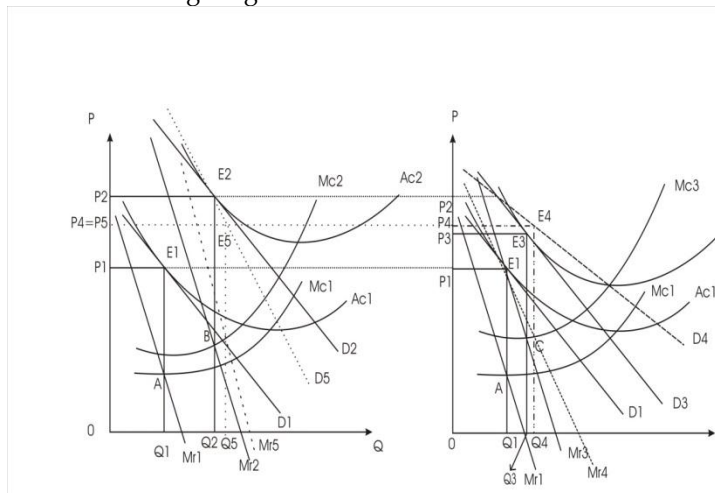
$$Y = 0.1026 + 0.03266 * X_1 - 0.005 * X_2 - 0.000379 * X_3$$

(0.0111) (0.0087) (0.0102) (0.0005)

Next we construct a simple model to look at the producer's side of the story.

6. THE MODEL

In the model we have tried to show that it is more profitable for the producers to campaign for their products through e-networking, rather than through traditional media. We consider two cases of a representative firm - in one case it is giving advertisements in the traditional media, and in the other case it is giving advertisements in the internet.



6.1 EXPLANATION OF THE MODEL

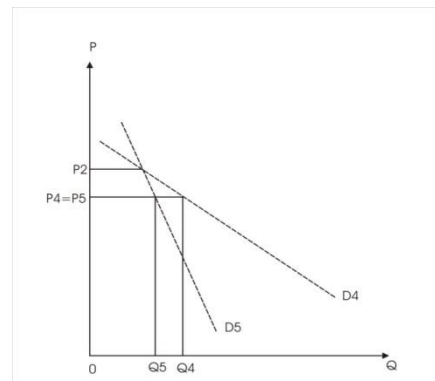
Case 1: We consider the initial equilibrium to be E_1 , where price = P_1 and quantity = Q_1 . We consider a rise in the advertisement cost of the firm, as a result of which AC_1 curve shifts up to AC_2 . The new demand curve (shifted as there is greater demand of the good being influenced by advertisements) and the shifted AC curve are tangent at E_2 , where price = P_2 & quantity = Q_2 .

Case 2: The initial equilibrium point is the same. Here a rise in advertisement cost shifts AC_1 to AC_3 , but the shift in this case is lesser than the previous case since **we assume that the cost of giving advertisement in net is less than the cost of advertisement in traditional media**. E_3 is the new equilibrium point

where the new demand curve is tangent to the new AC, where price = P_3 and quantity = Q_3 .

Since $P_2 > P_3$, there will be a shift of consumers from the traditional market to internet. However, in a developing country like India most people don't have access to the internet. But as the price difference increases between the two markets, due to increasing opportunity costs people try shifting to the internet through any possible means. This results in the pivoting of the demand curve D_3 at the point corresponding to the price P_2 , becoming flatter D_4 .

Thus, we get the new equilibrium point E_4 , where price = P_4 and quantity = Q_4 . By similar logic, the D_2 curve becomes steeper D_5 giving a new equilibrium price = P_5 and quantity = Q_5 .



The price changes will continue till it attains the same level for both the markets. Thus, $P_4 = P_5$.

The third diagram shows that at that same price, the flatter demand curve of the market through e-networking will yield a higher equilibrium quantity, while the steeper demand curve in the traditional market yields a lower equilibrium quantity. (This model has been supplemented by corresponding algebra in the appendix).

Thus, clearly the producers are better-off giving advertisements in the internet than the traditional media.

The result of our model has empirical evidences, as found out by many agencies. An increasing number of Indian companies are using social media as an effective business tool with 83 per cent firms in India agreeing that without social media activity, marketing strategies cannot hope to be successful, while globally, 74 per cent companies endorse the view, according to the survey by Regus, a leading office-space solutions provider.

7 AN INTERESTING CONFLICT

As the very definition suggests, social networking means gathering of individuals or groups for interaction and mutual benefit. The welfare effects of social networking have even been looked through at an earlier section of the paper. However, as the very next section suggests, human beings are anything but *homo economicus* - he is at the same time irrational and selfish. Thus, there arises the case of conflict between individual incentives to form relationships and overall societal welfare.

Let us investigate this in the simple case of network formation between buyers and sellers. The buyers each want a good and sellers each have a good for sale. The buyers differ in how much they value a unit of the good. In a fully centralized mar-

ket, one could hold an auction and the goods would end up being sold to the buyers who value it most, and societal welfare would be maximized. However, for a variety of reasons centralized markets are more the exception than the norm. Generally, buyers will form relationships with certain sellers and then tend to trade mainly with them. In terms of getting a good price, buyers would prefer to have less competition from other buyers and at the same time be in touch with a large number of sellers who would then compete for a sale. Analogously, sellers would like to be connected to many buyers who would compete for a purchase, but be in competition with a small number of other sellers. The optimal configuration, given costs to relationships, will involve having some buyers connected to more than one seller and vice versa, to make sure that goods end up in the hands of the buyer that happens to value them the most in any given instance, but will have fewer relationships as they become more costly. If buyers bear the full cost of forming relationships with sellers, then the efficient network will be pair-wise stable. It also turns out if sellers bear a nontrivial cost of forming relationships with buyers, then this efficiency result can fail. Buyers turn out to have incentives to form relationships that align with society's objectives, while sellers do not. The buyers end up getting their marginal value compared to the next highest valued buyer and so internalize the welfare effect, while sellers simply wish to see as high a price as possible.

8 DISADVANTAGES OF SOCIAL NETWORKING: SOME RELEVANT POLICIES

Though, undoubtedly social networking has been a revolution with numerous advantages, the other side of the coin throws up some blemishes -

Firstly, there is **lack of anonymity**. On the internet one puts out information about one's name, location, age, gender, and many other types of information that one may not want to let others know. There is clear lack of privacy. As a result, strangers can cause serious problems like stalking because as long as people can know who one exactly is, then some can find ways to do one in. For example, there are hundreds of thousands of active ".edu" email addresses of current students and alumni in just the United States and many of them can gain access to your site. Thus, one should be very careful while putting up personal information on the internet and even when divulging details about oneself during network formation, even though no one can be certain at any time. In the former case even the social networking sites can help by having provisions of blocking personal information.

Secondly, there are an **increasing number of crimes** through social networking. In forming social relation the probability of being duped is never nil; one may very well be enticed into a forged agreement. Proper legal measures should be undertaken, and properly implemented such that the opportunity cost of duping is large if the person is caught.

A person's involvement in a crime also depends on his/her social network to a large extent. This is a social problem which can hardly be dealt with explicitly. The problem lies in human conscience and his upbringing.

Through the internet, the chances of scams are even more as one does not have a direct contact with the other person. Online scams, identity theft, false lotteries, hacking, cyber bullying, spam mails, virus attacks are an increasing menace. The global cost of cyber crime has been estimated at a staggering \$114 billion per year!!! Though cyber crime cells have been set up, there hardly seems to be a remedy. Rules need to be stricter. The platforms of social networking sites should be more fool proof. Moreover, awareness needs to be spread among people using the internet.

Teens who regularly do Facebook are more likely to drugs:

A study by Columbia University found that kids, who use Facebook daily, are five times more likely to drink or smoke.

Joseph Califano, founder of the National Center on Addiction and Substance Abuse at Columbia University, told the Telegraph that images of underage drinking are rampant on Facebook, which encourages alcohol abuse. Califano rightly said "*Continuing to provide the electronic vehicle for transmitting such images constitutes electronic child abuse.*"

Thus, a possible remedy would be to deny use of their sites to children and teens who post pictures of themselves and their friends drunk, passed out or using drugs by the platform itself.

Of course, one may say that Facebook, or for that matter social networking sites are not encouraging child abuse, rather they are documenting what is happening and as such they help in creating awareness and taking proper steps. But no one can deny the fact that images of their 'friends' taking drugs or smoking do drive teenagers towards the social evil.

Thirdly, it can be really **time consuming** for some. This is especially true for e-networking. There are different kinds of people, and some may not see the point of 'clicking around' just for fun or for business purposes. However, it can really be distracting, especially while doing an important work assignment, or for students. That is why many schools and offices

block such sites.

Social media can have a **negative influence on worker productivity**. Employees may waste valuable time using social media channels such as Facebook and Twitter. They can also use social media to attack the company's reputation! There should be strict monitoring in the workplace and stringent fines should be imposed on the offenders. There should be proper reviewing of such sites by the concerned company; the employees should be made to be 'friends' of each other and also of the company's profile in on such sites so as to curb such malign practices.

Moreover, social networking might put one at a **viral social disadvantage** and may even damage one's reputation. Using social media for marketing and advertising could be **more time consuming** than companies expect. Furthermore, when social media is used excessively or in the wrong way, it could have serious **detrimental outcomes on both mental and even physical health** of individuals.

9 CONCLUSION

Apparently, though there is a conflict between individual incentive and greater societal welfare in network formation, but in reality the two are accommodating rather than competing. The very nature of human beings to maximize self-interest leads them to form networks with others through various means, and this ultimately leads to betterment of the society. The very concept of 'WE', rather than 'I', gives us the notion of social networks. Even the story of how a farmer's sons could break one stick but could not break a bundle of sticks talks of the power of social networking. In that story the realization led to better agricultural produce and subsequently a better standard of living for the protagonists. And in the recent past, we have witnessed the power of social networking all over the world - how it toppled rulers, raised concern over free markets, created a stir against corruption in our country!! Of course, it has its downside, as well, as has been discussed in the paper, which needs to be guarded against. Thus, what we drive home from the paper is that in order to get social network's full effect, one need to **understand how it works, when and how to use it, and which channels to focus on** depending on the end goal of using social network.

However, in line with the paper, further studies can be undertaken in the following fields:

- (i) The sample survey undertaken by us can be diversified and extended to cover, say, different other colleges. Consumer Behavioral patterns of such sample units may throw up interesting results.
- (ii) In this paper we have considered the representative firm to give advertisements of its product separately in the traditional media and the internet. However, what we usually see is that a firm gives advertisement in both the mediums simul-

taneously. Thus, there arises a case of "Bundling", which is beyond the scope of this paper. The study of same may present an interesting dimension to the whole theory.

- (iii) The finer nuances of how formation of social networks can lead to greater societal welfare can be worked out through the Samuelson-Bergson utility function, or through other forms of the Social Welfare Function.

10 APPENDICES

10.1 APPENDIX A

QUESTIONNAIRE FOR THE SAMPLE SURVEY:

- Name :
- Approximate Yearly Family Income :
- Are you influenced by advertisements that you see in the traditional media like newspapers, TV, etc.?
 - (i) Yes
 - (ii) No
- If yes, then what kind of products do you generally buy being influenced by advertisements in the traditional media?
- Approximately, how much of your income do you spend on such things?
- Do you inform your friends about the advertisements that you see in the traditional media?
 - (i) Yes
 - (ii) No
- Are you influenced by advertisements that you see in the internet?
 - (i) Yes
 - (ii) No
- If yes, then what kind of products do you generally buy being influenced by advertisements in the internet?
- Approximately, how much of your income do you spend on such things?
- Do you inform your friends about the advertisements that you see in the internet?
 - (i) Yes
 - (ii) No

• Do you cross-check the information that is available in the traditional media by having a look in the internet about the same?	1	0	8800	75000	900000	809460	0.130457342
	1	0	8500	80000	960000	863424	0.118134312
(i) Yes	1	0	13000	100000	1200000	1079280	0.144540805
	1	0	9000	85000	1020000	917388	0.117725543
• On an average, while surfing the net daily, what proportion of your time do you spend on social-networking and advertising sites?	1	0	6200	65000	780000	701532	0.106053608
	1	0	12000	90000	1080000	971352	0.148246979
(i) 0-20%	1	0	9500	75000	900000	809460	0.14083463
	1	0	7250	75000	900000	809460	0.10747906
(ii) 20-50%	1	0	10500	80000	960000	863424	0.14593062
	1	0	8500	95000	1140000	1025316	0.099481526
(iii) 50-80%	1	0	12000	120000	1440000	1295136	0.111185235
	1	1	8700	90000	1080000	971352	0.10747906
(iv) 80-100%	1	1	17250	145000	1740000	1564956	0.132272089
	1	1	28000	300000	3600000	3237840	0.103772886

10.2 APPENDIX B

APPENDIX TO THE REGRESSION ANALYSIS:

Response of the sample units:

x1	x2	monthly expenditure influenced by ads (approx)	monthly family income (approx)	yearly family income	Real yearly family income(x3)	proportion of annual real income spent	1	1	1	1	1	1
0	1	5600	60000	720000	647568	0.10372886	10500	95000	1140000	1025316	0.122888944	
0	1	17250	500000	6000000	5396400	0.038358906	13200	145000	1740000	1564956	0.101216903	
0	1	4500	400000	4800000	4317120	0.012508339	14300	160000	1920000	1726848	0.099371803	
0	1	3500	45000	540000	485676	0.086477405	12000	110000	1320000	1187208	0.121292983	
0	1	25000	200000	2400000	2158560	0.13891543	9350	90000	1080000	971352	0.115509105	
0	1	2750	40000	480000	431712	0.076439849						
0	1	5400	65000	780000	701532	0.092369272						
0	1	3000	60000	720000	647568	0.055592617						
0	1	2000	50000	600000	539640	0.044474094						
0	1	3500	65000	780000	701532	0.059868972						
0	1	3250	40000	480000	431712	0.090338003						
0	1	3250	55000	660000	593604	0.065700266						
0	1	5750	50000	600000	539640	0.12785602						
0	1	7000	60000	720000	647568	0.129716107						
0	1	2600	45000	540000	485676	0.064240358						
0	1	4300	55000	660000	593604	0.086926638						
0	1	7800	70000	840000	755496	0.123892119						
0	1	4000	50000	600000	539640	0.088948185						
0	1	7800	85000	1020000	917388	0.102028804						
0	1	13000	100000	1200000	1079280	0.144540805						
0	1	6500	80000	960000	863424	0.090338003						
0	1	2000	40000	480000	431712	0.055592617						
0	1	3500	55000	660000	593604	0.070754234						
0	1	7000	60000	720000	647568	0.129716107						
0	1	6000	65000	780000	701532	0.102635219						
1	0	12600	100000	1200000	1079280	0.140093396						

10-3 APPENDIX C

MATHEMATICS OF THE MODEL:

Let the firm face a demand curve of the form $Q_d = a - bP$(i) This is represented by the downward sloping straight line D_1 .

The initial cost function of the firm be represented by $TC_1 = C_1 + c'Q + c''Q^2$, where C_1 is the fixed cost incurred by the firm and Q is the quantity produced by the firm.

Thus, the corresponding average cost function is $AC_1 = \frac{C_1}{Q} + c' + c''Q$

At equilibrium E_1 , $Q = \frac{c_1}{Q} + c' + c''Q$, where the LHS Q is the quantity demanded.

$Q^2 = C_1 + c'Q + c''Q^2$

$Q^2 - c''Q^2 - c'Q - C_1 = 0$

$Q = \frac{c' + \sqrt{c'^2 + 4(1-c'')C_1}}{2(1-c'')}$, ignoring the '-' sign as it may

yield negative equilibrium quantity.

Putting this value of Q_1 equation (i), we get,

$$P_1 = \frac{a}{b} - \frac{c' + \sqrt{c'^2 + 4(1-c'')C1}}{2b(1-c'')}$$

Now, let us consider the two cases. We assume that the cost of giving advertisements in the traditional media, i.e., C_T is greater than that in the internet, i.e., C_N

Case 1: Let the firm give advertisements in the traditional media. As a result it incurs a cost of C_T . Thus, his fixed cost becomes $C_2 = C_1 + C_T$. Its average cost curve shifts to AC_2 . To maintain equilibrium, the demand curve shifts outwards and becomes $Q_D = d - bP$(ii), where $d > a$.

Proceeding as above, we get,

$$Q_1 = \frac{c' + \sqrt{c'^2 + 4(1-c'')C2}}{2(1-c'')} \text{ and}$$

$$P_1 = \frac{d}{b} - \frac{c' + \sqrt{c'^2 + 4(1-c'')C2}}{2b(1-c'')}$$

Case 2: Let the firm give advertisements in the traditional media. As a result it incurs a cost of C_N . Thus, his fixed cost becomes $C_3 = C_1 + C_N$, and $C_2 > C_3$. Its average cost curve shifts to AC_3 , but less than the shift of AC_1 to AC_2 . To maintain equilibrium, the demand curve shifts outwards and becomes

$Q_D = f - bP$,(iii), where $d > f > a$.

By similar logic,

$$Q_3 = \frac{c' + \sqrt{c'^2 + 4(1-c'')C3}}{2(1-c'')} \text{ and}$$

$$P_3 = \frac{f}{b} - \frac{c' + \sqrt{c'^2 + 4(1-c'')C3}}{2b(1-c'')}$$

Given our assumptions and working of the model, clearly $P_3 < P_2$. Thus, there will be an exodus of consumers from the traditional market to the market through e-networking. Due to reasons mentioned in the intuitive explanation of the model, the demand curve D_3 pivots around the point corresponding to the point P_2 and becomes flatter D_4 .

Let, the equation of the new demand curve be

$Q_D = m - nP$... (iv), where $m > d > f$, and $|n| > |b|$.

Thus, $P = \frac{m-Q}{n}$

$$\Rightarrow TR = P \cdot Q = \frac{m}{n}Q - \frac{Q^2}{n}$$

$$\Rightarrow MR_4 = \frac{m}{n} - \frac{2Q}{n}$$

Again, $TC_3 = C_3 + c'Q + c''Q^2$

$$\Rightarrow MC_3 = c' + 2c''Q$$

At equilibrium, $MR_4 = MC_3$

$$\Rightarrow \frac{m}{n} - \frac{2Q}{n} = c' + 2c''Q$$

$$\Rightarrow Q_4 = \frac{\frac{m}{n} - c'}{2(c'' + \frac{1}{n})} = \frac{m - nc'}{2(nc'' + 1)}$$

Putting this value of Q_4 in (iv), we get,

$$P_4 = \frac{2mnc'' + m + nc'}{2n(nc'' + 1)}$$

By similar logic, the demand curve D_2 pivots around the point corresponding to the point P_2 and becomes steeper D_5 .

Let, the equation of the new demand curve be

$Q_D = r - sP$(v), where $r < d$, and $|s| < |b|$

Thus, from (iv) and (v), we get, $m > r$, and $|n| > |s|$.

Proceeding as above, we get,

$$MR_5 = \frac{r}{s} - \frac{2Q}{s}$$

Again, $TC_2 = C_2 + c'Q + c''Q^2$

$$\Rightarrow MC_2 = c' + 2c''Q$$

Equating MR_5 and MC_2 , we get,

$$Q_5 = \frac{\frac{r}{s} - c'}{2(c'' + \frac{1}{s})} = \frac{r - sc'}{2(sc'' + 1)} \text{ and } P_5 = \frac{2rsc'' + r + sc'}{2s(sc'' + 1)}$$

To attain a stable equilibrium, P_4 must equal P_5 . Equating the respective prices we will get the condition regarding the relative position (elasticity and slope condition) of the demand curves D_4 and D_5 . Taking the prices to be equal, if we can show that Q_4 is greater than Q_5 , then our proposition is established.

Now, m and r being the intercept terms, and n and s being the slope parameters, clearly

$$|m - r| \gg \gg |n - s|$$

c' being very small in comparison to $|m - r|$, we get,

$$|m - r| \gg \gg |n - s|c'$$

$\Rightarrow |m - nc'| \gg \gg |r - sc'|$, given the structure of the model.

Again, $|n| > |s|$

$$\Rightarrow \frac{1}{|n|} < \frac{1}{|s|}$$

$$\Rightarrow \frac{1}{|nc'|} < \frac{1}{|sc'|}$$

$$\Rightarrow \frac{1}{2|nc''+1|} < \frac{1}{2|sc''+1|}$$

Thus, comparing $Q_4 = \frac{m-nc'}{2(nc''+1)}$ and $Q_5 = \frac{r-sc'}{2(sc''+1)}$, we see that though the denominator of the former is greater than that of the latter, the numerator of the former is much greater than that of the latter. Thus, $Q_4 > Q_5$, and the firm earns greater revenue through advertising in the internet. Thus, clearly the producers are better-off giving advertisements in the internet than the traditional media.

ACKNOWLEDGEMENT

We would like to take this opportunity for thanking all our respected faculty members of Economics Department, St. Xavier's College (Autonomous), Kolkata. This project would not have been possible without our basic understanding of what Economics is all about, and towards this end the indelible effort of Professor ParthaPratimGhosh, Professor Mallinath Mukherjee, Professor Dr. Ranjanendra Narayan Nag, Professor Bipra Kumar Das, Professor PiaGhoshal, Professor RelinaBasu and Professor NeelanjanSen needs special mention. We would like to thank all our friends who motivated us, to present this paper, irrespective of any discrimination on any grounds. We are grateful to Rev. Dr. John Felix Raj S.J. (Principal, St. Xavier's College), Rev. Fr. Jimmy Keepuram S.J. (Vice-Principal, St. Xavier's College, Arts and Science Department) who have readily helped us in our endeavour. We have also benefited from the treasure trove of books on Economics at the British Council library and the Central Library of St. Xavier's College (Autonomous). Lastly, we cannot forget to mention the excellent infrastructural support we received from the College in the form of the Central Library and the Cyber Room and are grateful to Computer Laboratory In-charge Mr. SujitChanda.

However, the usual disclaimer applies.

AUTHOR DETAILS

Soumik Banerjee, Currently pursuing Masters in Economics from Calcutta University, India. He graduated from St. Xavier's College, Kolkata, India in 2012. His research fields mainly include games and equilibrium, and development aspects of India. He has many academic papers and has undertaken project works (*The Saliency of Service-led Sectoral Interlinkage in India; Land Acquisition: Development and Displacement; Public and Private Health in India* to name a few) and was an active representative of his college in many national seminars. He won "The Young Economist Award" at Christ University, Bangalore. E-mail: soumikbanerjee07@gmail.com

Shubhashrita Basu, Currently pursuing Masters in Economics from Jadavpur University, India. She is a 2012-graduate from St. Xavier's College, Kolkata, India. She is an active participant in seminars organised nationwide. Her research fields' mainly concerns socio-economic development aspects. Her project works include *Inflation in India; Poverty Alleviation Programmes in India in the era of Globalization; Land Acquisition: Development and Displacement; The Hand that rocks the cradle doesn't rule the world* to name a few. E-mail: talk2bony@gmail.com

REFERENCES

- [1] Glanz, et al: "Health Behavior & Health Education" (Published in 1990)
- [2] Mathew O. Jackson, "The Study of Social Networks in Economics", <http://www.stanford.edu/~jacksonm/netsocialecon.pdf>, 2007.
- [3] G.S. Maddala, "Introduction to Econometrics" (Book Style)
- [4] Martin J. Osborne, "An Introduction to Game Theory" (Book Style)
- [5] John Quelch, "Quantifying the Economic Impact of the Internet", <http://hbswk.hbs.edu/pdf/item/6268.pdf>, 2009