Effects of social networks on innovation diffusion and market dynamics
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6 Discussion and implications

6.1 Theoretical implications

The main goal of this thesis is to incorporate part of the flourishing literature on network structures in a marketing context. Most of the results we have obtained and presented generate several implications. First of all we hope that the reader, after going through these chapters is convinced that often networks do play a role, that they can explain different market dynamics and that studying networks can be used to develop marketing strategies.

Most of the theoretical implications derive from the following metaphor: a new product that diffuses into a society of consumers is like an epidemic that spreads into a population of susceptible individuals. Inspired by this metaphor, we believe that marketing can gain useful insights studying, adjusting and adopting epidemic models. This is what we explicitly do in chapters 2, 3 and 4. We build different network structures of consumers with their preferences and their attributes and we study how the diffusion dynamics of different products vary. Although we believe that the diffusion of a new product might look like the spread of an epidemic, we are also aware that these two processes are not completely the same. A substantial part of the work presented here consists of adapting the epidemic models to a marketing framework that can include product characteristics, personal preferences and social influence.

First, we test different global network structures and we find that new products spread more and faster in scale-free networks compared to regular networks (chapter 2) and in small world networks compared to regular networks and random networks (chapter 3). While the fact that scale-free networks are more efficient than regular networks is an expected result (Pastor-Satorras and Vespignani, 2002), the fact that
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small world networks are more efficient than random networks is a new and surprising result because it goes in the opposite direction compared to what epidemic models predict. In epidemic models a simple contact may determine the infection of a susceptible individual but in an economic framework the fact that a neighbour has already adopted a new product might be not enough to convince a consumer to adopt the same new product. This is the reason why we find that in networks that are highly clustered (such as small world networks) positive social influence enhances the diffusion and in random networks it does not.

Second, we focus on the effects of local network characteristics studying how the consumers exert influence on the people being part of their personal networks. In chapter 2 we show that social influence may affect the diffusion either negatively or positively. On the one hand, at the beginning of the diffusion process, when the product is just introduced into the population, the fact that a large majority of consumers has not adopted yet represents a strong obstacle for the new product and this can cause a diffusion to fail. On the other hand, if the new product manages to reach a critical mass and to take off, then the social influence inverts its sign and it enhances the diffusion convincing more consumers to adopt. Besides the final penetration of a new product, social influence also affects the uncertainty associated to the diffusion of a new product. Markets characterised by high social influence, where the adoption of the consumers depends more on what other consumers do and less on the individual preferences of the consumers, are very unpredictable. In these cases, the final success or the final failure of a new product may depend on other effects than product characteristics. For example, the seeding of the diffusion plays a relevant role in this kind of markets (see Libai et al. 2005).

Finally we direct our study towards marketing strategies. In chapter 4 we compare two typical promotional seeding strategies for the entry of a new product: the throwing rocks strategy and the throwing gravel strategy. While the throwing rocks strategy consists of targeting a single group or a few big groups of highly connected consumers as seeds for the innovation, with the aim of igniting the diffusion in a precise area of the network, the throwing gravel strategy consists of targeting little groups randomly as the initial seeds of the innovation and aiming, in this way, at igniting the diffusion in many different areas of the potential market. We find that, especially for
markets characterised by high social influence, the optimal strategy in terms of market penetration consists of a balance between the two extreme strategies. The results of our agent based model suggest to ignite the diffusion with groups of cohesive consumers that are large enough to exert strong social influence to others and to place these groups in distant areas of the potential market. This result has proved to be quite robust because it persists within a large variation of different input parameters. However, the simulations generate this result for markets with strong social influence (e.g. brown good durables like DVD players but also clothes, etc.) but it tends to disappear in simulated markets characterized by low social influence (e.g. white good durables like refrigerators but also grocery, etc.). In particular, the lower the social influence consumers experience within a market, the more the optimal strategy moves towards the throwing gravel strategy. This result contributes to show how our agent based model is suitable to test different marketing strategies for different kinds of market.

These first three works of this thesis (chapters 2, 3 and 4) represent a contribution to the field of marketing showing that the combination of micro models about the adoption of the consumers and macro aggregate results about the diffusion of new products is possible and, we believe, useful.

The original design of this thesis expected to study the motion picture market as a typical example of innovation diffusion market. We believed that, as in the classical markets of innovation diffusion, movies could be considered as new products that enter and spread into the market guided first by external influence and then by internal influence. The relatively short life cycle of the movies and the huge availability of data about the revenues at the box office made this market highly attractive for the project. However, the more we dived into the literature of motion picture market, the more we matured the idea that this market is very peculiar and that it highly differs from the classical markets where innovation diffusion is usually tested (e.g. durables). The most evident difference between the motion picture market and the classical innovation diffusion markets consists of a different life cycle of the products. It is very rare to observe movies whose cumulative revenues at the box office resemble the well known S-shaped curve of innovation diffusions (Ainslie et al. 2005; Jedidi et al. 1998; Sawhney and Eliashberg, 1996). For durable goods the sales almost always start at a low level because when these goods are introduced into the market they are initially adopted by a
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few innovators. This kind of adoption is usually driven by external influence (e.g. mass media advertising). After a certain market penetration has been reached (3-15%) the sales take off and the rest of the potential market, now mainly driven by internal influence (e.g. WOM), adopt (Mahajan et al. 1990b). Movies do not diffuse in this way. Especially for the most visited movies, the slow initial growth does not exist at all. Usually, when a movie arrives at the cinemas, it immediately opens its box office with a very high revenue and then, in the following weeks, its revenues decline rapidly.

Moreover, in markets where innovation diffusion theory is usually tested external and internal influences are often seen as alternative to each other (Mahajan et al. 1990b); usually the WOM, consisting of the advice of a friend, is much more valuable than the mass media message that advertises the new product (Mahajan et al. 1995). Contrarily, in the cinema industry external influence and internal influence heavily overlap and strengthen each other. The strong mass media campaigns that characterize the pre-launch of movies are aimed at creating a buzz around the movie. Here, the suggestion of a friend to another friend for a particular movie is almost always generated by advertisement messages that probably have already reached both; usually this advice is not as valuable as in other markets and it almost always consists of an invitation to go to the cinema together. This characteristic of the cinema market is probably due a particular orientation that today characterizes this industry thoroughly: today cinema means entertainment. A large majority of movie visitors intends the cinema as an entertainment industry and they consume its products as such.

The work presented in chapter 5 corroborates this idea and presents empirical evidence for it. The data about the life cycles of the movies we find a correlation between the final revenues of the movies at the box office and the decay of their revenue during time. Surprisingly enough, the stronger the decay is, the higher the final revenue becomes. We use our agent based model in order to simulate the life cycle of the movies and to compare these life cycles with the real ones. We obtain this relation in the simulated data only when the agents of our model retain advertising messages more or at least equally than quality messages. This means that, given our model, the surprising relation mentioned above is explained by the fact that movie visitors are more susceptible to the buzz around the movie than to the real quality that unfolds after the movie appears into the theatres. Stated simpler, advertisement is more important than
quality. This is why the common life cycle of movies consists of high revenue at the opening week followed by a fast decay. Advertisement attracts movie goers at the cinema right after its release. On average, besides the almost inevitable faster decay, the more visitors a movie attracts at the opening weekend, the higher its final revenue becomes.

The fact that the demand of the cinema market is so heavily dominated by the buzzes that the big studio producers and distributors create before releasing their movies creates a very unequal distribution of the shares. In fact, only a few movies succeed in creating strong self-reinforcing buzz and the rest of the movies do not. The work presented in chapter 5 shows how social influences are strong drivers of such observed market inequalities. We show that the strong convergence of the movie visitors’ decisions towards the big hits of the market is due to the high influences that these decisions exert on each other. Most of the audience goes to visit big hits such as Spider Man, Harry Potter, Pirates of Caribbean, etc. because other consumers have seen them or because consumers assume that other consumers want to see them. In such a market the production budget and the quality of the product maintain their central role in determining the success of a movie but the powerful impact of buzz that is created around a movie seems to become even more important.

6.2 Managerial implications

Nowadays marketing campaigns highly make use of VIPs. Companies pay huge money to VIPs in order to sponsor their performances hoping, in this way, that consumers will associate their brands and their products to the VIPs. Common sense and daily experiences of managers that deal with the launch of new product suggest that the right use of the image of a few VIPs can create a strong visibility for the complete potential market they address. However, surprisingly enough, these campaigns do not immediately guarantee the success of the diffusion. Sometimes they work perfectly (e.g., almost all people that follow tennis remember that Rafael Nadal, the second player of the rankings, wears Nike clothes) and some other times they can remain quite
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unnoticed (not everybody remembers which brand of clothes Roger Federer, the first player of the ranking, wears).

Models of scale-free networks furnish a simple way to model the structure of markets where VIPs are present. They formalize a network where just a few nodes are connected to almost everyone and the large majority of other nodes has just a few contacts with others. These models can help a marketer to better understand and to direct the processes of the diffusion of a new product that take place among consumers. The fact that in scale-free networks the diffusion spreads more and faster than in other network structures may not surprise an expert marketer. In fact, a marketer knows perfectly that almost all amateurs that play soccer and buy soccer shoes know Ronaldo and that almost all consumers that watch television in the USA know Oprah Winfrey. However, adapting these models to particular marketing contexts including both product and consumers characteristics can result in interesting implications for marketers. For example, do VIPs exert positive social influence to adopt or do they just convey information about the existence of the product? How more (or less) likely is the diffusion to take place when consumers decide more according to their personal preferences than to the behaviours of the others? How more (or less) likely is the diffusion to take place when consumers are more affected by the behaviours of the VIPs compared to the behaviours of their normal friends? What should be the real visibility of the VIPs in order to obtain a significant increment of the market penetration?

In chapter 2 we conduct an analysis on the roles that VIPs play in the networks of consumers. Our simulation results show that, ceteris paribus, VIPs do have a strong positive effect on the final penetration of new products and that their real power consists of the informing role they have in the network. These results suggest that they do not have more convincing power than other normal consumers but their positive effect on the diffusion relies on their high visibility. Once they adopt the new product, almost the complete network knows about it. The implications for the marketers are straightforward: advertising the new product by VIPs seems to be necessary but not sufficient in order to let a new product to take off. If in the target market VIPs exist, it is highly advisable to advertise the new product through them. In fact, these campaigns can guarantee such a high visibility that almost the entire potential market becomes immediately informed about the new product. However, as the practical knowledge of
marketers may suggest, these kinds of campaigns do not automatically result in a takeoff of a new product.

In order to deepen our analysis on the determinants of the takeoff of a new product, in chapter 4 we test the timing of promotional strategies. We identify the optimal strategy that determines both a fast takeoff and a high market penetration according to the category of the new product. For white goods (such as laundry machines, refrigerators, etc.), whose markets are not characterized by high levels of social influence, the takeoff usually takes place quite late. Here, marketing campaigns are advised to be placed after at least 10% of the potential market has already adopted. If huge marketing campaigns (e.g. mass media campaign) are placed too soon, they encounter the risk of hampering the final penetration. In fact, if many consumers decide too soon, they may decide not to adopt because not enough other consumers have adopted yet and, in this way, they may ignite a negative social influence. For brown goods (such as TVs, CD players, etc.), whose markets are characterized by high social influence, big marketing campaigns can often anticipate the takeoff of the new product without damaging the final penetration. Here it is advisable to place the campaign very early in the life cycle of the new product, when the market penetration is around 3% of the potential market. In this way, it is possible to anticipate the takeoff and this may result in a competitive advantage compared to other products or brands.

Concerning the cinema market, the practical knowledge of big studio producers and distributors seems to anticipate the implications that the academic studies can offer to them. The advertising campaigns for movies follow almost always the same strategy: the wide release strategy. Using this strategy, studios producers try to ignite the buzz around the movie before its release in the cinema theatres by a heavy advertising and by a large number of screens at its opening weekend. Only a minor percentage of the movies, usually low budget movies, uses the platform release strategy. This strategy suggests to enter the market with a limited number of screens and then, if the response of the audience is positive, this strategy suggests to drive the positive WOM increasing the coverage of the market with a higher number of screens. But why do big studios prefer so much the former strategy? The cinema market has always been considered a market with very high uncertainty and high risk. It is not easy to foresee the response of the public after the movie enters the cinemas and its real
quality discloses to the audience. Studio producers defend their investments by standardizing their productions and their releasing strategies. They try to convince many movie visitors to see the movie at the opening weekend and, in this way, they can rely less on WOM, which is usually too difficult to control and to direct. This has strong implications for the industry: the production of movies focuses always more on the entertainment consumption because this is easier to standardize and consequently the characteristics of the movies become always more similar. Every week there are two or three big budget movies that enter the top-25 classification of the most visited movies at the first places, driven by huge pre-released mass media campaigns. After this high entry, they immediately start their decay in the top-25 classification and, just after a few weeks (8-12 on average), they exit it, leaving space for the next big hits. Consequently, the life cycles of the movies follow the observed fast decay and the chances for other movies (like independent movies) to grow on positive WOM become always more limited.

6.3 Methodological Implications

As we mentioned in the introduction of this thesis, all the works presented here heavily rely on the methodology of computational and agent based models. Analytical models for the study of networks are difficult or often impossible to solve and this holds also for network models (Strogatz, 2001). Computer simulations and computational models like agent based models have shown to be highly suitable for the study of networks (e.g. Barrat et al. 2004; Barthélemy et al. 2004; Newman, 2002; Watts and Strogatz, 1998). The practice with all the stages of the agent based modelling (designing, programming and analysis of the results) has allowed us to gain experience and confidence about this methodology and in this section we stress some of its advantages and some of the risks related to its use.

We have taken advantage of many and different features of agent based models. Hereby we confine ourselves to two simple examples: first, the extrapolation of macro variables is generated by the micro specification of the decision making of the agents and it is not difficult to obtain. Here the modeller needs careful design and
control of the sequence of the decisions of the agents, a clear and systematic collection of the simulated data that are generated and a click on the start button of the simulation run. Second, the study of uncertain phenomena suits particularly well this methodology. After the design and the implementation of the model, it is possible to conduct many runs with the same simulation settings and the simple standard deviation of the dependent variable is a good indicator of the uncertainty related to the phenomenon under investigation. For instance, in chapter 2 we have done so in order to analyse the uncertainty of the diffusion of the innovation.

However, we have also experienced some risks related to the use of this methodology. The design and the implementation of agent based models can easily become so large and so complex that the results become difficult to interpret. Hence it is important to balance the complexity of the model with the capacity to understand and to explain the simulated data created. One of the most attractive features of agent based models consists of the possibility of including different aspects of the simulated phenomenon and of testing their effects with relatively low effort. Thus, it is highly attractive to include into the design of the study many aspects of the research question. However, we believe that for agent based modellers it is very important not to transform these advantages into an abuse. The analysis of the simulated results has to be rigorous and fully understood both by the modellers and by the rest of the scientific community that may be less familiar with computational models. Often, the sensitivity analysis of the results, that shows how the results vary according to the variations of the input parameters, either does not explain how the simulation model has generated the results or remains incomplete for a vast area of the parameter space. This may represent a strong limitation for this kind of studies because there is no reason to believe that the simulated phenomenon adheres to the description given by the used input parameters. We maintain the idea that a sensitivity analysis of the simulated results can be confined into a particular area of the parameters’ space only when there is strong theoretical and/or empirical evidence that the values used as input parameters describe a realistic representation of the explanandum.
6.4 Future research

This thesis has investigated the effects of social network structures and social influences on different kinds of markets such as durables and movies. Markets where these effects are relevant are highly complex because these effects are non-linear in nature (Arthur, 1994; Arthur et al. 1997). In order to study these effects we have used agent-based models because they are highly suitable for analysing these kinds of dynamics (Gilbert and Troitzsch, 1999). However, markets highly differ from each other and not all markets display similar social influences and/or similar social network structures. For example, on the one hand there are markets such as cars, clothes and movies where networks are very dense because these products are very visible and consumers exchange much information about them. On the other hand there are markets such as salt, toilet paper and insurances where networks are somehow less dense because these products are less visible and consumers talk less about them. We believe that a promising future venue of research for agent-based models consists of investigating empirically how the decision-making process changes when consumers have to decide about different products (Jager, 2007). For example, Kuenzel and Musters (2007) find that even everyday food products fall into different involvement categories and that different degrees of involvement lead to different kinds of social influence and different uses of personal networks.

Up to now, agent-based models are used in many different fields and recently they have been welcome also in marketing studies (Goldenberg et al. 2004; Lusch and Tay, 2004). However, a real empirical foundation of these models is still missing. The micro specification of these models is often inspired by the intuition of the researcher (Epstein, 1999) and, although this does not always represent a limitation, these models would gain a substantial academic value if they could rely on standardized robust calibration procedures for their input parameters guided by empirical data about the decision-making of the consumers (Figure 1.1). For example, most of the agent-based models make large use of uniform, normal and beta distributions when they simulate heterogeneous populations of agents. However, in the community of agent-based modellers there is not a common and standardized methodology that specifies how to link these distributions to the real ones, how to take into consideration the relations, the proportions and the interdependencies among these distributions. Moreover, also the analysis of the outputs of these models may corroborate the relevance of agent-based
models in the academic world with a more robust test against empirical data. The results of the simulations consist of synthetic data that are often presented as similar to the observed phenomenon under study. We believe that the use of widely accepted models as benchmarks and the use of standard statistical procedures for the analysis of the simulated data may considerably contribute to the reputation of the agent based models in the academic world.

A second venue for future research that would be a natural development for the work of this thesis concerns network models. There are many different ways of formalizing networks. For example, in this thesis we have studied the effects of static and simple network structures that are not empirically tested in the real markets. However, the existing literature on network structures, both belonging to social science and to statistical physics, has continued to increase over the last years. Up to now, it furnishes a huge piece of literature where to find the most adapt models to use in marketing frameworks. Examples of network models that may be suitable for being used and studied in marketing contexts are weighted networks (Barrat et al. 2004) and evolving networks (Kossinets and Watts, 2006). For example, it would be interesting to study how consumers allocate different importance to relatives, to friends and to colleagues (weighted networks) when they are involved in the decisions for different goods; and how consumers select their neighbours in time according to the attributes neighbours display (evolving networks), a process already known in social science as homophily (Davis, 1963).

Finally, a third venue for future research concerns the motion picture market and the entertainment industries in general. It is surprising that the large majority of the literature of the cinema industry focuses on the supply part of the market and just a few works study the demand (Wierenga, 2006). We believe that for entertainment goods the consumers’ decision making depends largely on the way consumers are related and on the way they exert influence on each other. Studying their personal preferences towards this kind of goods would be already a significant improvement, especially for the motion picture market. However, this would still be not sufficient for completely depicting the consumers decisions for these entertainment goods. The relevant role that social influences play in these kinds of markets implies that a full analysis of the
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demand should include accurate studies on the relevance of neighbours’ decisions (imitation) and on collective decision making (coordinated consumption).