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Consumer choice in social networks

1.1 Motivation

The basic conjecture of this book is that consumers do not make decisions in isolation, but are influenced by and influence other consumers with whom they interact. Everyday experience suggests that we are frequently influenced by others: we ask our peers for restaurant tips, hear about new products from them, make joint consumption decisions for family cars within families, consume similar products to our peers in order to 'keep up with the Joneses' and use similar products as people we regard highly and aspire to. These processes happen within social networks, which in this book means all social relationships between people. In recent years, social networks such as Facebook have become very popular. Thinking about ones social relationships as a social network has consequently become very intuitive for many people – whether these relationships are maintained via Facebook, mobile phones or via traditional offline channels.

However, for a long time much of economics and marketing did not take these interrelationships into account. There are a number of good reasons for this focus on treating individuals as atomistic decision units: First, it was difficult to collect

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appropriate network data, especially in the past when such data had to be gathered with the help of network surveys asking respondents to identify relationships they have with their peers (see also Chapter 5). Secondly, most traditional statistical methods assume that observations are independent, an assumption that is clearly violated in social networks and requires different statistical approaches. Thirdly, data volumes when analysing electronic social network datasets can be huge. Large-scale social networks can have tens or hundreds of millions of users and for each user, there can easily be 100–1000 communications per observation period, meaning that data volumes can be 100–1000 times larger than for comparable individual-level data. Fourthly, it is more difficult to incorporate interdependences in social networks into theoretical economic and marketing models.

In the last couple of years, massive electronic social network datasets have become available and companies now have the computational capabilities to analyse them properly, although this can still be a challenge when working with datasets covering tens or hundreds of million users. At the same time, researchers such as Snijders, van de Bunt and Steglich (2010) have developed new statistical techniques and running experiments using electronic social networks have become increasingly popular (see e.g. Bakshy *et al.*, 2012). There has also been some progress on theoretical models (e.g. Sundararajan, 2007), but in general there has been a shift in emphasis towards more empirical work, something which is also driven by the increased emphasis of marketing practice on quantitative marketing and, therefore, greater demand for quantitative analystics skills.

A particular challenge when analysing influence processes in social networks is to identify the causality of events. There can be a large number of reasons why decisions of consumers in a social network are not independent (Manski, 1993) and one of the key challenges of research into social networks is to tease such different effects apart. For example, individuals who interact with each other typically behave in a similar way because they share the same environment, because they receive similar information and because of psychological factors like group pressure. If we want to use the social network structure to achieve a certain outcome, say because we want to promote a certain product, then identifying the main cause(s) is key to pursuing the right marketing strategy. If, for example, a lot of consumers who are likely to buy a product share the same context, then the company might want to target a certain social or geographic segment. For a wine retailer it is, for example, critically important to find the right location if a high number of consumers is geographically concentrated in a particular location as consumers will then buy their wine *independent* of the social networks that exist in this location. However, if a high number of customers of an online wine retailer recommend this retailer to their friends, then it is important to understand how customers interact with each other and which customers are most likely to successfully recommend the service.

This book uses a variety of electronic and non-electronic datasets to study how consumers influence each other, and establishes causality by using the time structure of events occurring over the network and via cross-country case study research. I also use social network analysis of very large electronic datasets, an approach that has the potential to revolutionise marketing and can help extend our understanding of human behaviour.

1.2 Using mobile telecommunications to illustrate the economics of social networks

A large part of the book is based on empirical analysis of the mobile telecommunications industry. Telecommunications networks are a prime example of markets where consumers influence each other and where this influence can be measured by data. Similar phenomena exist in other industries, such as social networking sites and finance. Furthermore, data on social network interactions are available to varying degrees in a number of other industries. Even if there is no electronic data readily available this book shows that social network surveys can be used in such cases (see Chapter 5). In mobile telecommunications, consumer demand is interdependent for a variety of reasons:

- First, every *subscriber to a mobile phone network benefits from other subscribers also using mobile phones* as it allows communication with a greater number of users. Network effects therefore influence the overall diffusion pattern of mobile phones. The same is true for social networking sites like Facebook, LinkedIn and so on. Likewise, network expansion drives the usage volume of people already using mobile phones. The usage volume of existing subscribers therefore increases with the total number of mobile telephone subscribers.
- Secondly, in mobile telecoms and other industries it is becoming increasingly important to create *product eco-systems*. While Apple, Google or Facebook directly provide the basic functionality of their respective products, they also create platforms and interfaces that allow other companies to offer their products and services via their platforms. This means that higher user numbers make platforms more attractive for these third parties to develop their offering for a particular platform, and this in turn makes the platform more attractive to end users as well. Often, complementary services developed for a platform also create direct network effects, such as Apple's FaceTime application which allows iPhone and iPad users to communicate with each other for free on their mobile devices. Such complementary services are, therefore, a good way of making products stickier.
- Thirdly, in mobile telecommunications, *calls to the same network are typically cheaper than calls to other networks*, and it is therefore beneficial for consumers to subscribe to the same network as the people they are calling. Mobile phone networks from different companies are highly compatible with each other from a technological point of view, but network effects are often induced by network operators through higher prices for off-net than for on-net calls, something which Laffont *et al.* (1998) termed tariff-mediated network effects. Tariff-mediated network effects can take the form of a general price discrimination between on- and off-net calls or can be created through discounts for certain types of on-net calls. Probably the most famous example of such a scheme is MCI's Friends and Family plan, which was introduced at the beginning of

the 1990s and allowed MCI customers to call up to 20 other MCI customers at a cheaper rate. In most European countries such price differentiation is common place, but there are also exceptions, like the Netherlands, where operators charge the same prices for calls to the same network and calls to other networks.

- Fourthly, the *use of mobile phones is conspicuous* and sends out social signals about the users. Using an attractive handset, like for example an iPhone, enhances the social standing of its owners and peers might be influenced by their peer group in their choice of mobile phone, just as drivers of luxury cars influence others in their neighbourhood and peer group to buy similar prestigious car brands.
- Fifthly, users of relatively complex products such as mobile phones and the services running on them benefit from *information exchange* with their peers. Such information exchange can be about new services, about the advantages and disadvantages of existing services or simply about how to use certain services or functionalities.

Variations of these factors will also be important in many other industries and can be observed in electronic data, for example, in many online businesses such as online social networks. While most of the empirical data for this book come from the mobile telecommunications industry, the insights and methods are, therefore, more generally applicable.

1.3 Structure of the book

The book consists of six main chapters: one chapter reviewing the relevant prior research and five empirical chapters looking at various aspects of how consumers influence each other in a social network. Each empirical chapter starts with an executive summary and one or two case studies on how social network analysis can and is used for marketing purposes.

Chapter 2 starts with a short history of the relevant literature and research from economics, marketing, sociology and physics. One of the exciting aspects of studying how social networks influence consumer behaviour is that a number of very different subject areas can contribute to our understanding. The chapter reviews the key relevant research strands in each area and shows how they add to our overall understanding of the underlying processes. In general, the book draws from two main bodies of literature that help us understand how consumers influence each other: economics/marketing and sociology/social network analysis. The economics literature in particular sheds light on aggregate phenomena, like overall competitive outcomes in markets with network effects; whereas the social network analysis literature offers a wide variety of lessons on how to influence behaviour at an individual level within a social network. Furthermore, Chapter 2 focuses on practical implications for companies and discusses how causal relationships can be identified when studying dynamic

processes in social networks – something that is of particular importance for marketing interventions.

Chapters 3 and 4 study how the diffusion of a new product like the iPhone (Chapter 3) and switching decisions between rival networks (Chapter 4) are influenced by social networks. The analyses use call detail records from all subscribers of two large European mobile phone operators to construct a social network and track product uptake and switching decisions over a period of four months. Based on survival analysis models, the results show that the more network connections that have taken up the iPhone, the more likely it is that the focal consumer also takes up the iPhone. Interestingly, this contagion effect decreases only slowly over time after an initial peak at product launch. Likewise, one friend switching operators has a strong impact on the switching decision of the focal consumer. These two chapters are particularly relevant for companies and researchers with access to large-scale social network data who would like to understand how to leverage the opportunities provided by such data for both research and marketing. Chapter 3 is accompanied by two case studies. The first discusses how mobile phone companies can approach social network marketing for customer acquisition, product upsell/ cross-sell and customer retention. The second discusses different ways in which social advertising is and can be used on Facebook. A third case study preceding Chapter 4 focuses specifically on customer retention, which is arguably the earliest and still most common application of social network marketing in the mobile telecommunications industry.

Chapter 5 demonstrates a different way of collecting social network data through the use of a social network questionnaire. This approach is particularly useful if electronic social network data is not available at all or if researchers/marketers are interested in particular individual-level data which are not available from electronically collected datasets. The chapter is based on primary survey data from a number of university classes in Europe and Asia and uses a statistical permutation method called Quadratic Assignment Procedure (QAP) to account for a correlation in error terms for non-independent observations in a social network. The results demonstrate that friends tend to choose the same mobile phone carrier and that this coordination is stronger the closer the relationship. Interestingly, using variations in the pricing strategy between operators and countries, this chapter shows that this coordination is caused by price differences, rather than by alternative potential causes such as peer pressure or unobserved socio-demographic similarities among friends. Besides deciding to use the same operator as their peers, consumers also react to the consumption decisions of their peers by choosing to be part of several networks at the same time if their friends are on different networks. The accompanying case study discusses how social network marketing can use homophily, the commonly observed tendency that similar people interact with each other more frequently, to identify consumers who are potentially interested in a particular product or to close gaps in the knowledge of certain individual-level variables.

Chapter 6 analyses how households – the core of most people's social network – coordinate their consumer choice. The chapter is based on a large traditional three-wave survey of British consumers and employs multinomial logit and probit models to estimate the extent to which households coordinate their choice of mobile phone

operator. Results show a very strong influence of household members on operator choice, with more than 50% of household members choosing the same operator. While there are market-level network effects, household effects are far stronger, with roughly 9.2 m subscribers to a network having the same impact as one additional member from the same household being on the same network. The results also show that parents coordinate more strongly than parents and kids and that older household members also coordinate more strongly. The accompanying case study discusses how marketers can identify families/households in social networks and how such knowledge can be used to improve marketing to these groups.

Chapter 7 – the final empirical chapter – analyses how company pricing strategies in markets with network effects can influence the market structure of the industry. Using price and subscriber number data from the UK telecoms regulator OFCOM and a time-series statistical model, the chapter demonstrates how higher charges for calls to other networks than for calls to the same network have a very strong impact on consumer choice. Results show that consumers react to these pricing strategies by coordinating operator choice and reducing calls to off-net numbers and that significant inertia maintains this coordination, even after the price differential decreases. The case study discusses pricing strategies that companies can pursue when pricing digital products which typically exhibit both strong network effects and economies of scale.

The closing chapter discusses the impact that the increased availability of electronic social network data has on academic research and marketing practice. For academic research, it is increasingly more common to directly observe social network interactions and it is likely that future empirical work will use updated and new statistical models to realistically account for these interactions rather than making the simplifying assumption that individual consumer behaviour is independent. It is also likely that many more population-level analyses will be carried out, which will lead to a more frequent use of the research and statistical methods used in this book. For marketing practitioners, the abundant availability of electronic consumer data means that there is a continued shift towards using statistical and data mining approaches in marketing. In particular, as this book will show, it is now possible to measure and influence how consumers influence each other, which opens the way for new marketing approaches. Some of these approaches are discussed as part of the case studies and I am sure that there will be many more in future as companies continue to experiment with these new opportunities.

Finally, Appendix A includes a discussion of the success factors for viral marketing campaigns contributed by viral marketing expert Simon Rees.

1.4 Why you should read this book

As a practitioner interested in marketing and big data:
The book contains several case studies demonstrating the importance of understanding how consumers influence each other. The case studies cover a range of topics, including social network marketing and social advertising (Sections 3.2 and 3.3), customer retention (Section 4.2), the use of the homophily principle for social network

marketing (Section 5.2), identification of and marketing to families and communities (Section 6.2) and pricing strategies for digital services with network effects (Section 7.2).

Of particular interest are also the first two empirical chapters which use two unique social network datasets based on call records from two large European mobile phone operators. These datasets make it possible to analyse a network containing millions of individual consumers, which circumvents the problem of selecting adequately bounded networks – a very common problem in social network analysis studies. Transactional electronic company data has rarely been used in the social sciences and these two chapters show how such data can enrich our understanding of the complexities of consumer choice and, in particular, how such data can be used to understand the interdependences between the choices of a consumer and those of her peers. Chapter 5 demonstrates how the arsenal of a social network marketer can be further enhanced by the use of network surveys, which can give a more in-depth understanding of particular social networks or can be deployed in industries where no electronic social network data are available. In the empirical analysis in this book I show that students in a number of European countries coordinate their choice of mobile carrier and highlight that pricing is the likely cause behind this coordination.

As an academic interested in economics and marketing:
There is a rich body of literature on the economics of networks which is discussed and extended in this book. This book in particular combines insights and methods from the largely separate fields of industrial economics and social network analysis. Like empirical industrial economics, social network analysis is mainly quantitative and, therefore, methods used in social network analysis can easily be applied to topics of interest to (industrial) economists. The main benefit of doing so is the inherently structural and contextual perspective of social network analysis, which enables the researcher to model interdependences between individual consumers. This reflects reality much better, as consumers are likely to make most economic decisions based on their own individual characteristics *and* on decisions taken by people with whom the individual interacts. The approach can, therefore, be seen as an attempt to reconcile insights from the two worlds of economics and sociology. Duesenberry (1960, 233) famously argued that 'Economics is all about how people make choices. Sociology is all about why they don't have any choice to make.' This book argues that the reality is best conceived and modelled as a combination of both paradigms. Individuals do make their choices based on an economic rationale but, for a number of reasons, are influenced in their decisions by the decisions of other individuals. The empirical chapters show different ways that this can be done empirically by using survival analysis models (Chapters 3 and 4), a permutation technique called Quadratic Assignment Procedure (Chapter 5), multinomial probit and logit models (Chapter 6) and time-series econometrics (Chapter 7).

Furthermore, most of the economic network literature treats direct and indirect network effects as equivalent (see for example Katz and Shapiro, 1985). However, this equivalence rests on the (strong) assumption that, in both cases, only the overall number of network members matters, not which consumers are in the

network. This assumption is plausible for markets with indirect network effects, but not for markets with direct network effects. For an example of the latter – mobile telecommunications – results from Chapter 6 using multinomial choice models show that the influence of other household members is about 10 million times more important than that of a random network member. This is the first empirical evidence that direct and indirect network effects can have very different implications in the real world. Whereas consumers are shown to be influenced in their operator choice by other household members, this is likely not to be the case for products with indirect network effects, as network effects in markets with indirect network effects arise through product complementarities and not through consumer interaction.

Finally, Chapter 7 introduces a new method of testing for direct market-level network effects and uses a time-series approach to test the model. Contrary to earlier empirical work on markets with direct network effects, this chapter focuses on technology *usage* instead of technology *adoption* and is, therefore, able to circumvent some of the econometric difficulties that the researcher faces when analysing such markets.

As an academic interested in social network analysis:
Chapter 2 shows how the economics literature on network effects is related to social network analysis in that it departs from the standard economics assumption that each consumer's choice is independent. Chapters 3 and 4 use unique large-scale networks based on mobile phone calling data to show how the iPhone diffuses through a social network and how switching of carriers is correlated among peers. Data for Chapter 5 was specifically collected for this book and is used to causally identify the reason behind the coordination of mobile phone choice in a social network using a cross-country quantitative case study approach. Identification of network effects as the cause behind operator coordination is achieved through differences in consumer coordination across companies and countries that induce tariff-mediated network effects and companies and countries that do not. Finally, Chapter 7 demonstrates a way in which market-level outcomes of individual-level consumer choice in social networks can be estimated.

As somebody interested in regulatory policy:
The importance of local social networks in markets with direct network effects also has implications for regulatory and anti-trust policy. For example, results from this book suggest that the high price of off-net calls can not only be a *result* of market power, but also can be a significant *source* of market power, which can especially be used to pre-empt entry by new competitors. On the other hand, when network effects are local in nature, multiple networks can more easily co-exist than in cases where only overall network size matters. If only overall network size matters, then markets with network effects indeed have a very strong tendency to be concentrated. However, for markets with direct network effects, this assumption is not supported by the results from this book and consequently the case for regulatory interventions in such markets is much weaker.

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