



Network effects, network structure and consumer interaction in mobile telecommunications in Europe and Asia[☆]

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ABSTRACT

This paper estimates the importance of (tariff-mediated) network effects and the impact of a consumer's social network on her choice of mobile phone provider. The study uses network data obtained from surveys of students in several European and Asian countries. We use the Quadratic Assignment Procedure, a non-parametric permutation test, to adjust for the particular error structure of network data. We find that respondents strongly coordinate their choice of mobile phone providers, but only if their provider induces network effects. This suggests that this coordination depends on network effects rather than on information contagion or pressure to conform to the social environment.

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1. Introduction

How do consumers choose between rival products in a market with network effects? A standard assumption of the network effects literature is that it is the overall size of the network that matters to the consumer. However, this assumption may only hold as a first approximation. For technologies that require direct interaction between consumers (such as telecommunications), we shall argue that the precise social network of a particular consumer is the relevant measure of the network as far as that consumer is concerned.

After the seminal articles of Rohlfs (1974), Katz and Shapiro (1985) and Farrell and Saloner (1985), there has been a plethora of theoretical studies into the nature of network effects and by now network effects theory has reached a rather mature state. However, empirical work in this area has been slow to keep track with the advances in theory, and it is only comparatively recently that such studies have appeared in any numbers. Recent empirical studies include Goolsbee

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and Klenow (2002) on home computers, Berndt et al. (2003) on anti-ulcer drugs, Rysman (2004) on yellow pages and Gowrisankaran and Stavins (2004) on electronic payment.

The literature on network effects usually distinguishes between two types of network effects: direct network effects and indirect effects. Direct network effects refer to the case where users benefit directly from the fact that there are large numbers of other users of the same network. In mobile communications, a direct network effect arises when the user can call a larger set of other users. Indirect network effects, on the other hand, arise because bigger networks support a larger range of complementary products and services. In second generation mobile networks, indirect network effects are only of second-order significance, but it seems probable that they play an increasing role with the introduction of third generation networks, where usage is more influenced by the availability of data services.

While it is widely acknowledged that network effects are a key feature of telecommunications industries, and indeed that telecommunications networks provide perhaps the leading example of network effects, relatively few studies, like e.g. Kim and Kwon (2003), have analyzed the empirical importance and extent of network effects in the telecommunications market.

Almost all these studies use market-level data and when individual level data is used (as in Goolsbee and Klenow, 2002), interactions between consumers are not modeled. In general, there are few studies in economics (and in management studies) that take this consumer interaction directly into account. The only exceptions in the economics of networks literature are a game theoretic model of Sundararajan (2006) and an empirical analysis of interactive network effects in the diffusion of a company video messaging system in a large investment bank (Tucker, 2006).

For some networks, like the network of ATM machines (see Saloner and Shepard, 1995), the assumption that overall network size matters seems plausible. However, especially in markets with direct interaction between consumers, like mobile telecommunications, it is rather an individual's social network that determines an adoption decision. Mobile networks are highly compatible with each other and the network effects that exist in the market are mainly induced by network providers in many countries through higher prices for calls to other networks (off-net calls) than for calls to the same network (on-net calls). These have been described as tariff-mediated network effects by Laffont et al. (1998), but they make the assumption that every subscriber to a network is of the same importance to the consumer. In a previous paper (Birke and Swann, 2006), we have shown that choice of mobile phone provider is strongly coordinated within households and that this effect is far stronger than the effect of overall network size.

In the current paper, we directly examine provider choice in a social network and test whether provider choice in a social network is correlated. The approach is therefore similar to the one taken in Bandiera and Rasul (2006) who study the correlation of adoption decisions of a new crop in social networks in Northern Mozambique. To gather data on social networks of mobile phone users, we conducted surveys of classes of students at Nottingham University Business School, the University of Nottingham's campus in Malaysia, the University of Utrecht (the Netherlands) and the University of Brescia in Italy. In running the survey in different countries, we took an approach similar to (quantitative) case study research in that the countries were chosen because of the different pricing structures in the respective markets.

As Manski (1993) points out, contextual effects and unobserved heterogeneity can lead to correlation of choice decisions of network members without network effects being present. Indeed, Bandiera and Rasul (2006) argue that correlation in their social networks is due to social learning. Likewise, different brands might be attractive to different consumers and brand affinity might be clustered among friends who share similar characteristics. Different underlying causes may have very different policy implications and for that reason, identification of causal relationships has been one of the main concerns of the recent empirical literature on network effects in economics and marketing (Hartmann et al., 2008).

To be able to test whether consumers coordinate choice of mobile phone provider because of induced network effects rather than because of word-of-mouth effects, it is necessary to have respondents who face different charges for on- and off-net calls. Due to a large number of different tariff plans, this data is very difficult to obtain for each individual and it would also have the drawback that price information reflect current prices which might be different from the prices that the consumer faced at the time of choosing the provider.¹

There are two alternatives to the use of individual level data. First, choice behavior can be contrasted for networks that charge higher prices for off-net calls and networks that do not. We have this opportunity in the UK, where the provider Three does not charge different prices for on- and off-net calls. The second alternative is to contrast choice behavior between countries with tariff-mediated network effects (most countries, including the UK, Italy and Malaysia) and countries where companies do not induce network effects (like the Netherlands).

This paper is organized as follows. Section 2 gives a brief introduction to the mobile telecommunications market in the UK, Malaysia, the Netherlands and Italy. Section 3 outlines the different surveys and discusses the econometric approach used in this paper. We also discuss some of the issues that may arise in this approach: first, some potential issues of endogeneity and second, some alternative interpretations of our findings in terms of conformism or information sharing rather than network effects as such. Section 4 provides a graphical and statistical analysis for each of the surveys, and compares the results. We show that students coordinate provider choice within their social network, but only if network effects are induced by mobile phone providers. Section 5 discusses the results and comments on their broader policy relevance. The findings are highly

¹ This is obviously only important if there are switching costs in the market, which is a reasonable assumption for the mobile telecommunications market.

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