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The diffusion of mobile social networking: Exploring adoption externalities in four G7 countries

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ABSTRACT

The diffusion of Mobile Social Networking (MSN) is driven by the development of new devices and improved mobile broadband. The instantaneous nature of MSN exchanges enhances the value of data access for mobile users, which generates network externalities. We explore the presence of these externalities in the diffusion of MSN in France, the UK, the US and Germany. For these countries, we compare estimates of two diffusion models: the Bass model and the Bemmaor model. We find evidence of network externalities in MSN adoption for all of these countries, captured by the *left skew* of the cumulative adoption curves. This evidence is confirmed even after taking into account the contrasting effect of heterogeneity in the propensity to adopt. Our results provide content providers, operators and regulators with insights about marketing strategies, helping with policy formulation under the combined presence of network externalities and heterogeneity.

1. Introduction

Over the last thirty years, the telecommunications industry has grown in both size and complexity, due mostly to the sector convergence of different applications, market deregulation and the penetration of the Internet. Prior to these transformations, the value chain of telecommunications providers (telcos) was characterised by a supply chain that was articulated into the sequence of: procurement, network operations, network-related service provisioning, billing, and added-value services and sales. Since 2007, however, the profitability associated with voice services has declined dramatically (West & Mace, 2010). Moreover, newcomers, defined as "over the top" companies (OTT), have progressively taken advantage of the standard IP-based Internet connection by adding new services. Accordingly, infrastructure and services have progressively become independent (Grove & Baumann, 2012, p. 40). One such example is Skype, which was able to lower call rates by combining Internet IP telephony with traditional telephony and reaping the associated economies of scale. Despite renewed efforts by telcos to provide IPTV and TV via telephone lines, OTT services (e.g., YouTube or Netflix) have emerged as more successful.[1]

These sector changes mean that telcos' products are progressively losing value by being commoditised (Funk,

[1] Moreover, the telcos' development of Internet-based applications has been slower in Western countries than in the Far Eastern ones. Funk (2007) identified the main causes of this as being related to differences in both the underlying architecture and priorities, with western companies focussing mainly on business users.

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2011; Grove & Baumann, 2012; West & Mace, 2010). The future and the modalities of telcos' market evolution depend critically on these developments. A key driver of this evolution is found in the fact that OTT services have increased the value of mobility for web-based services significantly. This is due mainly to the explosion of services based on user-generated content that allow real-time information sharing. West and Mace (2010) grouped these OTT services into five main categories:

- *additional communication features* that supplement or replace voice calling, i.e. SMS, e-mail, videoconferencing;
- *additional computing features* for third-party software vendors, such as add-on software packages, e.g., games or business productivity;
- *commercial content*, such as multimedia news and information services, movies, music and ringtones;
- *user-generated content*, typically photo and video sharing, blogging, wikis and social networking such as Facebook and Twitter; and
- *e-commerce* applications, allowing online commercial transactions either through dedicated client software or just through a browser. Typical commercial applications include online banking, auction sites like eBay, and accommodation and air travel booking systems such as Booking.com and TripAdvisor.

The diffusion of these services has increased the demand for mobile multimedia data significantly, and their evolution provides important insights into telcos' market infrastructure requirements and revenue forecasts.

Mobile Social Networking (MSN) is an essential data service that is currently showing strong growth. Recent estimates claim that there will be 2.4 billion MSN users by the end of 2016, compared to the 948 million active ones by end of 2012 (Informa, 2012). MSN diffusion is driven by the development of new devices, smartphones and tablets, improved mobile broadband and 3G and 4G/LTE networks, allowing quick access to the Internet, competitive pricing, and the proliferation of web content. MSN subscribers have instantaneous access to multiple sources of information when they are on the move, with the possibility to contribute. This implies that, for every MSN user, the amount and relevance of information available increases with the level of MSN diffusion among her/his peers. Hence, higher levels of MSN penetration increase the expected utility of both existing and prospective mobile users.

This increasing incentive to adopt, due to the increasing number of existing adopters, characterises markets with network externalities. Our research objective is to assess the potential presence of network externalities and to investigate their role in shaping the process of adoption and diffusion of MSN in four different countries: Germany, France, the UK and the US.

The remainder of the paper is structured as follows. After this introduction, Section 2 provides a literature review. Section 3 introduces the relevant models that are used later in the econometric analysis of the diffusion processes. Section 4 briefly describes the data sources, while Section 5 presents the diffusion model specifications, the forecasting methodology we use in this study, and the main results. Finally, Section 6 concludes the paper and indicates areas for future research.

2. Literature review

Social Networking (SN) sites are "web-based" services "that allow individuals to construct a public or semi-public profile within a bounded system; articulate a list of other users with whom they share a connection and view and traverse their list of connections and those made by others within the system" (Boyd & Ellison, 2007, p. 211). The role of SNs goes beyond the spread of personal information, because they also provide information about public affairs, by allowing citizens to express and broadcast opinions within online communities. In the 2008 US Presidential Election, nearly 10% of persons aged under 30 years signed up to candidates' sites, not only gaining instant campaign information but also posting and sharing comments online (Kim, 2011).

The identifying nature of SNs is to be found in the interaction between peers. Hence, the number of present adopters influences the future decisions of those who have not yet adopted and shapes aggregate diffusion patterns. Innovations based on users' interactions in SNs, and in telecommunications more generally, typically exhibit network externalities, as they become more valuable to their users as the number of adopters increases (cf. Mahler & Rogers, 1999, p. 720).

The economic literature has identified two main types of network externalities – direct and indirect – depending on whether the benefits of adoption are perceived by the users of a given service or commodity, or by those using other complementary products and services. Specifically, Katz and Shapiro (1985, 1986) define *direct network externalities* as those characteristics that increase the utility of a good or service as the number of users increases (e.g., mobile phone and e-mail). One key feature of these network externalities is that the increase in utility induced from present adopters also influences future adoption patterns, as present adoption levels affect expectations about the future utility of adoption (cf. Rogers, 2003, p. 315). *Indirect network externalities*, on the other hand, arise when the utility of a good or service increases with the number of users of a complementary product (e.g. the utility for a consumer of a DVD player increases with the increased penetration of DVD titles). In particular, for hardware and software products, the utility of the former depends of the number of compatible applications of the latter (Peres, Muller, & Mahajan, 2010; Stremersch, Tellis, Franses, & Binken, 2007). The presence of network externalities often implies the need for a *critical mass* of adopters in order for the diffusion of an innovation to succeed, as a "critical mass occurs at the point at which enough individuals have adopted the innovation so that the innovation's further rate of adoption becomes self-sustainable" (Rogers, 2003, p. 313).

Arthur (1989) and David (1985) provided pioneering contributions to the study of the effects of network externalities on the dynamic processes of the diffusion of innovations. They focused on the non-linear and path-dependent nature of these diffusion processes due to the presence of positive feedback, which causes adoption to become self-reinforcing only after reaching a critical threshold. Giovannetti (2000, 2013) identified the micro-economic conditions under which the opposite effects