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Investigating mobile broadband adoption and usage: A case of smartphones in Sweden

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ABSTRACT

Looking back at the last decade, the mobile phone has undergone great development, from only voice calls and text messages to a multi-purpose device that includes a camera, music player, games, and even a small computer. The development of internet features in mobile phones has also continuously and extensively changed from providing only limited internet browsing in the early 2000s to high quality video on demand today. The speed of the internet has also increased significantly since the introduction of smartphones. After the implementation of 3G networks in the past decade and the recent LTE networks of 4G technology in the last few years, the transmission speed of mobile internet supports the use of mobile phones to provide high-speed internet services known as mobile broadband. Furthermore, recent studies have suggested that mobile broadband has a positive effect on economic outputs as well as reducing the problem of the digital divide, especially in rural areas where fixed broadband infrastructure is limited or not available.

This paper analyses how mobile internet adoption has developed in the last decade and what factors determine mobile broadband adoption at this stage when smartphones are highly developed and the transmission speed is much improved. In this paper, Sweden is selected as a case study. The data set used in this paper is mainly based on the annual questionnaire conducted by the Swedish Post and Telecom Authority (PTS) in 2013. The methodology of this paper applies bivariate probit with sample selection since the data set consists of two sets of binary outcomes (adoption and usage). The findings show that smartphone adoption is less likely in the group of respondents who are older, have a lower income, lower level of education and live outside Stockholm. The findings on smartphone usage show that lower income respondents tend to use social networking, online shopping and internet telephone more than those with a higher income. The reasons could be explained by these kinds of applications reducing the costs for users compared with offline services. Identifying the determinants of mobile broadband adoption and usage is very useful for broadband policy, especially a policy related to reducing the digital divide. Policymakers can therefore use these findings to encourage the population to use the applications and services, especially people who are still non-adopters.

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1. Introduction

In the last decade, mobile phones have been continuously and substantially developed from only being communicating devices to multimedia devices. From previously only allowing voice calls and text messages, a mobile phone can now be used

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as a music player, camera and mini personal computer. With the continuous improvements in internet service for mobile phones, the transmission speed of mobile internet has increased significantly in recent years. The mobile phone has transformed into a so-called *smartphone* that can be used for many purposes, including providing broadband service. According to the Swedish Post and Telecom Authority (PTS), a smartphone, which is used for both calls and mobile broadband, is referred to as a mobile broadband add-on service.

At the early stage, one of the obstacles to mobile internet adoption was the transmission speed compared with fixed broadband speed, especially in developed countries (Westlund and Bohlin, 2008). However, after the development of 3G technology in the past decade and the recent introduction of 4G technology in the last few years, mobile internet can now provide faster speeds and become mobile broadband. Furthermore, mobile broadband adoption has grown significantly in recent years due to the massive increase in smartphone use. Even though mobile broadband can still not provide transmission speeds as fast as those of fixed broadband, several studies have suggested that mobile broadband has a significant positive impact on economic growth. For example, Thompson and Garbacz (2011) found that mobile broadband has a direct positive effect on GDP. In addition, scholars have suggested that mobile broadband can be applied as one of the regulatory tools to reduce the digital divide problem, especially in rural areas where fixed broadband infrastructure is limited or not available (see, for example, Srinuan et al., 2012a, and Prieger, 2013).

With a number of possible benefits from mobile broadband, it is important to understand which factors determine mobile broadband adoption at this current stage when smartphones are highly developed and the transmission speed is much improved. By understanding the factors of mobile broadband adoption and usage, the government will be able to initiate its broadband policy to increase adoption while the business sector will be able to use the knowledge of its market strategies to target particular applications for a specific group of users. In this paper, Sweden has been chosen as a case study because it was one of the first countries to adopt 4G/LTE technology. Hence, the growth of mobile broadband adoption has increased significantly, and the data set has become more available, which is enough to conduct an empirical study. This paper aims to investigate the determinants and relevant socio-economic factors of smartphone adoption as a representation of mobile broadband in Sweden. The aim of the study is to make recommendations for policy implementation for the public sector to increase the use of mobile broadband in the future. This paper has seven sections. Following this introduction, Section 2 provides an overview of Swedish mobile internet and the mobile broadband market. Section 3 discusses previous studies related to broadband and mobile internet adoption, while the data and model specification are explained in Section 4. The empirical results and the discussion of the findings are presented in Sections 5 and 6. Finally, Section 7 provides a conclusion, recommends policies and suggests future research.

2. Swedish mobile internet overviews

2.1. Mobile internet in the early to mid-2000s

The infrastructure for mobile internet in Sweden has been developed for more than a decade. At the early stage, the first step of mobile internet was in the form of GPRS (General Packet Radio Service). There were three mobile operators in Sweden able to provide GPRS from autumn 2001: TeliaSonera, Tele2 and Vodafone (later Telenor); however, at that time, the use of GPRS was still at the early stage. There were only about 105,000 subscribers using GPRS at the end of 2002 (PTS, 2003). In 2003, the users of GPRS had increased to about 516,000 subscribers, although the usage was limited with on average 0.16 Mb per month per user (PTS, 2004). In spring 2004, the 3G/UMTS[1] technology was finally commercially launched by the main mobile operators (TeliaSonera, Tele2 and Vodafone). Before that, even though 3G technology had been rolled out since 2001 and continuously developed for greater transmission speeds for mobile phone, only mobile operator, 3, had launched 3G by the end of 2003. As a result of commercial 3G services to provide faster internet, the number of users of mobile data and internet services increased to 983,000 with an average speed of 0.8 Mb per month per user. Nevertheless, compared with the numbers of mobile subscribers, only 10% of mobile users used mobile internet at the end of 2004 (PTS, 2005). However, mobile users have finally started to gradually use more mobile internet, with mobile data service accounting for 2.6 million subscribers in 2005 and 3.7 million subscribers in 2006. These results are due to individuals starting to connect to the internet via their mobile phones (PTS, 2007). Nevertheless, at that time, approximately 70% of the Swedish population still had not used mobile internet. The reasons for the low adoption were that mobile internet was too slow, and it was difficult to obtain an overview of the contents. Furthermore, there was still concern about the future cost of using mobile internet. At that early stage, the mobile internet users were mainly male, teenagers and young adults (Westlund, 2007; Westlund and Bohlin, 2008).

2.2. Mobile broadband market

With the development of 3G/UMTS technology, which increased the transmission speed for commercial 3G mobile internet services, mobile internet gradually turned into mobile broadband. Mobile broadband was first introduced in Sweden in 2006 with fewer than 100,000 subscribers. Since then, the number of mobile broadband subscriptions has continued to grow every year, in particular, with the introduction of LTE technology for the 4G network along with the explosive growth of

[1] UMTS = Universal Mobile Telecommunications System.

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