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Access to and penetration of ICT in rural Thailand

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ABSTRACT

This paper presents an econometric study of information and communication technology (ICT) in all 70,000 rural villages in Thailand, where the ICT considered consists of fixed-line telephone service, mobile telephone service, public telephones, computers, and Internet service. The results may provide information that helps policymakers decide where to put limited resources to promote ICT, and helps profit-seeking ICT companies target regions that maximize revenues. The study found that education is far more important than income in predicting the percentage of households who adopt ICT services, and that some unexpected variables such as the penetration of pickup trucks are useful predictors as well. Even in areas where fixed-line phone service is available, 70% of households with computers choose not to become Internet subscribers, although many presumably have enough money and technical knowledge. By separating availability from penetration of ICT, the study found that they can have different predictors, which means that researchers who do not separate them may get misleading results. There is no evidence showing mobile telephone service as a substitute for fixed-line telephone service. Also, public telephone service had little or no impact as a substitute for fixed-line or mobile telephone service, so phone companies need not fear that deployment of more public telephones will decrease their subscribership. Finally, there appears to be significant unmet demand for telephone service in rural Thailand where the infrastructure does not yet exist.

1. Introduction

Many countries wish to adopt a policy to make information and communication technology (ICT) available, affordable, and usable to all segments of their population; such as a policy that subsidizes the deployment of public telephones. Policymakers want information to help them decide where to put limited resources to promote ICT. Also, profit-seeking ICT companies want to know what regions to target to maximize revenues, and whether or not other kinds of ICT companies represent a threat or an opportunity; for instance whether mobile telephone service competes with fixed-line telephone service.

Some regions have low penetrations of ICT products or services because people choose not to use a given type of ICT, while other regions have low penetrations because providers do not make the products or services as widely available in these regions. Other studies have tried to determine what factors are highly correlated with the penetration of ICT without considering how many households in the region have access to ICT if they want it. This study breaks up "access to" (availability of) ICT from "penetration of" ICT in those areas where the service is available. As a result, it is possible to observe that some factors are correlated with ICT penetration because they are indicative of choices made by individuals and

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households, while other factors are correlated because they are indicative of choice made by service-providers to build out infrastructure.

The goal of this study is to provide information that helps both profit-seeking ICT companies and policymakers to answer these questions:

(1) What villages should profit-seeking companies offer ICT service to?
(2) What public policies are useful in expanding penetration of ICT service?
(3) To what extent do different kinds of ICT substitute for or complement each other?

This study analyses village-level data of rural Thailand in 2004, with variables associated with each village related to ICT penetration, geographic, and demographic information. The ICT considered consists of fixed-line telephone service, mobile telephone service, public telephones, computers, and Internet service. Linear and logistic regression models, regression trees, and factor analysis are used to study relationships between penetration of each type of ICT, access to each type of ICT, and a variety of demographic and geographic indicators. The study applies Two-Stage Least Squares regression (2SLS) to assess the extent to which different kinds of ICT substitute for or complement each other. Finally, the propensity scores technique is applied to predict penetration of ICT that could be achieved in the villages that do not currently have access, if the infrastructure were built out.

Section 2 discusses studies about predictors of ICT penetration, and substitution effects between mobile and fixed-line telephone. Background information about ICT in Thailand is presented in Section 3. The data set and research methodology are discussed in Section 4. After presenting results in Section 5, the policy implications for both profit-seeking ICT companies and policymakers are discussed in Section 6.

2. Literature review

Section 2.1 discusses various demographic and geographic predictors of ICT penetration in many studies. Section 2.2 discusses studies that investigate whether mobile and fixed-line telephone services are complements or substitutes.

2.1. Predictors of ICT

The ICT considered in this study is fixed-line telephone service, mobile telephone service, public telephones, computers, and Internet service. Studies about determinants or predictors of ICT penetration are conducted at different levels; countries or regional, and individuals or households level. This section gives a brief overview of predictors of each kind of ICT in different levels of study.

Fixed-line telephone service: Income has been found in many studies, using both household and national level data, as an important factor in predicting penetration of fixed-line telephone service. Torero and Braun (2006) surveyed rural households of China and found that annual household income is a predictor of fixed-line telephone penetration. Household income is suggested in Hudson (2006) as an indicator of willingness to pay for the service in developing countries. Using cross-country analysis, Torero and Braun (2006) and Norris (2001) found that a nation's per capita Gross Domestic Product (GDP) is an important predictor of fixed-line telephone penetration. Additionally, Torero and Braun (2006) found the education level of the household head, economic development of the area, and distance from household to the main road to be other predictors of fixed-line telephone penetration.

Mobile and public telephone service: Income is also a predictor of mobile and public telephone penetration. Using national level data, Norris (2001) and Torero and Braun (2006) found that a nation's GDP per capita is a good predictor of nationwide penetration of mobile telephone service. Based on data from 46 developed and developing countries, Kauffman and Techatassanasoontorn (2005) applied different diffusion models and found that Gross National Product (GNP) and telecommunications infrastructure are determinants of mobile telephones penetration. In rural households of Peru and Ghana, the study from Torero and Braun (2006) found that usage of public telephones can be predicted by education level of the household head, household income, and distance from a household to the public telephone.

Computers and Internet service: Using household and national level data, many studies commonly found that education, income, and age are important predictors of computer and Internet penetration. At the household level, the National Telecommunications and Information Administration (NTIA, 2001) found that household income, education level, and age of the household head are useful predictors of computer and Internet penetration in the US. A study from the Organization for Economic Cooperation and Development (OECD, 2000) and Norris (2001) concluded that penetration of computers is predicted by income, education, and age in OECD countries. At the national level, Torero and Braun (2006) and Hargittai (1999) found that per capita GDP is a useful predictor of computers and Internet penetration. Other studies also found gender (Pew, 1999), household size (OECD, 2000), and penetration of televisions and radios (Norris, 2001) as useful predictors of computer and Internet penetration.

2.2. Substitution and complement between fixed-line and mobile telephone services

Numerous studies have tried to assess the extent to which mobile telephone service and traditional fixed-line telephone service are substitutes or complements. A report from the International Telecommunications Union (ITU, 1999) concluded