Multiproduct Firms, Product Bundling and Market Entry

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Abstract

High-speed Internet providers in the U.S. offer mixed bundling, which consists of subscription television, telephone,

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entry into the high-speed Internet market: the demand effects and the retention of consumers. In terms of demand effects, an incumbent s provision of mixed bundling implies market demand for mixed bundling and thus increases the probability of entry by the telephone company that prepares to provide mixed bundling. On the contrary, an incumbent s mixed bundling leads to the retention of consumers. As consumers are locked into mixed bundling offered by an incumbent cable system, this paper assumes that consumers are less likely to switch from an incumbent cable system s mixed bundling to high-speed Internet service offered by the entrant. In terms of the retention of consumers, it is expected that the probability of entry is decreased by an incumbent cable system s mixed bundling. Therefore, the probability of entry is determined by the relative size between demand effects and the retention of consumers created by an incumbent cable system s mixed bundling. To distinguish the retention of consumers from demand effects, this paper uses the interplay between mixed bundling provided by an incumbent cable system and measures of consumer preferences such as income and education. Empirical findings in this paper suggest that the probability of entry in the high-speed Internet market decreases with median income or average years of schooling in markets where an incumbent cable system offers mixed bundling. Since markets with higher income or more years of schooling can have higher opportunity costs of time taken to switch service providers, these findings imply that the probability of entry decreases with higher opportunity costs of time when an incumbent cable system offers mixed bundling.

Key words: Entry, High-speed Internet, Multiproduct firms

JEL Classification: L11, L15, L86, L96

difficulties stemming from the need for compatibility with existing equipment, and hassle costs involved in switching (Lehr, 1998; Thanassoulis, 2007; Hannan, 2011). With an increase in switching costs, consumers are reluctant to change service providers and intensify post-entry competition. However, product bundling offered by an existing firm can indicate a preference for purchasing different services in a single bill to avoid higher costs and time required to purchase them separately. This may increase the probability of entry by a multi-product supplier.

While this paper examines two opposing influences of mixed bundling on firm entry, it also adds to the previous literature on product bundling in telecommunications. Prince and Greenstein (2011) explore the relationship between product bundling and consumers switching behavior in the U.S. telecommunications market. They suggest that households that have already purchased a bundle of TV, telephone, and high-speed Internet (i.e., triple-play) are less likely to switch service providers. While their study examines the influence of product bundling on consumers choice of switching service providers in the telecommunications market, this paper focuses on the supply side and empirically examines the impact that product bundling (i.e., mixed bundling) has on a multi-product supplier s entry decision in the high-speed Internet market.

Thanassoulis (2011) builds a theoretical model of the convergence process, which consists of partial convergence (i.e., product bundling offered by a single firm) and full convergence (i.e., product bundlin

Both cable operators and telephone companies in the U.S. telecommunications industry have expanded their services since the 1990s. Table 1 demonstrates that cable modem and DSL are the dominant services in high-speed Interne

its DSL entry. Due to the presence of its own telephone network, the telephone company does not require huge sunk costs for its entry into the high-speed Internet market, and consumers have been aware of the telephone company before its DSL entry. Therefore, the retention of consumers led by an incumbent s product bundling can be a key determinant for the telephone company s DSL entry. Estimating the likelihood of switching from an incumbent s mixed bundling to DSL service offered by the telephone company can be a critical element to understand the telephone company s DSL entry decision. Lastly, high sunk costs in cable TV means that the exit or entry of cable systems is a very rare occurrence.[6] Unlike industries that experience significant firm turnover like manufacturing, for example, this paper focuses on the determinant of firm entry.

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Market size (*S*) is proxied by total population in a market. $\dot{\omega}\,\wr$ is variable profits and $"\mathrm{O}\,\wr$ is fixed costs. $\doteq$ and $\bar{\Pi}$ are vectors of market-specific variables affecting variable profits and costs, respectively. $\iota, \dagger$, and $\prime$ are profit function parameters to be estimated and R is an unobserved random error term.

Variable profits could vary across markets and depend on competition intensity. This paper estimates the influence of an incumben s mixed bundling on the probability of entry. An incumbent s mixed bundling included in variable profits leads to two opposing effects: demand effects and the retention of consumers. Demand effects can imply the size of demand for mixed bundling and lead to positive influences on the probability of entry by an entrant that prepares to provide mixed bundling.[7] When consumers are locked into mixed bundling offered by an incumbent, the telephone company would face lower variable profits due to increased competition (e.g., greater advertising costs for competing with an incumbent). However, variations in the telephone company s entry decisions are observed among markets in which consumers are locked into an incumbent s mixed bundling. This paper examines the hypothesis that these variations in the probability of DSL entry can be determined by the likelihood of switching suppliers in markets in which an incumbent offers mixed bundling.

Kiser (2002) and Giulietti et al. (2005) provide insights into the importance of measures of consumer preferences in consumers decisions to switch suppliers by using household level data. In the market for the U.S. depository institutions, Kiser (2002 -reported inconvenience of switching as a proxy for switching costs and finds that respondents with college degrees and high incomes appear more likely to report inconvenience in switching depository institutions.[8] In the U.K.

residential natural gas market, Giulietti et al. (2005) suggest that low income households are more likely to consider switching, while there is an inverted U-shaped relationship between household income and the probability that an individual household considers switching suppliers. They explain that a greater opportunity cost of time for higher income households is the main source of the likelihood of switching.

high-speed Internet service is found to be higher for consumers who have higher incomes, are younger, or are more educated (Prieger, 2003; Savage and Waldman, 2004). Therefore, the variable profit per consumer[9] is given in Equation (3).

(3)

includes firm characteristics of an incumbent, local demand, and cost conditions.

DSL entry incurs fixed costs of entry that include costs of personnel and equipment for DSL service. A longer distance between the entrant s headquarters and the geographical market to enter (*DIST*) implies higher costs of training and communication. Wire centers of the entrant provide telephone and DSL services. Longer distance between a wire center and a location of a consumer lowers the quality of DSL service. This limitation is overcome by a Digital Subscriber Line Access Multiplexer (DSLAM) that is placed in a remote terminal (*RT*). Fixed costs of entry are given in Equation (4).

(4)

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service during the period from 1999 to 2000, data sources for cable operators, such as Warren Publishing, have provided information on cable modem and telephone services since 2002. To examine the influence of mixed bundling on the DSL entry decision, this paper examines the DSL entry decision since 2002. The sample contains the biannual periods in 2002, 2004, and 2006, because the year-to-year changes appear to be insufficient to exploit an annual panel.[10] For these years, this paper examines the DSL entry decision in the 14 states of Arizona, Colorado, Idaho, Iowa, Minnesota, Montana, Nebraska, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming in which the telephone company is the most likely entrant into the high-speed Internet market.

DSL entry decisions are examined at the Census Block Group (CBG)[11] level in this paper. A CBG contains from 300 to 3,000 people. Consistent with Warren Publishing and a prior study on cable systems (Chen and Savage, 2011), one or two cable systems are found at the CBG level.[12] In markets with two cable systems, examining DSL entry decision at the CBG level requires identifying a dominant cable system, which contains a larger number of subscribers to basic service. Then, the telephone company s DSL entry decisions are matched with the corresponding service area of a dominant incumbent cable system.

[10] Crawford and Yurukoglu (Forthcoming) point out persistent non-updating of entries in the Warren *Television and Cable Factbook*. For example, there are rare changes in yearly entries on the number of subscribers to basic cable TV service, monthly subscription price to basic cable TV service, and monthly subscription price to cable modem service during the sample period.

[11] To examine DSL entry decisions, it is critical to define a geographic market, which allows us to identify an incumbent cable system and find whether it offers mixed bundling. Geographical markets in prior studies on the DSL deployment are postal service codes (Prieger, 2003; Xiao and Orazem, 2005), counties (Gillett and Lehr, 1999), wire centers (Gabel and Kwan, 2001), and census block groups (Molnar and Savage, 2012).

A wire center has the switching machine
by the same (or a different) wire center. A

14 196.61 re ET BT 1 0 0 1 213.17 402.99 T 56.61 ou DET BT 1 0 0 1 420.55 259.19 T 56.61 oudt(g)6(e)6( )] TJE(e)-Wntele6(ical)-16( )] TJceninp0(s)3

To examine the DSL entry decisions of Qwest in markets in which an in

influenced by consumer loyalty and opportunity costs of searching alternative service providers. bundled service time, effort, and , and compatibility to existing equipment. It is possible that consumers who are locked into an incumbent s mixed bundling in some markets are more (less) likely to switch than their counterparts in other markets. The likelihood of switching from an incumbent to the telephone company s DSL service is measured by the interplay between measures of consumer preferences and mixed bundling: *INCOME*×*MXB* and *EDUC*×*MXB*. In markets with higher median income, consumers would not switch a service provider because of subscription fees for cable modem service. When

amount of monthly subscription fees for the high-speed Internet service regardless of the number of occupants in the same household. For a given population,

control for the likelihood of switching in model (4); with the additional control for year effects to control for unobserved factors that affect the DSL entry over time in model (5).

Without any consideration for the likelihood of switching,

significance in model (5), the coefficient on *EDUC*عي*MXB* is still negative and statistically significant at the five percent level.

The overall effect of mixed bundling offered by an incumbent on the probability of DSL entry is estimated by:

¶ ΌΎΰ¸Όèòìώj¶ ΰ ώő سي طىπ‰ωσψσ طى π‰πππρ عي ΰΰőΰ ΰΌ طي π‰πςυφ عي ΌΌΎΥő.

At the mean value for *INCOME* and *EDUC*, the estimate of overall effect (¶ ΌΎΰ¸Όèòìώj¶ ΰ ώő) is negative (-0.0189), statistically significant at the one percent level. This implies that mixed bundling offered by an incumbent can decrease the probability of DSL entry by 1.89 percent points. A negative overall effect suggests that the demand effects of an incumbent s mixed bundling is outweighed by the negative effect resulting from the retention of consumers. Overall, an incumbent s mixed bundling can decrease the probability of DSL entry by the telephone company. An interesting implication of this effect is obtained by evaluating¶ ΌΎΰ¸Όèòìώj¶ ΰ ώő at the sample minimum for *EDUC*. When evaluated at the minimum value (which is about eleven years of schooling), the probability of DSL entry is about five

firms which provides either wireline or wireless service in a market (*COMPETITION*)[24] and the average price of cable modem service offered by an incumbent (*PRICE*). Following Bresnahan and Reiss (1991) and Berry (1992), an increase in the number of firms (*COMPETITORS*) would lead to intense competition in the market[25] and, in turn, decrease the probability of DSL entry.

Price can also affect the probability of DSL entry. Information on the average monthly subscription fee for high-speed Internet service offered by *COMPETITORS* in a market over the sample period was not available. While the average monthly subscription fees of cable modem service offered by an incumbent (*PRICE*

markets with the presence of an incumbent s manager who has been more recently employed and has accumulated more recent knowledge about the market than in markets with the traditional managers. Since data on complaints about an incumbent show the number of complaints (*COMPLAINTS*) mostly for the top ten largest cable operators, *COMPLAINTS* captures both an incumbent s firm size and the service quality of an incumbent. A positive coefficient on *COMPLAINTS* indicates the size effect outweighs the quality effect. The probability of DSL entry does not increase with the number of complaints on a big incumbent.[26]

Regarding demand conditions, the probability of DSL decreases with the number of local businesses (*EST*), as this paper examines residential DSL service. This increases with median income (*INCOME*) and average years of schooling (*EDUC*). A coefficient on *HOUSING* is negative, statistically significant at the one percent level. Given the population, an increase in housing (*HOUSING*) indicates smaller housing size. As high-speed Internet access is more likely in households with two or more occupants (Savage and Waldman, 2005), smaller housing size may imply lower demand for high-speed Internet access and decreases the probability of DSL entry.

In terms of fixed costs of entry, the fixed effects linear probability model considers only variables that change over time. There is no variation across years in the distance between headquarters of the entrant and the geographical market to entry (*DIST*), which is dropped in the regression. As the presence of a remote terminal (*RT*) improves the quality of DSL service, this increases

the product bundling as an entry deterring strategy, there are relatively fewer

interactive TV. While the American Recovery and Reinvestment Act of 2009 earmarked $7.2 billion for NGN investment, it is uncertain when and to what extent it will be deployed in the market (Nitsche and Wietahus, 2011). Infrastructure

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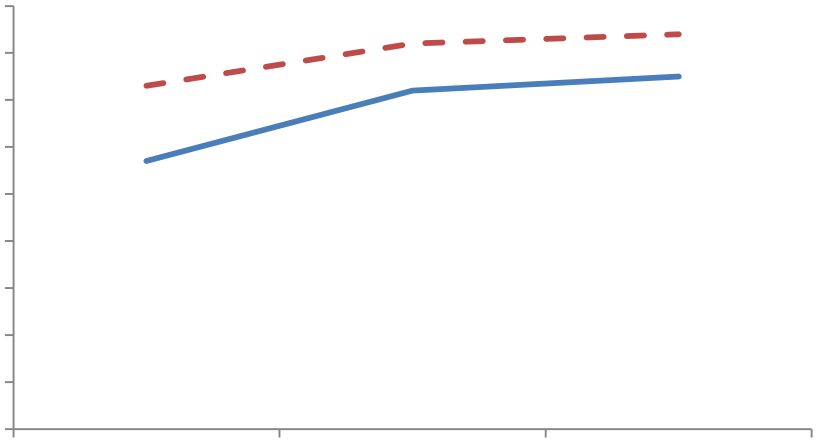
Figure 1. DSL DEPLOYMENT RATE OF QWEST



Note:
efore is the data based on 73,920 CBGs which include observations with missing values and rare observations of exits.
fter is the data based on 53,346 CBGs which exclude these observations.

Table 1. RESIDENTIAL HIGH-SPEED INTERNET LINES IN U.S.
(Over 200 kbps in at least one direction)

Technology	**1999 Dec**	**2000 Dec**	**2001 Dec**	**2002 Dec**	**2003 Dec**	**2004 Dec**	**2005 Dec**	**2006 Dec**
ADSL	291,757							

Table 2. CABLE SYSTEMS IN 14 STATES

State / U.S.	No. of cable systems	No. of cable systems with DSL entry	Mean MXB	Mean Income	Mean Educ-ation
Arizona	7,791	6,875			

EDUC	Median number of years of schooling calculated from the data on the population over 25 years of age in each educational category.TQq163.94 555.58 381.55 164.42 r
EST	
AGE	
HOUSING	

Table 4. DSL ENTRY EQUATION SUMMARY STATISTICS

Variable

Table 5. AN EXAMPLE OF CONSUMER COMPLAINTS FORM

57 (the total number of complaints)	XXXX (the name of the firm)
3	Billing Rates
2	Billing Dispute
	2005 June
1	Consumer Rate Issue
	2005 April
37	Cable Internet Modem Service
10	No Sub-Categories Available
	2005 May Jul Aug Oct Nov
27	No Sub-Category Assigned
	2005 Apr May Jun Jul Aug Sep Oct Nov
4	Connections to Cable Systems
	No Sub-Category Assigned
	2005 May Aug Oct
3	Other
	Other
	2005 Mar Jun Jul
10	Service Issues
1	Digital Service
	2005 Feb
3	Service Availability
	2003 Aug
5	Service Treatment
	2005 Jun Aug Nov
1	Signal Quality
	2005 Sep

Appendix A. Remote Terminals (*RT*)

There is a sample data, which includes market size, variable profits, and fixed costs. The FCC Hybrid Cost Proxy Model (HCPM) data contains information on fixed costs. This section explains the merge between the FCC HCPM and the master sample data. To estimate the fixed costs of providing telecommunication networks at the census block group (CBG) level, the number of high-density remote terminals (*RT*) is chosen from the FCC HCPM workfiles. Before merging these two data sources, the duplicated CBGs in the FCC HCPM workfiles need to be dealt with. In the FCC HCPM workfiles, it is observed that a CBG contains more than one value on fixed costs. The duplicated CBGs refer to the appearance of these CBGs, which does not have a single, identical value on the fixed cost. The second issue is the number of matched CBGs between the FCC HCPM workfiles and the master sample. As the FCC HCPM workfiles contains the duplicated CBGs, a set of different values for remote terminals can be observed in a given CBG. Thus, the total number of *RT*, within the same CBG, is calculated as follows:

$$\text{No. of high density RT_sum} = \qquad \text{high density RT}_i \qquad (1)$$

where $i=1\ldots n$ is the number of duplicated CBGs, and *RT* is the total number of remote terminals within the CBG.

The master sample data initially contains 78,225 CBGs. Among 78,225 observations, 24,936 CBGs are matched to the FCC HCPM workfiles. By merging FCC HCPM workfiles with the master sample, 32 percent of the master sample contains the information on *RT*. Running a regression of *RT* on demographic variables makes it possible to predict the number of *RT* in the unmatched CBGs. As *RT* is a count variable, poisson and negative binomial model can be applied. Because of the presence of a significant overdispersion in the poisson model, a negative binomial model is applied. Table A.1 demonstrates the coefficients obtained from the negative binomial model.

-0.0002**POP* - 0.1776**DEN* - 0.0142**INCOME* 0.0338**AGE* + 3.1539**POP_GROW* (2)

Because a negative binomial model is applied, the predicted number of *RT*

Appendix B. The Random Effects Logit Model

Estimates in Table 6 and 7 are obtained from the fixed effects linear probability model. However, obtaining estimates from the fixed-

Appendix C. Endogeneity

There are potential endogeneity concerns associated with the likelihood of switching variables (i.e., *INCOME*×*MXB* and *EDUC*×*MXB*) in the DSL entry equation (5). Prior studies suggest that switching costs can consist of setup (paying membership fees when changing gyms) or sunk costs (e.g., non-recoverable time, money, and effort). Consumers perceive that establishing and maintaining a relationship requires these sunk costs (Jones et al., 2002; Wise and Duwadi, 2005; Lee et al., 2006).

Basic installation fees for an incumbent s subscription TV (TV hereafter) are used as an instrument for the likelihood of sw