Policy implications of market segmentation as a determinant of fixed-mobile service substitution: What it means for carriers and policy makers

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ABSTRACT

The determination whether mobile and fixed telecommunications services operate in the same market not only affects business decision of service providers, but also has wide implications on public policy decisions pertaining to the means by which they should be regulated in the United States. This study conducts a two-stage cluster analysis implementing the American Customer Satisfaction Model on two datasets of 3251 and 5060 data points pertaining to mobile and fixed-line phone services, respectively, collected by the National Quality Research Center at the University of Michigan in order to determine whether the way consumers perceive these services can indicate as to their levels of substitutability. It concludes that different types of customers with different needs consume these products and offers policy makers some insight on how to further the penetration of mobile services.

1. Introduction

In fewer than 25 years of existence as a commercial telecommunications offering, wireless mobile services have changed dramatically. Originally perceived an expensive offering and a status symbol (Katz and Sugiyama 2005; Lemish and Cohen, 2005; Ozcan and Kocak, 2003; Turel et al., 2007), the mobile phone has become a common technology within reach of many. While at first it served mostly as a voice communications service, it has developed into a hub of multimedia products. Under these changing circumstances consumers have the opportunity to make choices among competing services that can be provided by either wireless or fixed means. Indeed, a survey conducted in 2007 by the National Center for Health Statistics (NCHS) in the United States concluded that during the second half of 2007 15.8% of American households had only wireless service and that in addition, 13.1% of American homes received all or almost of their calls on wireless telephones despite having a landline telephone in the home.[2]

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[2] http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless200805.htm.

The percentage of wireless only homes, according to the same study, grew threefold since 2004. Demographically, wireless only households tended to be occupied by younger, lower income adults, with smaller families, with a higher likelihood of being either Hispanic or black who rented rather than owned homes. The NCHS study also identifies a striking change in the utilization of mobile services, as early studies of fixed-mobile substitution in the United States (e.g. Rodini et al., 2003) indicated that such substitution was "moderate" and visible mostly with regard to a second telephone line. Indeed, this dramatic change in the basic definition of access to telephone has led the FCC to include mobile phones as a measure for "telephone service" (FCC, 2009, p. 2).

One phenomenon that stands out in this context is the dramatic change in the position of the United States among other nations with regards to the adoption rates of mobile services. Traditionally a trailblazer and world leader in connectivity and new technology adoption, in recent years the United States has become a follower of both Western European and East Asian powerhouses. The International Telecommunication Union (ITU) reports that in 2005, one-third of the world's population was subscribed to mobile services, and that over a half of the world's population was subscribed to fixed-line services. The Compound Annual Growth Rate (CAGR) from 2000 to 2005 was 5.2% for fixed phone lines and 24% for mobile subscribers (ITU, 2007). According to the same data, however, during the same period the CAGR for mobile subscribers in the United States was only 13%. While in 2007 there were approximately 84 mobile subscribers per 100 inhabitants in the United States, there were more than 90 in South Korea, 105 in the Netherlands, 113 in Sweden, 115 in Finland, and more than 100 in 31 countries in Europe alone.

A similar gap exists between the United States and European countries with regard to the wireless-only phenomenon. Across the European Union, 24% of households have only mobile access, however the number differs significantly between the wealthier EU 15 (20%) and the 12 New Member States (39%). The variation among the different European countries cannot provide a single explanation for consumers' preferences as, for example, in tech-savvy mobile-saturated Finland 61% of homes are wireless-only while in neighboring Sweden, where mobile penetration is similar (Sutherland, 2008), wireless only homes constitute only 3% of total households (EU, 2008).

The adoption rates and patterns of mobile services have attracted much scholarly attention in recent years (see Ahn and Lee (1999), with regards to a variety of 64 countries; Gruber and Verboven (2001), for the European Union; Gruber (2001), regarding Eastern and Central Europe; Madden and Coble-Neal (2004), regarding a variety of 56 countries; and Jang et al. (2005), regarding 29 OECD countries and Taiwan). One important attribute of mobile telephony is that the basic service it has been providing since its market introduction may potentially cannibalize a service previously offered by regular wireline companies. In addition to capturing the voice communications segment, mobile telephony also competes for sophisticated data and Internet services that are often superior to those offered by landlines. As a result, the question arises whether these two services can be seen as substitutes for each other.

The telecommunications landscape in the United States is unique in many ways and is a result of a combination of unique characteristics and circumstances ranging from geography through political philosophy to technological availability. There could be a few competing explanations for the laggardness of the United States market regarding new technologies: One could be high penetration levels and availability of wireline services, which slow the introduction of wireless substitutes; another could be high levels of consumer satisfaction with traditional fixed services; a third could be the subjective perception of mobile services as supported by marketing efforts, which place them in a separate "luxury" category, thus not intuitively perceived as a substitute or complementary service for wireline; and yet a fourth explanation could be that public policy, in particular with regard to interconnection and tariffs inhibits growth. This search, though, for a policy implication and subsequent recommendations would be limited by a comparison to markets that have demonstrated high wireline connectivity prior to the mobile revolution, as no doubt in developing countries in which wireline was unavailable, the growth of wireless services took place under incomparable conditions and there is no substitution effect.

In this study, we attempt to identify the substitutability between mobile and wireline services in the characteristics of fixed and mobile telecommunications consumers in the United States, and what their perceptions of the respective services to which they subscribe say about them and their identity as consumers. By identifying the different levels of loyalty consumers develop towards these services and the considerations that affect these decisions, the study attempts to determine whether mobile and fixed services have been determined as substitutes by United States consumers. In order to reach this conclusion, this study adopted the American Consumer Satisfaction Model and applied it to two datasets of 3251 and 5060 data points pertaining to mobile and fixed-line phone services, respectively that were collected in 2004–2006 by the National Quality Research Center at the University of Michigan. A Two-Step clustering technique was used in order to test similarities and associations between segments in representative samples of wireless and wireline users, without making any assumption on the final number of clusters. Making no assumption on the final number of clusters was possible for the following reasons. First, sample sizes were very large in both segments. Second, the average number of services in the industry was known. Third, we were interested in exploring differences in behavior between the samples. The market segments created then inform our understanding of the markets for the two services – fixed and mobile telephony. The existence of self-described different consumer groups implies whether or not the two markets are similar in the eyes of consumers, and thus whether or not through the subjective perceptions of consumers the two products serve as substitutes.

The study begins by discussing the characteristics of the mobile telephony market in the United States, by showing how it compares to some other relevant markets and by explaining the theoretical foundations for using consumer loyalty as a means for predicting substitution in telephony markets. It then describes data analysis, focusing on the differences between
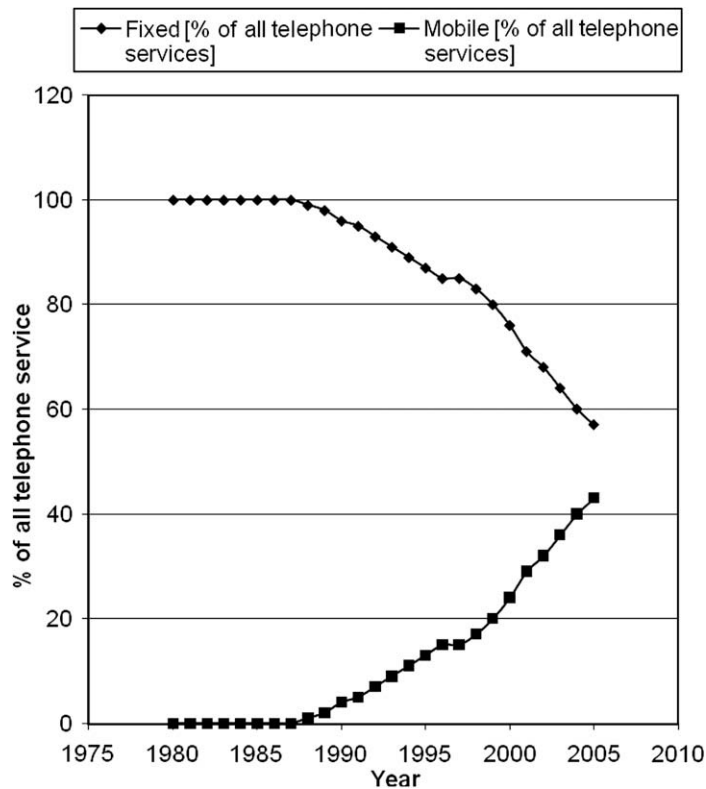
Fig. 1. Trends in the composition of the telephone market in the US (1980–2005) (based on data from FCC, 2007).

the two consumer groups. Following what we believe is the conclusion that while in the United States mobile and fixed markets are two markets perceived as distinct by consumers, but that some of their overlapping offerings may be perceived as substitutes to the extent that the latter service (in particular wireline) is surrendered, even though this may mean surrendering additional services it offers, we discuss the policy implications and make recommendations that may contribute to higher penetration of mobile services in the United States by making the mobile market more competitive, adopting the positive characteristics of its wireline predecessor, as determined by the consumers.

2. Literature review

2.1. Fixed-mobile substitution and the United States telecommunication market

The telephone market is an important component of the US economy. US consumers spend on average about 2.3% of their annual expenditures on telephone services (e.g., telephone expenditures were $990 per household in 2004). This percentage has been fairly stable in the last 25 years, ranging from 1.9 to 2.4 (FCC, 2007). While the telephone expenditure is stable, its composition has changed over the years. The same FCC report shows that while in 1980 100% of the expenditure pertained to fixed-line services, in 2005 only 57% pertained to fixed-lines, and the rest related to mobile wireless services (see Fig. 1). Since many households may have a single fixed-line but many mobile phones (potentially one for each household member), the percentage of wireless subscribers (65.6%) has passed that of fixed-line subscribers (60.1%) in 2005 (FCC, 2007). This trend is further supported by the statistics describing residential lines. In 2003, a decline has started in the number of primary and non-primary residential lines. At the same time, the number of households with wireless services only has increased from close to 0% in 2000 to 15.8% in 2007. Indeed, the growth of the mobile market has been steep. The number of mobile subscribers has exceeded 200 M, the average minutes of use per month has gone up to 740, and the average monthly bill has gone down to about $50 in 2005, compared to $96 in 1987. Furthermore, whereas wireless service providers' revenues have more than tripled from $32.9 B in 1997 to over $100 B in 2005, the revenues of fixed-line local service providers have only marginally increased from $97 B to $121 B during the same period. These numbers further demonstrate the turmoil that the US telephone market is experiencing, and the need to further understand subscribers and their switching behaviors, in both the fixed and mobile telephone markets.

The statistics in other countries in the world, however, have been much more dramatic regarding penetration levels of mobile telephony. Thirty-one European countries had passed the 100 subscribers to mobile telephony per 100 inhabitants

by 2007, and the penetration rate in the developing world in 2005 was 85%, significantly higher than that in the United States.[3]

The beginnings of mobile services in the United States were slow. Parker and Roller (1997) found that even though cellular operators were initially licensed two-to-a market, to encourage competition, this structure led to outright cartel pricing, which slowed down the penetration levels of the service. King and West (2002) claim that the United States' lag in cellular telephony is inconsistent with previous technological development, and they attribute it to the culture created by the AT&T-Bell virtual (though not technical) monopoly. The dominant unique attribute of the telecommunications market in the United States is that it developed as a privately owned monopoly, in complete contradiction to most telecommunication service markets around the world that developed as government owned and operated monopolies. As a result, US policy decisions were guided by AT&T-Bell's interests and since mobile telephony appeared on the technological horizon concomitant with the breakup of the monopoly, policy making in the United States lacked the leadership needed to keep it ahead of other countries in which the government monopoly structure was still intact. This unique attribution of foot-dragging in technological development to the introduction of competition to a market stands out, as for example Gruber and Verboven (2001) find that the major impact on the diffusion of mobile telecommunications in the European Union should be attributed to the transition from analog to digital systems with a smaller (but positive) effect awarded to competition. Regarding Eastern and Central European countries, Gruber (2001) finds that increase in the number of firms – an indicator of growing competition – increases the rate of mobile diffusion, as does the size of the fixed telecommunications network. Ahn and Lee (1999) concur that the availability of fixed line facilities has a positive effect on mobile penetration in addition to country-specific circumstances such as tariff systems, national wealth, technological development, industrialization, and the per capita GDP. Interestingly they find that price effects on the subscription levels to mobile services are not strong. When it comes to substitution between mobile and fixed services, Barros and Cadima (2001) predict that the effect of mobile diffusion on fixed-line penetration rates would be roughly 10% in a small European economy (Portugal in their case). Madden and Coble-Neal (2004) international comparative study concludes that while mobile phones were initially perceived as a complementary service to wireline services, there is a growing substitution effect with the advancement of technology. They attribute a larger effect of this behavior to the rising price of fixed services and the subsequent declining price of mobile services, and they identify these effects – that enhance substitution – with the growth in the size of the mobile network. Sung and Lee (2002) identify a growing pattern in which mobile phones have become substitutes to wireline in Korea in the 1990s.

2.2. Predicting loyalty in telephone markets

Substitution of one service for another is indeed an outcome of a perceived identity on the functionality of a product, however customer loyalty may affect such a decision as well. Customer loyalty is defined as a favorable attitude towards specific service provider that consists of two dimensions: (1) repurchase likelihood (RL) and (2) price tolerance (PT) towards the service provider's price and towards competitor pricing (Fornell et al., 1996). That is, the concept of loyalty captures financial and quality sacrifices users make when staying with a specific service provider. Loyalty is one of the major concepts in consumer behavior, and a large part of a telecom service provider's effort is aimed at creating and maintaining loyalty among its customer base. Loyalty is important because it positively impacts important outcomes, such as customer retention, repurchase, long-term customer relationships and company profits (Willis et al., 2007). That is, loyalty is a primary factor in reducing churn (i.e., switching/abandoning behaviors). Several attempts have been reported in the telecommunications policy literature to understand the concept of loyalty and its antecedents. It has been demonstrated that customer loyalty in the German mobile market is predicted by user satisfaction, and that loyalty in turn, affects retention (Gerpott et al., 2001). In the Korean market, it has been found that while switching behavior is dependent on the level of satisfaction with alternatives and specific service attributes (e.g., call quality, handsets, etc.), loyal behavior is predicted by attributes such as call quality and handset type (Kim et al., 2004).

In other words, loyalty is strongly affected by satisfaction and moderately by switching barriers. It has been also shown that loyalty in the context of Canadian mobile services is comprised of two distinct, yet correlated dimensions, namely repurchase likelihood and price tolerance, due to the existence of switching barriers (Turel and Serenko, 2006). The latter study also demonstrated that loyalty is strongly predicted by customer satisfaction. Several issues about these studies are noteworthy. First, all of them focus only on mobile wireless services, thus omitting fixed-line ones. Second, loyalty as a concept has been treated inconsistently in the literature. While some conceptualize it as a behavioral intention (e.g., willingness to recommend a service) (Kim et al., 2004), others operationalize it as an attitude (Turel and Serenko, 2006). Our study follows the latter approach, and applies the American Customer Satisfaction Model (ACSM) to predict loyalty in both the fixed-line and mobile markets. This model was selected because it is robust across industries and technologies and has been successfully applied to various means of communications (Dow et al., 2006; Turel et al., 2006). The ACSM is a general, cross-industry model that offers a market-based performance measure for firms, industries, sectors, and nations. It measures the quality of the goods and services as experienced by consumers, and gauges their actual and anticipated consumption experiences (Anderson and Fornell, 2000). According to the model, loyalty and price tolerance are affected by user satisfaction, and satisfaction is positively associated with prior expectations, perceived quality, and perceived value. The prior expectations (PE)

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[3] http://www.itu.int/ITU-D/ict/statistics/ict/graphs/mobile.jpg (retrieved on 11/19/07).

construct represents both previous experiences with the service and forward-looking beliefs regarding a provider's ability to offer the desired quality. Perceived quality (PQ) is the served market evaluation of recent service usage experiences. It is derived from the degrees of customization and reliability of the service. Perceived value (PV) adds the price dimension to perceived quality and therefore addresses the perception of quality for money. In addition, it controls for differences in income and budget constraints that enables cross-industry comparisons (Fornell et al., 1996). These three constructs lead to customer satisfaction (CS), which is defined as a subscriber's reaction to his or her judgment of the state of fulfillment (Oliver, 1997). Satisfaction, in turn, affects the two dimensions of loyalty (i.e., price tolerance and repurchase likelihood).

2.3. What is market segmentation?

It is now generally accepted that it costs more to attract new customers than to keep existing ones (Kotler et al., 2005; Massnick, 1997). In the past, many managers believed in the concept of mass marketing and argued that it creates the largest market potential, which leads to lowest costs and largest revenues. Today, most companies are moving away from mass marketing to market segmentation and targeting (Bikert, 1997). According to Kotler et al. (2005), segmentation is splitting a market into smaller groups of buyers with distinct needs, characteristics or behaviors that require individual products or marketing mixes. Nowadays companies realize that they cannot appeal and reach all consumers in the marketplace. Moreover they know that they cannot target all consumers with the same service, product, and strategy. In segmentation, rather than trying to compete with other companies in an entire market, each company identifies submarkets that it serves best and most profitably. Hence, using market segmentation, companies divide large heterogeneous markets into smaller homogenous segments that can be reached more successfully.

There are several ways to segment a market: (i) geographic segmentation based on dividing the market into different geographical areas such as nations, regions, cities, etc., (ii) demographic segmentation based on age, gender, family size, etc., (iii) psychographic segmentation based on the social class, lifestyle, and/or personality characteristics, and (iv) behavioral segmentation based on occasion segmentation, benefit segmentation, loyalty status, and user status (Kotler et al., 2005). Cooper and Inoue (1996) tackle segmentation using the concept of competitive market and consumer structures. The idea is to cluster the market by targeting competitive consumers' groups. This is done through what they call "switching probabilities" and "product attribute rating." This allows positioning the segments and understanding differences among them. Marcus (1998) argues that segments derived from complex statistical techniques should be useful for managers to design effective communication strategies. The Customer Value Matrix that identifies key segments and helps designing effective marketing strategies is a useful alternative.

Technically, there are several ways to segment the market. Statistical techniques vary from K-means, through Two-Step to hierarchical clustering. The basic objective is to propose natural groupings of consumers based on similarities and association measures, i.e., sort consumers into homogenous sets called segments. Segmentation requires the selection of a set of variables/criteria that help differentiating between unique clusters or groups of consumers. Segments are usually defined in terms of intra-group homogeneity and inter-group heterogeneity. Respondents belonging to the same cluster should exhibit the same behavior and fit the same profile that leads to intra-group homogeneity. Conversely, respondents belonging to different clusters have different profiles leading to inter-group heterogeneity (Brusco et al., 2002; Chaturvedi et al., 1997).

3. Methodology and results

3.1. Study design and descriptive statistics

Two datasets of 3251 and 5060 data points pertaining to mobile and fixed-line phone services, respectively were subjected to cluster analysis. The data were collected in 2004–2006 by the National Quality Research Center at the University of Michigan. The following constructs of the American Customer Satisfaction Model were measured by using the original instruments (see Fornell et al. (1996) for scale descriptions): prior expectations, perceived quality, perceived value, customer satisfaction, repurchase likelihood, and price tolerance. Those are well-established, valid and reliable constructs that have been successfully tested in multiple studies. In addition to scale items, basic demographic information was also solicited. A list of potential respondents was randomly generated from the phonebook of the US population; only one person from each household was surveyed. Each individual answered questions pertaining to either mobile or fixed-line services. Only those who had personally used a mobile phone were allowed to respond to items relating to mobile services. Overall, it was believed that the selected subjects relatively accurately represented the entire US population of mobile and fixed-line services. Table 1 presents age and gender statistics. Wireless and fixed-line datasets were analyzed independently.

Table 1
Descriptive statistics.

	Fixed-line	Wireless
Age-range	18–84	18–84
Age-mean	50	46
Male (%)	39	52.5
Female (%)	61	47.5

3.2. Procedure

This study has an exploratory purpose. Therefore, cluster analysis seems to be a natural technique to segment both the fixed-line and the wireless market. This approach is best suited to identify consumption/behavior patterns and create a consumer typology. Six variables that capture three stages of consumer behavior were used: (1) pre-purchase dimension (prior expectations); (2) actual purchase dimension (perceived value, perceived quality, and customer satisfaction); and (3) post-purchase dimension corresponding to behavioral outcomes (price tolerance and repurchase likelihood). Since the K-means analysis can only be used when the number of expected clusters is known, the Two-Step clustering technique was used that allows testing similarities and associations between segments in both samples without making any assumption on the final number of clusters. Two-Step clustering is a good substitute to hierarchical clustering because of a large sample size and known average number of services in the industry. Specifically, we are more interested in exploring differences in behavior between the samples using the actual industry segmentation structure than predetermining the number of segments, because the behavior demonstrates actual choices made by consumers reflecting on their perceptions of the two products.

3.3. Data

Missing item values for the six-abovementioned variables were replaced with the mean. No missing values were replaced for all categorical scales (age, sex, and income). However, since age was measured using an open-ended question, it was re-coded into five main age classes. Moreover, results from cluster analysis need to be reformatted. Since each respondent belongs to a specific segment, a cluster number is allocated to that consumer. For instance, if somebody belongs to the *k*th segment, he/she will be allocated the number *k* for cluster *k*. The ultimate objective of categorizing all variables is to crosstab all results to profile consumers in both markets and obtain more robust results.

3.4. Algorithm

The following algorithm was used independently on both datasets:

1. *Intra-group homogeneity*: Test unidimensionality with each sample for multiple indicator constructs – confirmatory factor analysis, discriminant and reliability measures. This ensures that the each variable measures only one dimension.
2. *Inter-group heterogeneity*: Test mean differences between samples – one-way ANOVA. This ensures that there is a significant behavioral difference between both samples.
3. *Test customer groupings*: Create clusters-categories – allocate each respondent to a given category using a two-step clustering procedure.
4. Cross-tab those categories with respondents demographics to design their profiles.
5. *Predict cluster membership*: Run a discriminate analysis to explore what is/are the variable(s) that discriminate the most among respondents.

4. Findings

4.1. Intra-group homogeneity

Each dataset (wireless and wired phone services) was analyzed separately. For multiple indicator constructs, Cronbach's alpha exceeded the cut-off value of 0.7, corrected item to total correlations were over 0.5, and each item loading in confirmatory factor analysis with Varimax rotation was above 0.7. To test for discriminant validity, a matrix of loadings and cross-loadings was constructed and each item loaded higher on its own construct than on other cross-loading measures. Therefore, some confidence in intra-group homogeneity was developed.

4.2. Inter-group heterogeneity

To make sure that both samples present different profiles of consumers, an ANOVA test was conducted that showed a significant difference at the 0.01 level between fixed-line and wireless consumers (see Fig. 2). Fixed-line consumers exhibited higher scores on all measures. This means that compared to wireless consumers, fixed-line customers are relatively more satisfied, have higher perceived value, prior expectations, and perceived quality. In addition, they are less price-sensitive and are more willing to repurchase. Since this is mainly due to the nature and market structure for both products, it implies that in the eyes of consumers these are two disparate markets.

4.3. Customer groupings testing and cross-tabbing

To test customer groupings, first, the application of the Two-Step clustering option in SPSS generated the clusters. Second, the correspondences between different segments were explored through the log-likelihood approach for distance measure-
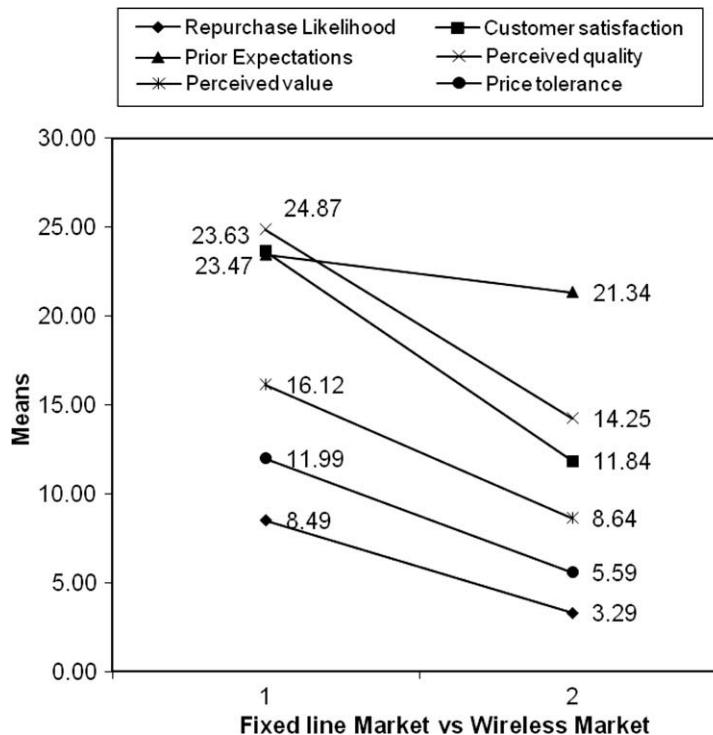
Fig. 2. Means plots for the fixed-line and wireless markets.

ment. Segments were created by entering continuous (price tolerance, perceived value, prior expectations, perceived quality, repurchase likelihood, and customer satisfaction) and categorical variables (age, gender and income).

4.3.1. Fixed-line market

Table 2 demonstrates that there are two segments:

Segment 1: The high score segment that is composed of 70% of all respondents with high measures on all six attributes corresponding to the three purchase dimensions: (i) respondents have high prior expectations, (ii) they perceive the company services as being of high quality and high value hence making them relatively highly satisfied, and, (iii) they are very likely to repurchase services from their actual service provider. This explains why they have a high price tolerance to switch to other companies.

Segment 2: The low-score segment that is comprised of 30% of all respondents with low scores on all six attributes corresponding to the three purchase dimensions.

In this project, three demographic indicators – age, gender and income – were employed in the analysis of categorical variables to profile consumers into different sets. Note that the distribution of demographic data was approximately equal in both clusters.

4.3.2. Wireless market

For wireless services, five clusters emerged (see Table 3); clusters 1, 2, 3 and 5 were high-score segments that represented 82.5% of the market, and cluster 4 was a low score one that embraced only 17.5% (see Table 4 and Fig. 3). It is noted that even though clusters 1, 2, 3 and 5 exhibit the same means, respondents do not necessarily behave the same way in these four segments. To uncover their hidden profiles, we need to characterize those segments in term of age, gender, and income (see Fig. 4 for more detail).

Table 2
Centroids for the fixed-line clusters.

	Minimum	Maximum	Cluster 1 Mean	Cluster 2 Mean
Prior expectations	3	30	23.47	21.34
Costumer satisfaction	3	30	23.62	11.83
Perceived quality	3	30	24.87	14.25
Perceived value	2	20	16.11	9.63
Repurchase likelihood	1	10	8.49	3.29
Price tolerance	0	25	11.98	5.59

Table 3
Centroids of the wireless clusters.

	Minimum	Maximum	Clusters				
			1	2	3	4	5
Prior expectations	3	30	23.08	25.32	24.59	19.07	23.83
Costumer satisfaction	3	30	22.54	25.52	24.37	11.52	23.19
Perceived quality	3	30	25.10	27.12	26.30	14.71	25.47
Perceived value	2	20	15.18	17.17	16.36	8.2	15.39
Repurchase likelihood	1	10	8.01	9.00	8.71	3.14	8.13
Price tolerance	0	25	11.39	13.10	12.26	5.7	11.47

Table 4
Respondents distribution per wireless clusters.

Clusters	Percentage (%)
1	16.8
2	18.1
3	20.0
4	17.5
5	27.6
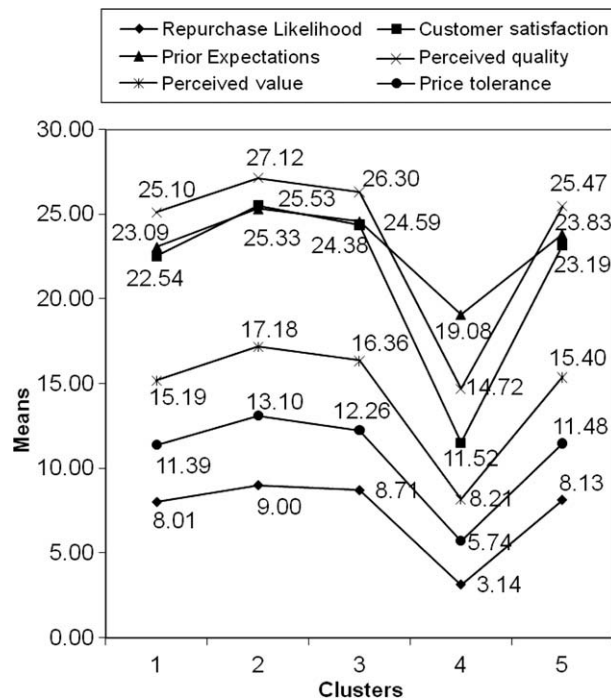
Fig. 3. Means plots for the wireless clusters.

Segment 1: This segment is composed of an even representation of young males and females. All of this cluster's respondents are distributed between the two first age categories: 5.7% for the 15–25 years old category and 11% for the 26–30 years old category. Moreover, most of the respondents are located in two income clusters: below $20K and $40–60K, which is consistent with the age distribution findings. Respondents in this segment are also very satisfied. They said that, on average, if the company increases its price by 13% (highest rate in the sample) they would switch to another company. This explains why they have the highest repurchase likelihood.

Segments 2 and 3: These segments are only composed of females. While the target market of cluster 2 is exclusively composed of elderly people, 50+ years old, cluster 3 is geared towards young adults (31–40) and mature adults (41–50). Most of the respondents have an income below $30K for cluster 2 and $40–80K for cluster 3.
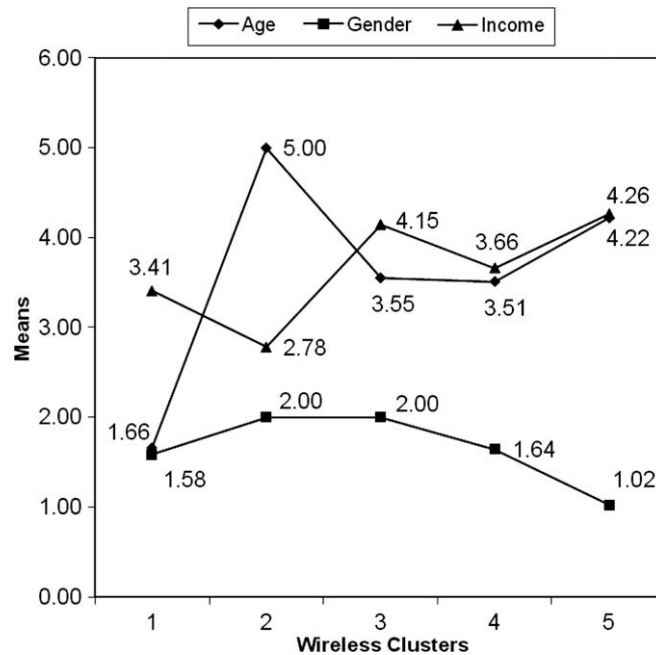
Fig. 4. Demographic characterization of wireless segments.

Segments 4 and 5: They are composed mainly of young and mature adults as well as elderly people with almost no representation of their younger counterpart. While cluster 5 is predominantly composed of men, cluster 4 is evenly composed of both genders. Further, both clusters mostly appeal to the $40–60K respondents. Finally, it is important to note that both clusters differ with regards to one important element – cluster 4 is a low-score segment while cluster 5 is high-score one (see Table 3).

In summary, clusters 1, 2, 3, and 5 are high-score segments. More precisely, cluster 1 is more geared towards young generations with a relatively low income. Both genders are evenly represented in this segment. Theses respondents are very satisfied with the services they receive; hence they are not price sensitive and are very loyal to their actual service provider. These consumers may be considered as regular cell phone users. Cluster 2 is the target market for elderly people not having high disposable income. These consumers might need a cell phone for basic usage. In contrast, cluster 3 suits adults with medium-to-high incomes. Finally, cluster 5 is almost exclusively composed of elderly men regardless of their income. Hence we can hypothesize that cluster 5 might be offered a wide variety of services when compared to cluster 2, and may be considered a business segment. At the same time, cluster 4 represents the only low-score segment where consumers do not have high expectation and hence are moderately-to-low satisfied. This is translated into their behavior, i.e., low loyalty and high price sensitivity.

4.4. Predicting cluster membership

In order to assess the predictive power of each variable in predicting cluster memberships, a discriminant function analysis was done. This analysis may be used to determine which variable(s) discriminate among two or more naturally occurring groups. For instance, after segmenting the market using cluster analysis, managers would like to know how to classify new costumers according to a set of variables. This is achieved through discriminant analysis techniques. In the present case, one variable was entered at a time (see Table 5).

Table 5
Classification accuracy.

	Fixed-line (%)	Wireless (%)
Prior expectations	60.0	27.7
Costumer satisfaction	92.8	36.7
Perceived quality	88.8	34.0
Perceived value	88.9	34.1
Repurchase likelihood	88.6	33.6
Price tolerance	67.7	23.6
All combined	95.6	39.9

First, the employment of all variables in the fixed-line and wireless market allows to correctly classify 95.6% and 39.9% of the customers, respectively that shows the superiority of the fixed-line segment in terms of predicting customer perceptions and behaviors. Second, in both sectors, customer satisfaction exhibited the highest explanatory power (92.8% and 36.7% for fixed-and wireless sectors, respectively); this means that a fixed-line company may use this construct to get a sense of the market and to classify customers with almost 93% accuracy. Third, prior expectations and price tolerance had the lowest predictive power for the fixed-line and wireless market. Fourth, wireless consumers have a very complex psychographic profile, which means that companies need to use an optimal mix of those variables (i.e., the maximum is 39.9% predictive power when combining all variables together). Fifth, three purchase dimensions capture only part of wireless consumers' behavior.

In order to uncover other possible relationships in the wireless cluster, a second set of discriminant analysis was run with the demographic indicators. It was observed that age and gender were the best predictors (46.6% for age and 45.1% for gender) when compared to income (29.4%). Note that on average gender, age, and income classify individually 50% of all fixed-line respondents. These results are consistent with results of the cluster analysis, which makes our findings more robust.

5. Discussion

Two distinct behaviors emerge from the data that imply that mobile and wireline consumers are indeed distinct groups. While this finding complements Ward and Woroch's (2004) conclusion that "the two services appear to have achieved a coexistence in the marketplace as well as in household budgeting, each providing consumers with particular advantages" (p. 13), it seems to contradict the data presented by the National Center for Health Statistics (NCHS),[4] which implies that there is a significantly growing number of wireless only households. This contradiction suggests that wireline and wireless may serve as full substitutes, however not for a full array of services. The demographics of the wireless household: young, renter, low income, minority, implies that this household is not necessarily a choice made through conscious preference but rather out of no real choice. Interestingly, the identification of the wireless household with the less affluent bodes well with at least one characteristic of high salience of wireless only homes in Europe – mostly a characterization of less developed countries, thus not an expression of substitution in the sense of relinquishing wireline, but rather of acquiring for the first time a telecommunications service.[5] Indeed, as our study shows, high satisfaction is a characteristic of wireline services – thus the growth of the wireless home can be seen as the emergence of a new consumer and not as an expression of switching by an existing one.

While in order to effectively target consumers in both wireless and fixed-line markets, there is a need to design three diverse service communications plans and positioning in terms of: (1) offered packages and prices, (2) consumer psychographics, and (3) consumer demographics, such as gender, income and age. Fixed-line consumers demonstrate a higher level of prior expectations, perceived quality, perceived value, and satisfaction than their wireless counterparts. They are also more price-tolerant and are more likely to repurchase services from the same provider in the future. This supports prior findings by Turel and Serenko (2006) who empirically demonstrated that that the degree of customer satisfaction with mobile services is lower than that with fixed-lines. Anecdotal evidence and periodicals also frequently report on cases of customer disappointment with their mobile phone experience, however, as Barros and Cadima (2001) note regarding the Portuguese market, and as the FCC (2007) data demonstrate, there is no discernable transition of consumers from mobile operators to landline services.

Indeed, the fixed-line sector is homogeneous whereas the wireless one is heterogeneous in terms of its underlying market segments. Recall that two and five clusters were identified in the analysis for these markets, respectively (Tables 2 and 3). Therefore the structure of the wireless market represents more ample ground for segmenting both current and potential customers as they transition among mobile products and represent socially and economically different groupings than their wireline counterparts do. As such, five segments were determined in the wireless market. These clusters are complementary and exclusive (see Fig. 3). Different age classes and income classes are discernable. Indeed, elderly people are more satisfied, less price sensitive and more loyal. It is also interesting to note the youngest segment has high prior expectation and is not price sensitive. It could be argued that these respondents still live with their parents and hence do not pay for mobile services but enjoy the independence of possessing one without "waiting in line" with other family members to use them. It is also noted that high score clusters, (i.e., clusters 1, 2, 3 and 5) have similar scores on the six psychographic variables but when it comes to age, gender and income, they represent different demographic profiles (see Fig. 4). Even though the wireless market is unstructured compared to the fixed-line one, we notice that there are more satisfied fixed-line costumers. This may be due to the nature of competition and structures of both markets, which affects the product perception of consumers and the substitutability between the products. Landline consumers tend to be very satisfied, have high expectations and are more price sensitive, wireless only consumers are young and newcomers to the market. Age emerges as an indicator of consumers' needs and identity, since elderly people may have different requirements than younger individuals do especially in terms of price sensitivity, repurchase likelihood, and expectations. This could be explained by assuming that younger individuals more heavily engage in information searching and that elderly people ask for different services than the younger customers do.

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[4] See Footnote 1.
[5] This, of course, needs to be seen as a partial explanation as the discrepancy between Finland and Sweden pointed out in Section 1, implies.

Overall, wireless respondents have a dissimilar profile than fixed-line ones because they have access to a wider variety of services and several service providers. In addition, there are more high salary respondents with low price sensitivity in the fixed-line market than in the wireless market. This is related to value-for-services in the fixed-line sector (i.e., how consumers value the dollar service). People expect to have a higher value in the additional features they buy. This expected value service is translated into slightly higher price sensitivity. Uncharacteristic with the rest of our findings, wireless respondents behave as fixed-line customers when it comes to gender. This, however is in line with the demographic characteristics of the NCHS study in which gender plays a marginal role.

6. Limitations

There are noteworthy limitations to these conclusions as arising from the data. First, we assume full substitution between the two services as the basis for our differentiation between the clusters. Both wireline and mobile services, however, have developed, as we have noted, to provide a wider variety of services and are not limited anymore to voice. Some of these services (and in particular mobility itself) are not available over both infrastructures. As a result, partial substitution may occur, which our clusters cannot provide an answer to. This limitation however is becoming less significant because there is a growing transition to wireless only households. The communities identified in the NCHS study correlate with our clusters; indeed age and income determine much of this transition.

Second, the comparison of fixed-line and mobile service perceptions across two independent samples leaves open whether respondents in each of the two subsamples were simultaneously subscribed to landline and wireless services or exclusively to just one of the two services when they participated in the survey. Such a design does not provide direct insights with regard to the extent to which consumers use mobile services to complement or to substitute their demand of traditional wireline offers, but only infers them. However, during the survey, the respondents were asked to consider their experience with only one service (i.e., exclusively either fixed-line or wireless). Finally, it should be noted that there may be other ways, such as interviews with consumers, and surveys designed to measures substitutability, to test the issue of fixed line-wireless substitutability. While some of these approaches, and certainly their combination, may be advantageous, we were somewhat constrained by the use of existing data sources. Future research, therefore may apply other methodologies to further investigate this important issue. It may also take into account additional variables, especially in view of the recent economic downturn that has probably altered the financial scrutiny families apply and the range of factors they consider.

7. Policy implications and conclusion

Consumer behavior often serves as a trigger for regulatory policies. Thus, for example the fact that consumers use mobile phones while driving has led many countries[6] and states in the US[7] to ban such behavior. Cook and Coupey (1998) state that "research is needed to assess how the technology affects consumer behavior before the form of regulation...is developed." (pp. 231–232), while Batt and Katz (1998) find that studying consumer behavior "should be of significant scientific interest, as well as benefiting telecommunications policy makers" (p. 46). In the first half of the 1990s, Mueller and Schement (1996) developed the "bottom up" approach to universal service research. Using ethnographic methods and computerized maps they were able to identify the causes underlying patterns of telephone disconnection. Their results demonstrated that in contradiction to the policy wisdom of the time, users were driven off the network by high usage costs and not as previously assumed by the price of access and thus universal service policy was misguided.

Uncovering the motivation for switching from wireline to wireless service (or for adopting a wireless service instead of a wireline for first-subscribers) through consumer satisfaction studies is not necessarily the only way or the best way to understand substitution in telecommunication service in general and between fixed and mobile services in particular. However, what we demonstrated in this study is that consumer satisfaction can provide an additional dimension that either contradicts, but in our case strengthens, other data, which is purely descriptive and has more explanatory power than previously available. While corroborating data is in line with our finding that wireless only households are low income and young, using the consumer satisfaction model we can shed more light on the path these consumers went through. In our case, we have mostly learned that they did not necessarily make a choice, but were driven to the wireless only consumption out of lack of choice, and are indeed unhappy.

What do these findings tell policy makers? The transition of the wireless sector further to an advanced services industry rather than one based primarily on voice communications, with the introduction of the third generation wireless networks will result in industry reconfiguration (Tilson and Lyytinen, 2006). The United States is not only behind major economic powers in mobile phone penetration; it is also behind in wireless mobile phone-based Internet access (Bleha, 2005). The ills of the mobile industry, which emerged as a limited competition industry adopting cartel-like behavior (Parker and Roller, 1997), should therefore not be carried into its next generation. This, however, is not the case.

As a rule of thumb, policy makers do not intervene in free choices made by consumers in competitive markets. However, as this study demonstrates, it is not clear whether indeed the growing substitution effect between wireline and wireless

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[6] http://www.cellular-news.com/car_bans/.
[7] http://www.ghsa.org/html/stateinfo/laws/cellphone_laws.html.

services is a result of free choice. Indeed, the NCHS study and our data identify the same mobile users. Paradoxically, mobility, which only a decade ago signified a luxury service whose users were predominantly affluent, is currently the technology of choice of the less affluent. This characteristic of the wireless-only crowd coincides with our findings, that the high satisfaction levels are more highly correlated with wireline than with wireless service. Clearly, as the uncompetitive nature of the United States' wireless industry (see e.g. Frieden, 2009) coincides with these results, a worrisome picture emerges as a new "underclass" of users is identified: inferior in the service they are receiving and unable to make choices.

Thus the findings bear implications both with regard to competition and to universal service policies. Clearly more competition in wireless services would have led to better service and higher consumer satisfaction among all clusters. At the same time the wireless only customer may be using only a pre-paid or other limited service, thus being in a technological disadvantage while purportedly "connected." As long as telephone services, and mobile services among them, were limited only to voice, the main challenge for regulators was to ensure affordability and connectivity. In the current technological reality, both exist with regard to voice, however low income consumers find themselves yet again in a position of inferiority, locked into a service that they find less satisfactory.

The challenge for policy makers is clear: how to ensure that inferior mobile services do not become an inferior service offered to those without a choice (alongside a quality multimedia service offered to the more affluent consumers). The fact that consumers clearly differentiate between mobile and wireline product markets and develop entirely different behavioral patterns with regards to both services, requires us to further investigate the unique attributes of the mobile industry and assess what can be done to enhance consumer connectivity. Indeed, consumers are less satisfied with a product that offers them so much more. The most satisfied consumers are those that do not bear the cost of the service or those that have little or no choice. This implies that in order to enhance consumer connectivity, regulators need to refocus their regulatory efforts as a result of studying consumer satisfaction patterns. Indeed, United States consumers adopt mobile phones in growing numbers, but they do not perceive them necessarily as substitutes to wireline services, but rather as separate, perhaps complementary products unless their circumstances imply otherwise. On the other hand, the high satisfaction levels and consumer loyalty to wireline providers indicate the lack of competition in that market; this can be attributed to its regulatory failure (since there are higher levels of competition in other countries that employ more aggressive pro-competitive policies) and to the customer culture that defines mobile services as a unique product. Indeed, while the numbers we present demonstrate the growth of the mobile market, they do not necessarily, as this study shows, imply that consumers are disconnecting their landline to acquire a mobile service. This may be true with first acquisition behavior of younger consumers, but it is yet to be determined whether the mobile will stay their only service of choice once they mature as consumers.

In the meantime, policy makers need to continue regulating both markets separately to ensure no abuse of dominant positions in either prevails. We believe that employing customer satisfaction in policymaking can help to further uncover consumer motivation in choosing telecommunication services and serve eventually as a useful tool for policy makers seeking to achieve high connectivity levels for advanced services.

References

Ahn, H., Lee, M., 1999. An econometric analysis of the demand for access to mobile telephone networks. Information Economics and Policy 11 (2), 297–305.

Anderson, E.W., Fornell, C., 2000. Foundations of the American customer satisfaction index. Total Quality Management and Business Excellence 11 (7), 869–882.

Barros, P.P., Cadima, N., 2001. The Impact of Mobile Phone Diffusion on the Fixed Line Network. <http://ppbarros.fe.unl.pt/My%20Shared%20Documents/BarrosCadima.pdf>.

Batt, C.E., Katz, J.E., 1998. Consumer spending behavior and telecommunications services – a multi-method inquiry. Telecommunications Policy 22 (1), 23–46.

Bikert, J., 1997. Cohorts II: a new approach to market segmentation. Journal of Consumer Marketing 14 (5), 362–379.

Bleha, T., 2005. Down to the wire. Foreign Affairs 84 (3), 111–124.

Brusco, M., Cradit, D., Stahl, S., 2002. A simulated annealing heuristic for a bicriterion partitioning problem in market segmentation. Journal of Marketing Research 39 (1), 99–109.

Chaturvedi, A., Douglas, C., Green, P., Rotondo, J., 1997. A feature-based approach to market segmentation via overlapping K-centroids clustering. Journal of Marketing Research 34 (3), 370–377.

Cook, D.L., Coupey, E., 1998. Consumer behavior and unresolved regulatory issues in electronic marketing. Journal of Business Research 41 (3), 231–238.

Cooper, L., Inoue, A., 1996. Building market structures from consumer preferences. Journal of Marketing Research 33 (3), 293–306.

Dow, K., Serenko, A., Turel, O., Wong, J., 2006. Antecedents and consequences of user satisfaction with email systems. International Journal of E-Collaboration 2 (2), 46–64.

FCC, 2007. Trends in telephone service. The Federal Communications Commission, Industry Analysis and Technology Division, Wireline Competition Bureau.

FCC, 2009. Telephone subscribership in the United States. The Federal Communications Commission, Industry Analysis and Technology Division, Wireline Competition Bureau.

Fornell, C., Johnson, M.D., Anderson, E.W., Cha, J., Bryant, B.E., 1996. The American customer satisfaction index: nature, purpose, and findings. Journal of Marketing 60 (7), 7–18.

Frieden, R., 2009. The way forward for wireless. In: Schejter, A. (Ed.), ...And Communications for All: A Policy Agenda for a New Administration. Lexington Books, Lanham, MD, pp. 153–166.

Gerpott, T.J., Rams, W., Schindler, A., 2001. Customer retention, loyalty, and satisfaction in the German mobile cellular telecommunications market. Telecommunications Policy 25 (4), 249–269.

Gruber, H., 2001. Competition and innovation: the diffusion of mobile telecommunications in Central and Eastern Europe. Information Economics and Policy 13, 19–34.

Gruber, H., Verboven, F., 2001. The diffusion of mobile telecommunications services in the European Union. European Economic Review 45, 577–588.

ITU, 2007. ICT Statistics Database.

Jang, Show-Ling, Dai, Shau-Chi, Sung, Simona, 2005. The pattern and externality effect of diffusion of mobile telecommunications: the case of the OECD and Taiwan. Information Economics and Policy 17 (2), 133–148.

Katz, J., Sugiyama, S., 2005. Mobile phones as fashion statements: the co-creation of mobile communication's public meaning. In: Ling, R., Pedersen, E. (Eds.), Mobile Communications: Re-negotiation of the Social Sphere. Springer, London, pp. 63–81.

Kim, M.K., Park, M.C., Jeong, D.H., 2004. The effects of customer satisfaction and switching barrier on customer loyalty in Korean mobile telecommunication services. Telecommunication Policy 28, 145–159.

King, J., West, J., 2002. Ma Bell's orphan: US cellular telephony, 1947–1996. Telecommunications Policy 2, 189–203.

Kotler, P., Armstrong, G., Cunningham, P., 2005. Principles of Marketing. Pearson Prentice Hall, Toronto, Canada.

Lemish, D., Cohen, A., 2005. Tell me about your mobile and I will tell you who you are: Israelis talk about themselves. In: Ling, R., Pedersen, E. (Eds.), Mobile Communications: Re-negotiation of the Social Sphere. Springer, London, pp. 187–202.

Madden, G., Coble-Neal, G., 2004. Economic determinants of global mobile telephony growth. Information Economics and Policy 16, 519–534.

Marcus, C., 1998. A practical yet meaningful approach to customer segmentation. Journal of Consumer Marketing 15 (5), 494–504.

Massnick, F., 1997. The Customer is CEO: How to Measure What Your Customers Want – And Make Sure They Get It. New York, Amacom.

Mueller, Milton, Schement, Jorge Reina, 1996. Universal service from the bottom up: a study of telephone penetration in Camden, New Jersey. The Information Society 12, 273–292.

Oliver, R.L., 1997. Satisfaction: A Behavioural Perspective on the Consumer. Boston, Irwin McGraw-Hill.

Ozcan, Y.Z., Kocak, A., 2003. Research note: a need or a status symbol? Use of cellular telephones in Turkey. European Journal of Communication (18), 241–254.

Parker, P., Roller, L., 1997. Collusive conduct in duopolies: multimarket contact and cross-ownership in the mobile telephone industry". RAND Journal of Economics 28 (2), 304–322.

Rodini, Mark, Ward, MichaelG., Woroch, GlennA., 2003. Going mobile: substitutability between fixed and mobile access. Telecommunications Policy 27, 457–476.

Sung, Nakil, Lee, Yong-Hun, 2002. Substitution between mobile and fixed telephones. Korea Review of Industrial Organization 20 (4), 367–374.

Sutherland, Ewan, 2008. Mene, Mene, tekel upharsin: counting mobile phones. SIM Cards and Customers. <http://lirne.net/test/wp-content/uploads/2008/05/sutherland-mobilenumbers.pdf>.

Tilson, D., Lyytinen, K., 2006. The 3G transition: changes in the US wireless industry. Telecommunication Policy 30, 569–586.

Turel, O., Serenko, A., 2006. Satisfaction with mobile services in Canada: an empirical investigation. Telecommunications Policy 30 (5–6), 314–331.

Turel, O., Serenko, A., Detlor, B., Collan, M., Nam, I., Puhakainen, J., 2006. Investigating the determinants of satisfaction and usage of mobile IT services in four countries. Journal of Global Information Technology Management 9 (4), 6–27.

Turel, O., Serenko, A., Bontis, N., 2007. User acceptance of wireless short messaging services: deconstructing perceived value. Information and Management 44 (1), 63–73.

Ward, M., Woroch, G., 2004. Usage Substitution between Mobile Telephone and Fixed Line in the US. The Report can be accessed at <http://www.uta.edu/faculty/mikeward/mobile_usage.pdf>.

Willis, R., Serenko, A., Turel, O., 2007. The effect of contractual obligations between mobile service providers and users on customer loyalty. In: Taniar, D. (Ed.), Encyclopedia of Mobile Computing and Commerce. Idea Group Inc., pp. 143–148.