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Hedonic Prices in the Iran market for mobile phones

Mohsen Nazari
Faculty member in Faculty of Management
University of Tehran
Tehran, Iran
Mohsen.nazari@ut.ac.ir

Seyed Vahid Tabatabaie Kalejahi
Department of Business Administration, Faculty of Management
University of Tehran
Tehran, Iran
Tabatabaie@ut.ac.ir

Amin Jambor Sadeghian
Department of Information Technology, Faculty of Computer Engineering
Islamic Azad University of Tabriz
Tabriz, Iran
Amin_sadeghiyan@yahoo.com

***Abstract*— this paper provides a hedonic price analysis of mobile telephones for the Iran market, based on data of 111 different handsets from 5 manufacturers, which was collected in 7/20/2010. The hedonic price function is linear. We choose about 10 main features of mobile phones, but only four of them have impact in mobile phone prices in this model. Our results indicate that mobile phone users in Iran are ready to pay about $161 for HTC brand. They are also ready to pay about $101 for wireless network connectivity. Other features that have significant impact in mobile phone prices are Touch Screen, GPS and every Mega Pixel Quality of camera. Mobile phone users are ready to pay $43 for Touch Screen feature of mobile phone. In Iran, all of mobile phone suppliers import them from other countries and distribute them in the market. This paper helps them to know which features of mobile phones have more value to customers. They can import mobile phones that have those features and reach a higher market share.**

Keywords-component; Hedonic Pricing Analysis, Mobile phone, Regression analysis

I. INTRODUCTION

The demand for mobile phones has considerably increased over the past 10 years in Iran as well as in other countries. Mobile phone for Iranian now is a necessity, so every day the competition between mobile phone suppliers gets fiercer. Mobile phone suppliers' market shares vary heavily from month to month. Nevertheless little *formal empirical* analysis has been accomplished on the pricing of mobile phones in Iran. This paper's goal is to fill this gap and provide a formal statistical analysis of different mobile telephone prices. Specifically, an empirical hedonic price analysis is performed, using data on 111 different mobile phones from 5 manufacturers.

The data has been collected from the daily newspaper "Donyaye-eghtesad" [20] in 7/20/2010. This newspaper publishes the price of many of goods in Tehran's Market every day. Also, information on characteristics, such as Weight, Battery Duration, Wi-Fi, Guarantee, Touch Screen, GPS, Radio availability and Camera features was collected from mobile phone manufacturers' websites. In order to estimate hedonic prices for various features, (OLS) Linear regression was used.

Pricing is one of the four elements of marketing mix. One of the important decisions any business faces is selecting pricing strategies that can be effective in achieving company's goals. One of the pricing methods which are suitable for multi-feature products like house [25] and hotel and tourism industry [13,23,26] is hedonic pricing. This method helps businesses to know how much each feature of its products has value for its customers. In Iran, all of mobile phone suppliers import them from other countries and distribute them in the market. This paper helps them to know which features of mobile phones have more value to customers. Then they can import mobile phones that have those features and reach a higher market share.

II. THEORITICAL FRAMEWORK

The hedonic price theory and its theoretical and statistical foundation are found in the works of [8,15,24] see in [26]. This theory's hypothesis is that the price of a product is a function of its attributes. Another classical suitable case concerns cars, where the price of a car can be viewed as a function of, for example, its manufacturer's nationality, its size, its engine's performance, or its "subjective" quality (cf. [27]) [26]. Another example would be the mobile phone. That is because many of the mobile phones provided by the manufactures cannot be easily reassembled, then customers must choose from a finite number of multi-feature mobile phones rather that assemble their desired features in a mobile phone. Furthermore, positive attributes (as evaluated by the consumer) are expected to drive up the overall price, whereas undesirable attributes will deflate the price. Thus, the aim of hedonic price models is to disentangle the various attributes' positive or negative impacts on shadow prices.

Another important assumption is that consumers have preferences over those attributes. There are maximum amounts that they are willing to spend, these are known as the consumer's willingness to pay (WTP) for any given good or service they buy. This bid depends upon the consumers' preferences as well as the bundle of characteristics. On the other hand, producers choose the bundle that maximizes their profits subject to the price of inputs, the production function, and the market price for each alternative bundle of characteristics. Thus, the producer's offer or willingness to accept the function indicates the minimum unit price the producer will accept for those services. The prices seen in the market are their tangency points since the market equilibrium is the tangency of these bid and offer functions [1,121,24] see [17].

According to Rosen's [24] setting, a mobile phone can be understood as a vector (bundle) of attributes

$$C= (c_1, c_2, c_3,\ldots, c_N), \quad (1)$$

where c_n is the n-th attribute of mobile phone, like its weight. Obviously, mobile phone importers can import those mobile phones that have high-value attributes [23].

Because the overall price of the mobile phone is assumed to be a function of its attributes, the hedonic price function becomes as follows:

$$P(C) =P (c_1, c_2, c_3,\ldots, c_N) \quad (2)$$

In the typical case, the price of, for example, a hotel room is empirically modeled as the additive function of various objective hotel attributes (e.g., type of board, distance to downtown, distance to amusement parks, and presence of swimming pool, sauna, bar, and restaurant) and more subjective attributes (e.g., service quality, atmosphere, and hotel star rating). Usually, this model is estimated by means of OLS regression or some related technique [26].

III. Related Works

Waugh examined the pricing of asparagus (see [28]) before Lancaster [15] starting hedonic pricing analysis. In more recent times, hedonic price analyses have been applied to many different products such as automobiles (see [2]), wine (see, e.g., [12]), housing (see, e.g., [18]), modern technology products such as PCs (see [22]) or personal digital assistants (PDAs) (see [5]) and even somewhat exotic purchases such as islands (see [3]) [7].

IV. Data and Analysis

A. *Data and Variables*

To conduct such a hedonic price analysis for mobile phones, data on 111 different handsets from 5 manufacturers has been collected. The data was assembled from the daily newspaper "Donyaye-eghtesad" [20] in 7/20/2010. Apart from the prices that the handsets commanded in the Iran market for mobile telephones at the time of their market introduction, information on various characteristics such as the handset's weight, battery duration and additional features such as WAP, Radio and GPS has been collected.

Table 1 gives some descriptive statistics for variables used. Weight, call time, substitution time and CameraInPixel are ratio scale variables and others are ordinal scale variables.

B. *Analysis and Results*

It is important to decide the form of the function in (2). Some often used functions are linear, quadratic, log–log, semi-log, exponential and Box–Cox. Until now, however, there has been no definite rule for choosing a function type in the hedonic price model. Researchers used several functional forms for the hedonic price function on the basis of goodness of fit. In some recent studies [11,14,19] see [17], nonlinear functions such as semi-log, log–log, and Box–Cox functions [4] see [17] are used. In fact there is no specific function is required for the model because the chosen function is consistent with the economic theory [17] see [9].

In this study, we use linear function to present our model, because its adjusted R^2 and F-value is better than semi-log function. Model is presented in Table 2.

TABLE 1. Descriptive Statistics

Variable	Mean	Std. dev	Min	Max
Price	226189.6	143779.2	30000	693000
isSonyEricsson	.19	.393	0	1
isHTC	.05	.227	0	1
isLG	.14	.343	0	1
isSumsung	.33	.474	0	1
hasGuarantee	.87	.333	0	1
WeightInGram	106.272	21.7335	66	181
isTouchScreen	.36	.482	0	1
CamInMegaPixel	3.512	2.3933	0	12
CallTimeInHour	7.001	2.5675	1.6	13
SubsTimeInHour	406.757	133.6339	5	800
hasRadio	.94	.244	0	1
hasWireLess	.34	.477	0	1
hasGPS	.35	.480	0	1

Table 2 shows the results from the OLS regression analysis. We used the backward elimination procedure in choosing the variables. As a result, many variables in Table 1 are excluded in model (table 2). The value of F-statistics is 103.53, which is statistically significant. This confirms the statistical significance of this regression model. The value of R2 is 0.823, which means that the price change of mobile phone is explained by about 83% according to the independent variables of our model.

By examining the variance inflation factor (VIF) and the condition index (CI), we find that both the VIF and CI of our regression results are lower than 10. In other words, our results are free from the multicollinearity problem [17] see [6,10].

The estimated regression coefficient, for all variables are positive as expected. It means that having more features results in high mobile phone price.

TABLE 2. MODEL

Variables	Unstandardized Coefficients		Standardized Coefficients
	B	*Std Error*	*Beta*
Constant	73437.98123	10387.90287	
isHTC	160638	26962.5	0.253784422
isTouchScreen	43589.32102	14619.51136	0.146212787
CameraInPixel	22618.40617	3270.38774	0.376494964
hasWireless	101778.3906	18626.22277	0.337407621
hasGPS	40068.4	18417.7	0.133643166

TABLE 3. MODEL (CONT. OF TABLE 2)

Variables	t-Value	Sig.	VIF
Constant	7.069568	1.78E-10	
isHTC	5.95783	3.45E-08	1.1297804
isTouchScreen	2.981585	0.003565	1.497327
CameraInPixel	6.916124	3.76E-10	1.845156
hasWireless	5.464253	3.15E-07	2.374043
hasGPS	2.17553	0.03183	2.34964

TABLE 4. MODEL(CONT. OF TABLE 2 AND 3)

Variables	Condition Index
Constant	1
isHTC	2.09878
isTouchScreen	2.815122
CameraInPixel	3.123204
hasWireless	4.628852
hasGPS	5.7809

The coefficient of *isHTC* variable is 160638. It means that mobile phone users pay 160638 Tomans[1] ($161) more for this mobile phone brand relative to Nokia brand (because our base brand in this model is Nokia). Its main reason is that HTC mobile phones introduced some new features that mobile phone users liked, accepted and used them. *IsTouchScreen* variable's coefficient also shows that Iranian mobile phone users pay 43590 Tomans ($43.9) more for Touch Screen mobile phones. Iranian users also pay 22618 Tomans ($22.6) for every MegaPixel of Quality feature of mobile phone camera. General Positioning System (GPS) is recently activated in Iran and users are ready to pay about 40000Tomans ($40) for this feature of mobile phones. The second feature (after HTC brand) that has more coefficients is Wireless network connectivity feature. In Iran users are ready to pay as much as 101778 Tomans ($102) for this feature. One main reason is that nowadays wireless networks are widely used in Iran's Universities, Organizations, Institutions and some other public places.

V. CONCLUSION

In this paper we used Hedonic Pricing Method (HPM) to evaluate the effect of mobile phone features (Table 1) on its price in Iran. This analysis is based on 111 different handset data from 5 manufactures which is gathered in 7/20/2010.

As explained in Analysis section, HTC brand, Wireless network connectivity, Touch Screen, GPS and Mega Pixel quality factor in camera have positive effect on price of mobile handset.

This paper can help mobile phone importers in Iran to select and import those mobile phones that have high-value for customers.

One of the most important limitations was the shortage of information about mobile phone market and market share of big manufactures. Also, prices of mobile handsets are gathered from only an economic newspaper. There is no other newspaper or magazine to conform these prices.

For future studies, new methods can be applied to evaluate the effect of mobile phone features on its price, like Artificial Neural Network (ANN). For example, Selim (2009) has used hedonic regression and ANN and by comparing these two models, concluded that ANN can be a better alternative for prediction.

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