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# Hedonic Valuation of Online Game Participation

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## ABSTRACT

We use hedonic valuation to establish a basis for valuing the time a user participates in an online gaming community. We distinguish between utilitarian and hedonic value. Our application involves elements of both utilitarian and hedonic value, however, the latter is much more important. We use an extensive data set involving a *massive multi-player online role-playing game* (MMORPG) from Korea. We specify and test econometric models that reflect the appropriate empirical structure for the setting, based on information about the players and the activities they engage in. The results permit us to estimate the hedonic value in monetary terms for the use of this mechanism per minute of participant use. We explore how such information can be used to create the appropriate incentives via optimal participation fees and subsidies to maximize consumer value.

## Categories and Subject Descriptors

**H. [Information Systems]:** Miscellaneous – *online games, economic analysis, valuation.*

## General Terms

Management, Design, Economics.

## Keywords

Economic analysis, hedonic pricing model, hedonic value, mechanism design, online games, utilitarian value, valuation.

## 1. INTRODUCTION

Social network activities have been studied in diverse disciplines such as psychology, information systems (IS) and communication studies in order to understand and explain the nature of interactions within online communities. An important social network-related issue is to find the value of social network participation. *Customer value*, meanwhile, is a key concept in marketing. In the past, *value* has been conceptualized as a tradeoff between quality and price. Recent research views value in a more complex manner though [2]. Customer value is divided into *utilitarian value* and *hedonic value*, to represent the idea that consumers spend money to purchase goods because they are needed, or because they make them happy. The latter is called *hedonic gratification* [1].

In online network activities, user behavior can be utilitarian or hedonic also. Users tend to prefer efficiency in utilitarian tasks to achieve the benefits they hope to acquire with less time and effort, such as purchasing a book from Amazon. They may be less concerned with their expenditure of time and effort when they engage

in hedonic tasks, such as surfing the Internet, participating in a social network or playing games on the Internet.

The Internet stimulates positive changes in online users' lives by creating new forms of online interactions and enhancing offline relationships. It extends the meeting spaces for those with common interests. Online users are attracted to the Internet because it can save them time. Longer site visit times are positively correlated with the quality of a user's Internet experience [4]. So utilitarian value and hedonic value appear to co-exist for online network participation. In the age of the Internet, there is high online user participation, and now social media and online activities are important in also every area of business. In the past, the presence of a particular user typically did not affect other users' willingness to join a communication network, other than on the margin. An individual's willingness to join increased in proportion to the overall number of participants. Today, such positive *network effects* continue to be important in general, but in social networks, not all participants are created equal.

## 2. THEORY, METHOD AND DATA

We employ the hedonic value equation of Diewert [3] to measure the hedonic value of online game participation. Participation involves the consumption of an hedonic commodity that offers hedonic value through its multiple attributes that offer participants utility. Since we are studying a setting in which the user plays an online game, we adapt this construct so that a number of attributes represent it. For our model, consumption of a hedonic game commodity can be gauged by the participant's time spent in the game, and the flow factors that allows the person to have fun. This way of defining the drivers of hedonic value represents the experience a user has when she plays a game. User experience can be expressed with the points earned based on the role played, the efficiency exhibited in play through increased knowledge of the game, and the skills necessary to play well.

The MMORPG that we have studied involves movement, combat and other commands that all are mouse-controlled. A gaming firm in Korea developed it, and it also is available in Japan, Taiwan, Thailand, and Indonesia. An English version was released too. The game has seven different game roles, which are personas that players take on which control the kinds of powers they can use, and the style of their interactions with other game players. We obtained individual-level data for user time, spending behavior (money) and gaming level, as well as the number of game participants (network effects) from the online game. Data were collected between July 1 and December 21, 2006. We obtained data on 775 role-playing participants in the seven different roles.

## 3. EMPIRICAL MODEL

**Preliminary comments.** Hedonic value in an online game arises from the player's experience. People also want to be able to participate in online games in an efficient and effective manner to achieve their goals. The players seek the benefits of appropriate game functionality when they do specific things in the game. Thus, our approach involving hedonic and utilitarian value is ap-

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appropriate to identify online gamers' involvement and game enjoyment simultaneously. Our model includes network effects, time, and player characteristics, including flow factors and game skills, to represent her capacity to achieve efficiency, in addition to estimating the hedonic value of online game participation. As a result, we have a reasonable basis for developing appropriated and meaningful insights that will not be frail with respect to the main elements of theory that we have identified as being relevant.

Another source of hedonic value may arise in game play when a player shifts from one role to another role. This might involve re-establishing new flow in participation, as one role reaches a dead end for advancement, or is under-resourced, etc. This also creates the opportunity for role alliance created by the same players. Such alliances might permit a player with a given base role to be more effective in achieving a higher level in the game without the additional weapons and resources that usually are required. The players may choose to exercise outside options to purchase resources for the game that are not available to them inside the game. This is a common phenomenon in online game-playing. For example, game players develop relationships with one another for exchange outside the game setting boundaries, or they may go to externally established marketplaces, where it is possible to make game resource-related transactions. Our *Money* variable, as a measure for game resource expenditures, may not be a perfect measure. It probably captures most of the individual differences in game resource purchases though. So we are continuing to work on this.

**Model.** Our current empirical model is a multiplicative form, so all the variables interact. We estimate it via its log linear form:

$$\ln(Money)_i = \beta_0 + \beta_1 \ln(Wage)_i + \beta_2 \ln(NetEff)_i + \beta_3 \ln(Time)_i + \beta_4 \ln(Skills)_i + \beta_5 \ln(ExperPts)_i + \beta_6 \ln(GameLevel)_i + \varepsilon_i$$

This says that the value of the game (*Money*) for the online player is a function of her opportunity costs per unit time (*Wage*), the related network effects of other participants (*NetEff*), the *Time* she spends playing, the *Skills* she develops in game play, the points she earns along the way (*ExperPts*), and her *GameLevel*.

**Omitted variables bias.** We needed to address about omitted variable bias and unobserved heterogeneity in our hedonic value estimation. We don't have information on things such as income level, education level, the number of different games in which a participant is involved, the length of time in months that the participant has played the game, and so on. These things may influence gamers' spending levels. We investigated the following approaches to deal with the data issues. We have performed our econometric estimations in several different ways to ensure that only the relevant independent variables were included for explanatory and associational purposes.

We also ran a Ramsey reset test to diagnose omitted variable bias, which was present, and checked for collinearity between explanatory variables, which was not a major concern. We further assessed what information we could obtain from the game environment to address the neglected heterogeneity associated with individual game player difference. To this end, we added the variable *GameLevel* to our hedonic model.

**Outliers and endogeneity.** We diagnosed variable selection and outlier influence problems as well. We performed robust regression to minimize the influence of the outliers. We also employed

instrumental variables regression to treat the unobserved omitted variables bias and other endogeneity problems. We used the Hansen and Hausman test for the validity of the instrumental variable *Access*, and for the exogeneity of the other variables.

## 4. PRELIMINARY RESULTS

Our preliminary empirical results show that most of the coefficient estimates have the expected signs, implying that willingness to pay to participate in the online game increases as network effects grow and the qualities of the hedonic game commodity change for the better. *Wage* was not significant across all of the different estimations that we ran. Efficiency gained based on participant knowledge, skills, and gamer level was as expected, since the dependent variable generally decreases as gaming skills increase. The coefficients of network effect and experience points were significant also. The effects of the roles were different. The value of online network participation was affected by time, fun, and efficiency of skills in support of game enjoyment. We also identified the value of user time from consuming online gaming services, in terms of money spent per unit of online game-playing time. According to our estimation, the marginal rate of substitution between money and time is 54.97. So the value of a gamers' playtime is KRW54.97, or about US\$0.05 per minute.

## 5. IMPLICATIONS

Our study suggests the basis for differential pricing in online gaming that is tied to the experiences and different levels of willingness to pay for heterogeneous users. Similar to other IT-mediated digital intermediation settings (search engines, electronic markets, social networks, and so on), it is useful to point out that early stage game play is likely to deliver less utility and value to online gamers than later stage play, when they become more adept at the required skills, and the innovativeness in design of the game and its challenges are revealed through persistent use. This suggests that optimal pricing based on willingness to pay might involve an initial stage of free access or subsidized pricing, followed by the implementation of more aggressive pricing once the participants' differences become more evident to the gaming vendor as the former's participation grows over time.

Although it might be impractical to develop individually differentiated prices for the heterogeneous individuals who participate, there probably will be ample evidence to identify when online gamers might need discounted play incentives, or some types of monetary rewards to encourage them to perceive high value in the gaming environment and to continue their participation.

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