Household Preference For Plumbing Materials

Mohammed Zeeshan Ali[1], Harale Vamshi Krishna[2]
[1, 2]Dept of Master Of Technology, Construction Management
[1, 2]MIT-ADT University, Pune-412201, Maharashtra- India

Abstract- *Costumer's decisions on plumbing material selection are decided by various factors, including state and local regulations, service providers, and individual household preferences. The regulations and standards of the federal, state, and local governments have major impacts on the plumbing material chosen for installation during a private house.*

For example, general contractors are the primary decision-taker of plumbing material installation, replacement in new houses, while utility companies respond to corrosion threats by adding corrosion inhibitors to drinking water treatment. Consequently, all service providers influence consumer decisions, regarding the best plumbing material for private properties.

Keywords- Civil Engineering, Construction Industry, Household preference, Plumbing Materials.

I. INTRODUCTION

As mentioned above, the household decision-making process with regards to choosing a plumbing material for a private residency is complicated, and involves several factors, such as federal, state, and local standards and regulations, corrosion risk perceptions of drinking water as viewed by infrastructure service providers, insurance companies, households, as well as the financial impact of corrosion prevention. The regulations and standards of the federal, state, and local governments have major impacts on the plumbing material chosen for installation in a private house. These regulations are influenced by the services provided such as plumbers, Piping Engineers, material producers, and water utility companies.

To make an informed decision about the optimal plumbing material for their home, homeowners need information on the various risks involved in choosing plumbing systems. When we make aware about the plumbing material behavior the consumers are able to decide on an alternative most preferable to them based on the preference trade-offs among plumbing materials' attributes. Households make decisions on a plumbing alternative and having options such as to repair the existing system, to install new system etc. Each alternative has advantages and disadvantages that impact health and the overall cost of installation and maintenance. The problem becomes more complex as consumers think in terms of cost (material plus labor charges), taste and odor of the water, corrosion problem, longevity of the pipe system, fire resistance, convenience of installation or replacing, plumbers', general contractors' opinions, experience and proven record in the market. Householders weigh each of these attributes in order to choose the most preferred option for their houses

II. SOME DETAILS OF MATERIALS IN PLUMBING

Copper is the most commonly used material in residential plumbing field and has several advantages, including affordability, fire resistance, little health hazards, and durability. Woodson (1999) he studied the performance of different plumbing material alternatives: copper, CPVC, and PEX. And He found that copper pipes generally perform well, except for cases involving major leak problems. Due to some increased pinhole leak incidents reported in hotspot areas of the U.S. (eg. Washington D.C. suburbs and Sarasota, Florida), many costumers replaced copper with other options. Concerns with copper pipes include a metallic taste, especially with long stagnation periods and increased absorption of residual disinfectant by the pipe walls. High levels of copper can cause nausea, vomiting, and diarrhea (ATSDR, 2004). Some High copper level in drinking water may increase lead levels when lead solder joints, lead service lines, or brass fixtures are present in plumbing material. Hence, It is advised to test for lead while testing for copper levels in drinking water as lead and copper enter drinking water under similar conditions.

PEX (polyethylene cross linked) is another type of plumbing material often used in residential plumbing. This material is used to make flexible plastic pipes. A different plumbing design technique characterized by individual pipe lengths is required for every fixture. The main advantage of PEX is the lack of joints requiring soldering, which decreases the probability of pipe failures. On the other hand, PEX plumbing has raised some concerns regarding possible leaching of MTBE (methyl tertiary butyl ether), ETBE (Ethyl tert-butyl ether), and benzene into drinking water. Other concerns are the negative health impacts associated with PEX's reaction with chlorine, increased water odors (Durand & Dietrich, 2007), the material's ability to withstand fire, and

its final disposal (PRNews Wire, 2004). In addition to that, PEX may become stiff in cold weather which makes faulty pipe repairs more difficult. PEX use has been approved in all U.S. states (Toolbase News, 2008), and has met all health standards set by NSF/ANSI-61 for potable water supply (NSF, 2008).

III. EMPERICAL ANALYSIS

The empirical analysis of the Southeastern Community home plumbing data includes several econometric and statistical techniques. The first survey data analysis uses simple descriptive statistics, such as mean (average values), percentages (percent distribution across all responses), and total sums, in order to provide a summary view of the home plumbing issues faced by the Southeastern Community. These issues include the frequency of pipe failure, the location of the failure in the plumbing system, the costs and time associated with fixing pipe failures, and the preventive measure taken to avoid incidences in the future. The analysis so called preferred plumbing materials concentrates on estimating the household preferences for plumbing types based on the follow-up survey of the Southeastern Community. Thus the data estimation process employs the Ordered Logit regressions, based on which the household preferences for plumbing materials are received. The paragraphs presented below describe the econometric models in more detail.

A. ORDERED LOGIT MODEL DESCRIPTION

The second Southeastern Community survey data analysis employs the Conjoint Analysis (CA) methodology to analyze the preferences for plumbing materials. Actually this type of analysis includes i.e eliciting the preferred good / service choices based on the presented information / stimuli. Utility Maximization Theory is usually employed to guide the process, design, and analysis of the CA studies, and involves making a choice that yields the greatest satisfaction to the respondents. otherwise it is known as utility, based on their available financial resources. As a result, the preference maximization problem is defined mathematically, as maximization of a utility function based on a specified financial resource constraint (Varian, 1992)

Maximize utility function: u(x) (1) Subject to: $px \leq m$, where x is in X, (2) where u(x) represents the utility function, and $px \leq m$ represents the financial resource constraint, with m being the fixed amount of cash available to households (Champ et al., 2003). Now in this chapter, a household faces a choice among three plumbing material options. Thus the utility (satisfaction) obtained from choosing a plumbing material, i, by the nth household is Uni. The decision maker chooses the option yielding the highest level of utility, which implies the following behavioral model: Uni > Unj , where $i \neq j$. The level of utility isn't observed by the researcher, but the attributes of the plumbing alternatives (xni) within the choice set are observed, also because the socioeconomic characteristics of the decision maker (zn). Based on the known variables, a representative utility function are often specified as: Vni = V (xni, zn) for all alternatives (Train, 2003). For this exercise, each respondent pair-wise rated the well-liked plumbing material option. The rating scale ranges from 1 to 9, with 1 indicating a not preferred plumbing material option, and 9 indicating the most preferred option. The plumbing material rating exercise is predicated on the utility-maximizing behavior, as higher plumbing material rating leads to an increased level of utility, and thus , a better preference level for a given alternative.ow it is the time to articulate the research work with ideas gathered in above steps by adopting any of below suitable approaches:

IV. HOUSEHOLD PREFERENCE FOR PLUMBING MATERIALS

Every respondent to the first Southeastern Community survey was asked to participate in the follow-up survey. Three hundred sixty three respondents agreed to participate, and 245 responded to the follow-up survey. Each respondent evaluated three Conjoint Analysis scenarios describing a set of two plumbing materials (Material A= epoxy coating, Material B = plastic, and Material C = copper that were blinded to neglect the survey exposure bias) and answered questions comparing material attributes. Each plumbing material was described by the following attributes: corrosion resistance, taste and odor, health effects, convenience of installation, proven performance on the market, plumbing material cost, and warranty length. Table 1 presents the plumbing material attributes in more detail. Each respondent was asked to match a pair of plumbing materials, and evaluate each plumbing material supported a 1-9 preference scale. For example, Material A could be rated as 6, while Material B could be rated as 1. The 1-9 preference scale had a verbal preference assigned to every categorical value. Preference values of number 1, 3, 5, 7, and 9 were assigned as ‘Not Preferred’, ‘Moderately Preferred’, ‘Strongly Preferred’, ‘Very Strongly Preferred’, and ‘Extremely Preferred’, respectively. Two hundred thirty respondents fully answered all questions, and each viewed three pairs of two plumbing materials resulting in 1,380 preference responses

As each presented plumbing material had all attributes listed, and there was no randomization of attribute levels across the plumbing materials,. The preference score was easily identified from the preferred plumbing material by

just comparing the attribute levels with the plumbing material details. All preference responses to every plumbing material were then summed, and therefore the plumbing material with the very best number of 'Extremely Preferred' responses and with lowest number of 'Not Preferred' responses was selected as the most preferred plumbing material. The Table 8 presents the descriptive statistical summary of preference valuation break down of the 1,380 responses for plumbing materials. Material C (copper) is the least preferred type of plumbing material (211 not preferred responses), while Material A (epoxy coating) is the most preferred material among homeowners (39 extremely preferred responses).

V. EMPERICAL ANALYSIS RESULTS

A. ORDER LOGIT MODEL WITHOUT SOCIOECONOMICS VARIABLES

For this part of the analysis, the Ordered Logit regression is utilized in the plumbing material estimation of preferences and is estimated at the aggregate response level. The aggregate level analysis implies that average value coefficients are estimated for the participating sample of respondents.

The analysis provides information on the preferences of homeowners for plumbing materials, and the attributes that drive their decision, when making purchasing decision with regards to the type of home plumbing system. Each respondent evaluated a set of two plumbing material portfolios at one time for a total of six portfolios using the valuation metrics 1-9 described earlier. Each of the plumbing materials has a set of attributes described in Table 1. Thus the each material attribute level is employed as the independent variable in the material preference analysis aspect. They are coded as neglecting variables taking as value of 1 when that plumbing material characteristic is a part of the product portfolio and zero otherwise. Finally, the socioeconomic characteristics (reported in the first survey) are also included in the Ordered Logit model. These characteristics represent household home value (continuous variables), age of the house (continuous variable), plumbing material type (dummy variable), pinhole leak occurrences in the past (dummy variable), respondent's previous cost of plumbing material repairs and replacement (continuous variables)

VI. CONCLUSIONS AND DISCUSSIONS

Due to the fact that homeowners have an important stake in finding plumbing systems appropriate for their households, they should not only rely on expert advice, but also acquire information on important plumbing material attributes such as price, health impact, longevity and corrosion resistance in order to make informed utilities, and firms with interests in drinking water infrastructure.

This chapter addressed the issues of household plumbing material decisions. The information was elicited by two surveys of residents residing in a Southeastern Community in the U.S. The first survey elicited information on the prevalence of pinholeleaks and other plumbing material failures, households' experiences with plumbing material failures, the cost of repairs and property damages due to the material failures, and household preferences for corrosion preventive measures. The follow-up survey, sent only to those residents who agreed to participate in future studies related to the plumbing material issues, elicited information on households' preferences for a set of hypothetical plumbing materials.

REFERENCES

[1] Aaron. G. (2005). Ordered Logit Model, Available at online: http://www.uoregon.edu/~arrong/teaching/G4075_Outline/node27.html, Accessed: June 2011.

[2] Agency for Toxic Substances and Diseases Registry (ATSDR)(2004). Toxicological Profile for Copper, Available Online at: http://www.atsdr.cdc.gov/toxprofiles/tp132.html, Accessed: June 2011.

[3] Bosch, Kleczyk, Lee, & Tanellari. (2008). Southeastern Community Survey Report, Department of Agricultural and Applied Economics, Virginia Tech, Blacksburg, VA

[4] Champ, P., Boyle, K., & Brown, T. (2003). A Primer on Nonmarket Valuation, Boston: Kluwer Academic Publishers, IBSN 0 792-3649-88.

[5] Dietrich, Heim, Johnson, Zahng, Edwards, G. V., Loganathan, et al. (July 2006). Plumbing Materials: Costs, Impacts on Drinking Water Quality, and Consumer Willingness to Pay, Proceedings of 2006 NSF Design, Service, and Manufacturing Grantees Conference, St. Louis, Missouri, Available online at http://www.dmigranteeconference.org/paper.htm, Accessed: June 2011.

[6] Dillman, D. A. (1978). Mail and Telephone Surveys, New York: John Wiley & Sons, IBSN 0471-3235-43.