

Socio-demographic Determinants of Computer Ownership: An Empirical View in the City of Gui Lin

Yong Kang Cheah
Faculty of Economics and Administration
University of Malaya
Email: cheahygang@gmail.com

Chun Mei Ning
School of Social Sciences
Universiti Sains Malaysia
Email: chemy27@sina.com

Abstract: This study aims to investigate the socio-demographic determinants of computer ownership in Gui Lin, China. A cross-sectional primary survey data with a total of 459 respondents is used for the analysis. By applying the binary logistic regression model, the results show that age, marital status, education, income, residential area, internet experiences and online frequency are statistically significant in determining the likelihood of owning a private computer. However, other variables like gender and employment status are found to have no significant impact on computer ownership. Based on the findings, a number of insightful policies are suggested.

Keywords: China, computer, internet, ownership, socio-demographic

JEL Classifications: C81, D10, D12

1. Introduction

In this rapidly urbanising society, computer ownership is becoming more and more prevalent. The increasing demand for computers for jobs and academic related tasks, huge reductions in market price, consistently growing internet usage and improvements in computers' features are all noted as factors that influence one to own a computer (Loke and Foo, 2010). Several advantages of using computers are also worth highlighting (Shotton, 1991). First, computer users tend to have better analytical and problem solving skills. Second, computer users are more likely to have better self-esteem and confidence because of expansion in their circle of friends through online social networks. Third, mental stress and depression are less likely to be suffered by those individuals who use computers frequently.

In terms of computer and internet usage, China is still falling behind other well-developed Asian countries. As pointed out in the study by Loke and Foo (2010), it is estimated that only 22.33 per cent and 5.61 per cent of the population in China are internet users and private computer owners, respectively. This compares with Japan, Korea, Hong Kong and Singapore where 60-80 per cent are internet users and 40-80 per cent are computer owners, thus indicating a huge gap in information technology (IT) adoption between China and those developed countries. This is due to lack of IT skills among the population in China as well as their poor command of English.

By far, socio-demographic factors' effects on computer demand have received extensive attention in the literature. In particular, gender, employment status, age, marital status, income and education were verified as having significant correlation with a consumer's decision to use and own a computer. It appears therefore, that governments should pay special attention to this issue, if the objective of creating effective policy is to be met.

Considering the benefits of the computer and its important role in economic development, it is essential to have better understanding of the impacts of socio-demographic factors on computer ownership. The purpose of this paper is to provide policy makers with baseline information for promoting computer usage in the community. However, previous studies were used to focus on this topic in the ICT developed countries (Caselli and Coleman II, 2001; Cutler *et al.*, 2003; Ono, 2005; Ono and Zavodny, 2005; Dholakia, 2006; Chinn and Fairlie, 2007), with little attention paid to those less developed. The present study attempts to fill this research gap by a particular focus on socio-demographic determinants of demand for computers in China.

The balance of this paper is structured as follows. Section 2 lists the literature reviewed in relation to the determinants of computer ownership. Section 3 introduces the methodology, which includes the data sources, econometric specification, definition of variables and characteristics of survey respondents. Section 4 provides the results and discussion. Section 5 provides the summary and conclusion, which includes policy recommendations and limitations of the present study.

2. Review of Past Studies

Gender was commonly observed to have a significant impact on computer use (Losh, 2003; Cutler *et al.*, 2003; Korupp, 2006). In particular, Cutler *et al.* (2003) used the US household survey data and found that women were more likely to live without a computer at home. Similarly, Korupp (2006) emphasised that men were more likely to use computers compared to women. This finding was also shared by Yin *et al.* (2005) who claimed that men tended to spend more

money on computer hardware than women. One reason may be the existence of a gender stereotype in the use of computers (Dholakia, 2006). However, this conventional wisdom was not confirmed by Ono and Zavodny (2005) who based their study in Japan and claimed that there was no significant influence of gender on computer ownership.

Ono and Zavodny (2005) ascertained that employed individuals were more likely to own and use a computer at home. In terms of broadband adoption, Dwivedi and Lal (2007) found that employment status was the important determinant, because different job categories required different working skills, resulting in different preferences for broadband adoption. For instance, those in white collar jobs would be more likely to adopt broadband than those in blue collar jobs.

Prior empirical studies had consistently found that age was an important determinant for computer ownership. A study by Chinn and Fairlie (2007) found that computer ownership and internet usage were more prevalent among young people. In Malaysia, age was observed to have a negative relationship with the likelihood of owning a computer at home (Loke and Foo, 2010). A likely reason was that older people often held the view that computers were not user friendly for them, thus they tended not to acquire even basic skills in using one (Cutler *et al.*, 2003; Dwivedi and Lal, 2007).

Even though the influence of marital status was often overlooked in previous studies, there was still some evidence suggesting its significance in affecting computer ownership. Cutler *et al.* (2003) documented that a widowed individual tended to reside in a household without a computer, compared to those who were married. As explained by Yin *et al.* (2005), given the greater number of family members, married households were likely to have higher demand for a computer. Similar evidence was provided by Korupp (2006) in that the presence of children in a household could lead to greater computer usage compared to one without children.

Budget constraint could also affect an individual's decision to own a computer. Ono (2005) examined the case of East Asia and found that higher income individuals were more likely to own a computer at home. Likewise, Cutler *et al.* (2003) found that individuals from high income families were more likely to live in a household with a computer. Using per capita income as the indicator in a cross-country study, Chinn and Fairlie (2007) found out that a USD1000 increase in per capita income would lead to a one per cent increase in the number of computers per capita. However, as pointed out by Loke and Foo (2010), income did not have any significant impact on computer ownership in Malaysia.

Caselli and Coleman II (2001) focused on computer investment per worker and emphasised that a high level of academic qualification was a key

factor leading to computer-technology adoption. Similarly, Korupp (2006) and Chinn and Fairlie (2007) found a significant positive relationship between years of education and computer use. Further, studies by Cutler *et al.* (2003), Ono (2005) and Loke and Foo (2010) claimed that less educated individuals were more likely to live without a computer because they tended to have poorer understanding skills compared to those more highly educated.

3. Method

This section focuses on discussing the data (section 3.1), econometric model (section 3.2) and explanatory variables (section 3.3) that are used in the present study, as well as the detail of characteristics of survey respondents (section 3.4). The data used in the present study is a cross-sectional survey data of Gui Lin, China. A logit model is thus applied to examine the factors affecting individuals' likelihood of owning a computer. Numerous socio-demographic and personal information variables are incorporated into the current model for analysis.

3.1 Data

A cross-sectional primary survey was used in this study. The survey was based on convenient sampling of various places in Gui Lin (a developing city in China) including urban and rural areas. In essence, it was decided to conduct a detailed investigation of this issue in a developing city where the ICT industry is still in an infant stage.

The survey was conducted between January and February 2011. Throughout this period, questionnaires in both English and Chinese were distributed to the respondents for self-administration. Respondents had to be at least 18 years of age, and to have been resident in Gui Lin no less than one year. It was considered that at this age, most respondents would be financially independent and able to make a purchase independently.

During the survey, respondents were asked to indicate whether they had owned any private computers (e.g. desktop, laptop, tablet) at home. They were also asked for their socio-demographic profiles and information regarding their personal internet usage. A total of 500 respondents were canvassed, but due to incomplete information reported by some, only 459 were retained for final analysis.

3.2 Econometric Specification

The dependent variable is measured as a dummy variable where a respondent who owned a computer is coded as 1, otherwise, as 0. Given this binary outcome,

a logit model (i.e. logistic regression) is suitable to be used for the calculations (Greene, 2007). In general, the logit model can be written as follows:

$$\log \frac{P}{1-P} = \alpha + \beta_1 X_i + \varepsilon \quad (1)$$

where:

P refers to the probability that an individual owns a computer;

1 – P indicates the probability that an individual does not own a computer;

log (P / 1 – P) is the log of odds that an individual owns a computer;

X is the explanatory variable expected to affect the probability of owning a computer;

β is the coefficients of the explanatory variables; and

ε is the error term to capture the unobserved components.

3.3 Definitions of Variables

All the explanatory variables are entered into the current model as dummy variables to allow clear comparison, and given the absence of any prior in-depth study of computer ownership in China, the variables are selected based on previous empirical studies conducted elsewhere (e.g. Caselli and Coleman II, 2001; Cutler *et al.*, 2003; Losh, 2003; Ono, 2005; Ono and Zavodny, 2005; Dholakia, 2006; Chinn and Fairlie, 2007; Loke and Foo, 2010). As such, socio-demographic factors like gender, age, marital status, education, employment status, income and residential area are all hypothesised to affect the likelihood of owning a private computer in the present study. In addition, other relevant variables such as personal internet experiences and time spent on the internet per week are also taken into account in the model (Table 1).

Socio-demographic

Gender is registered as 1 if the respondent is male and 0 if female. Respondents' ages are categorised in four groups – 18-22, 23-30 (base group), 31-50 and >50. For marital status, a married respondent is denoted as 1, while single/divorced/widow(er)s as 0. Respondents' education backgrounds are segmented into primary, secondary and tertiary (base group). A respondent's employment status is registered as 1 if he/she is employed (i.e. self-employed, civil servant or private company worker), and as 0 if unemployed (i.e. student, housewife or retiree). Respondents' individual incomes are arrayed into four categories: <RMB2000 (base group), RMB2000-4999, RMB5000-9999, and \geq RMB10000.

Table 1: Definition of Explanatory Variables

Variables ^a	Description of variables
<i>Socio-demographic</i>	
Gender	Respondent is male
Age1	Respondent's age: 18 – 22
Age2*	Respondent's age: 23 – 30
Age3	Respondent's age: 31 – 50
Age4	Respondent's age: > 50
Marital status	Respondent is married
Education1	Respondent has primary education
Education2	Respondent has secondary education
Education3*	Respondent has tertiary education
Employment	Respondent is employed
Income1*	Respondent's income per month: < RMB2000
Income2	Respondent's income per month: RMB2000 – 4999
Income3	Respondent's income per month: RMB5000 – 9999
Income4	Respondent's income per month: ≥ RMB10000
Residential area	Respondent resides in urban area
<i>Personal information on internet usage</i>	
Internet1	Respondent's internet experience: ≤ 1 year
Internet2*	Respondent's internet experience: 2 – 5 years
Internet3	Respondent's internet experience: ≥ 6 years
Online1*	Time spent on internet per week: < 8 hours
Online2	Time spent on internet per week: 8 – 16 hours
Online3	Time spent on internet per week: 17 – 24 hours
Online4	Time spent on internet per week: > 24 hours

Note: *

Represent the base group of variable.

^aAll variables are in binary outcome (1 = yes; 0 = no)

House locality of a respondent is included as 1 if he/she resides in urban areas and 0 otherwise.

Personal Information on Internet Usage

A respondent's internet experience is registered in three categories: ≤ 1 year; 2-5 years (base group); and ≥ 6 years. The frequency of internet browsing is also taken into account, measured as the time an individual spends on the internet per week. Four periods of duration are categorised: ≤ 8 hours; (base group); 8-16 hours; 17-24 hours; and ≥ 24 hours.

3.4 Characteristics of Survey Respondents

Of the 459 respondents, 323 (70.37 per cent) are computer owners, while the remaining 136 (29.63 per cent) are non-computer owners. By gender, 30.93 per cent are male. The age breakdown is as follows: 20.26 per cent aged 18-22; 52.07 per cent aged 23-30; 22.44 per cent aged 31-50; and 5.23 per cent aged >50 . Approximately 44.01 per cent of total respondents in the sample are married, whereas the remaining 55.99 per cent are single/divorced/widowed. In terms of education, around 4.58 per cent, 41.18 per cent and 54.25 per cent of respondents have primary, secondary and tertiary level education respectively (Table 2).

Overall, there are roughly 68.41 per cent of respondents employed. As for income, 77.56 per cent are in the category of $<RMB2000$, 18.08 per cent are in the range $RMB2000-4999$, 2.18 per cent are in the range $RMB5000-9999$, and another 2.18 per cent receive $\geq RMB10000$. In addition, 67.76 per cent of respondents are from urban areas. Among the total respondents, 21.31 per cent have ≤ 1 year of internet experience, 42.48 per cent have 2-5 years and 36.38 per cent have ≥ 6 years. The majority (45.32 per cent) of the respondents spend <8 hours a week online, 21.13 per cent spend 8-16 hours, while the remaining 11.11 per cent and 22.44 per cent spend 17-24 hours and >24 hours respectively.

4. Results and Discussion

To test the regression's goodness of fit, the LR and Hosmer-Lemeshow tests are used. First, the LR χ^2 with the 17 degrees of freedom is 177.47, and it has a probability value of 0.0000. Hence, the null hypothesis is able to be rejected at 1 per cent, 5 per cent and 10 per cent significance level, and we conclude that the model is good fit. Second, the Hosmer-Lemeshow χ^2 with 8 degrees of freedom is 8.87 with a probability value of 0.3535. This indicates that the

Table 2: Descriptive Statistics of Variables in the Statistical Model

Variables	Percentage (%)		
	Total sample (n = 459)	Computer owners (n = 323)	Non-computer owners (n = 136)
Socio-demographic			
Gender	30.93	33.75	24.27
Age1	20.26	20.12	20.59
Age2	52.07	59.13	35.29
Age3	22.44	18.89	30.88
Age4	5.23	1.86	13.24
Marital status	44.01	40.87	51.47
Education1	4.58	1.86	11.03
Education2	41.18	31.58	63.97
Education3	54.25	66.56	25
Employment	68.41	67.18	71.32
Income1	77.56	73.99	86.03
Income2	18.08	23.22	5.88
Income3	2.18	0.93	5.15
Income4	2.18	1.86	2.94
Residential area	67.76	73.07	55.15
Personal information on internet usage			
Internet1	21.13	8.36	51.47
Internet2	42.48	47.37	30.88
Internet3	36.38	44.27	17.65
Online1	45.32	35.60	68.38
Online2	21.13	21.67	19.85
Online3	11.11	13.93	4.41
Online4	22.44	28.79	7.35

Source: Author

null hypothesis cannot be rejected at 1 per cent, 5 per cent and 10 per cent significance level, and we further conclude that the model is good fit (Table 3).

In terms of gender, no significant differences in the likelihood of owning a computer are found between males and females. This finding does not comply with Losh (2003), Cutler *et al.* (2003) and Korupp (2006) who concluded that males are more likely to purchase a computer than females. A possible explanation is that in this rapidly urbanising society, the traditional gender stereotype in using technology is disappearing.

With regard to age, only the oldest age category (>50) is statistically significant in determining computer ownership. The result shows that individuals in the age group >50 are less likely to own a computer than their counterparts aged 23-30 (OR: 0.26). This is quite in line with Chinn and Fairlie (2007) and Loke and Foo (2010) who also found a significant negative relationship between age and computer ownership. As explained by Cutler *et al.* (2003) and Dwivedi and Lal (2007), older people in this city also, still tend to have the perspective that a computer would not be of great benefit to them. Hence, they are less likely to seek out knowledge of using a computer.

As revealed in the result, married individuals are more likely to own a private computer at home than their unmarried counterparts (i.e. single, divorced, widowed) (OR: 2.11). This is somewhat in line with the finding of Cutler *et al.* (2003) who concluded that widow(er)s are more inclined to reside in a household without a computer. There are two reasons for this outcome (Yin *et al.*, 2005; Korupp, 2006). First, increasing computer demand from household members (e.g. presence of children) for jobs and academic related tasks would result in a higher likelihood of owning a computer. Second, married individuals often need to spend more time at home with their family, thus they would rather choose to own a computer at home for getting their work done than spending too much time in the office.

Consistent with the previous studies of Korupp (2006), Chinn and Fairlie (2007), Ono (2005) and Loke and Foo (2010), education is found to be positively related to computer ownership. This current study ascertains that individuals who have only a primary or secondary academic qualification have lower propensity to own a computer compared to their tertiary counterparts [OR (Education1): 0.16; OR (Education2): 0.32]. This is because they tend to have a poor command of English and lack the knowledge of using a computer (Ono, 2005; Loke and Foo, 2010). Also, less educated individuals tend to work in a job that is not IT related, thus they tend to have less intention of owning a private computer at home.

The result reveals that there is no significant influence of employment status on computer ownership. While such a finding appears to contradict the studies of Ono and Zavodny (2005) and Dwivedi and Lal (2007), this may be

Table 3: Results for Logit Analysis of Computer Ownership

Variable	Estimated coefficient	Odds ratio	Z-statistic
Constant	0.80 (0.40)	-	2.03**
Gender	0.05 (0.33)	1.05 (0.35)	0.15
Age1	-0.35 (0.35)	0.71 (0.24)	-1.01
Age2	-	1.00	-
Age3	0.07 (0.43)	1.07 (0.46)	0.16
Age4	-1.35 (0.66)	0.26 (0.17)	-2.04**
Marital status	0.75 (0.40)	2.11 (0.83)	1.90*
Education1	-1.80 (0.65)	0.16 (0.11)	-2.76***
Education2	-1.15 (0.35)	0.32 (0.11)	-3.30***
Education3	-	1.00	-
Employment	0.09 (0.35)	1.09 (0.39)	0.25
Income1	-	1.00	-
Income2	0.96 (0.51)	2.61 (1.34)	1.87*
Income3	-2.32 (0.84)	0.10 (0.08)	-2.77***
Income4	0.45 (0.77)	1.56 (1.20)	0.58
Residential area	0.90 (0.28)	2.47 (0.70)	3.18***
Internet1	-1.96 (0.37)	0.14 (0.05)	-5.31***
Internet2	-	1.00	-
Internet3	-0.18 (0.34)	0.84 (0.28)	-0.52
Online1	-	1.00	-
Online2	0.37 (0.35)	1.45 (0.50)	1.07
Online3	1.21 (0.54)	3.37 (1.82)	2.24**
Online4	1.22 (0.44)	3.37 (1.47)	2.78***
LR χ^2 (17)	177.47		
P> χ^2	0.0000		
Hosmer-Lemeshow χ^2 (8)	8.87		
P> χ^2	0.3535		

Note: Asymptotic standard errors in parentheses. Asterisks *** indicate significance at the 1% level, ** at the 5% level, and * at the 10% level.

due to the multipurpose features of a computer, as it can serve the needs of every individual regardless of employment status. For example, individuals who are not in the labour force can use the computer for academic work and job hunting, whereas those in the labour force can use it for office work as well.

The relationship between income and computer ownership is found to be ambiguous. Individuals with an income between RMB2000 and RMB4999 are more likely to own a computer than those with income less than RMB2000 (OR: 2.61). However, individuals who have an income between RMB5000 and RMB9999 have lower odds of owning a computer (OR: 0.10). This finding somehow does not match the observed outcome of Cutler *et al.* (2003), Ono (2005) and Loke and Foo (2010). One explanation could be that when individuals have a certain high level of income, they are likely to be working in a top management position in a company where a personal computer is provided, thus they would have less tendency to purchase a private computer.

As anticipated, residential area is found to be significant in affecting computer ownership. The conclusion is that individuals residing in urban areas have a greater propensity to own a private computer at home than their rural dwelling counterparts (OR: 2.47). Lack of IT related supplies in the rural areas can be a plausible explanation for such an outcome. Another reason could be that rural dwellers often engage in jobs where a computer is not required. Hence, their preference for owning a computer tends to be lower compared to urbanites.

Apart from the socio-demographic factors, internet experience is also found to be statistically significant in affecting computer ownership. As revealed, individuals who lack internet experiences (≤ 1 year) are less likely to own a private computer at home compared to their counterparts who have more internet experiences (2-5 years) (OR: 0.14). The result also shows a significant relationship between internet browsing frequency and computer ownership. Individuals who spend 17-24 hours and >24 hours on the internet per week are more likely to own a private computer at home than those who spend <8 hours [OR (Online3): 3.37; OR (Online4): 3.37]. Overall, these findings tend to support the fact that individuals who are highly reliant on the internet in their lifestyles tend to have greater preferences for owning a computer.

5. Concluding Remarks

In general, the present study sheds some light on the pattern of computer ownership in Gui Lin, China. There is evidence suggesting that the elderly and those with low educational attainments are less likely to own a private computer at home, whereas individuals who are married and residing in urban areas are more likely to own a computer. Employment status and gender are found to be insignificant. Furthermore, individuals who have more frequent internet experiences and are spending more time on the internet per week are

more likely to own a private computer. Based on these findings, several policy implications are discussed.

First, it is suggested that policy makers organise more IT related programmes in the community. For example this can be done by making computer related subjects and courses compulsory in all stages of education, particularly at primary and secondary levels. The importance of English as a subject should be given consideration in tandem. Second, IT professionals, software producers and computer scientists could play a role in highlighting the usefulness and advantages of computers, with the purpose of exerting more influence on society.

Third, there is a need to develop computers that are more user friendly for all age groups, particularly the elderly. Designing computers in accordance with the needs of different age categories guarantees less discrimination. Furthermore, the organising of additional computer classes specially designed to teach the elderly regarding computer usage is greatly required. Frequent motivational talks in these classes would help as well, in improving the confidence of older individuals.

Fourth, considering income factors, subsidising the computer prices might help to increase the prevalence of computer ownership among the poor. Alternatively, governments can provide financial assistance to low income cohorts in the form of computer loans or tax rebates in the case of computer purchases. In addition, computer fairs could be organised frequently, preferably in places of majority low income residents such as rural areas.

Fifth, given the lack of computer ownership among rural dwellers, it is recommended that public administrators specifically target this group in several ways. First, providing attractive incentives such as low rental fees, low sales tax and free transportation to computer sellers located in the rural areas might give promising results in terms of increasing computer supply in the rural areas through clustering more computer retail outlets. Second, creating more IT related jobs in the rural areas might work well to increase opportunities for rural dwellers to use computers. This would inevitably result in higher rates of computer ownership. Finally, considering the evidence that low online frequency can lead to low likelihood of owning a private computer, methods of promoting internet usage such as reductions in internet subscription fees are suggested when it comes to policy implementation.

Given budget and time constraints, some inherent limitations of the study are noted. First, the method of collecting the survey data (i.e. convenient sampling) might not be that advantageous. In addition, the sample size is fairly limited and thus unable to represent the country as a whole. Second, the study only takes into account socio-demographic and personal information regarding internet usage, whilst other variables such as attitudinal beliefs and other

personal perspectives on computer ownership are neglected. Future avenues of research then should collect data from various places in China rather than just a single city. Furthermore, it is recommended that a more comprehensive method such as random stratified sampling be used in data collection.

Note

- ¹ The authors are grateful to two anonymous reviewers and Ibrahim Ndoma for their insightful comments and suggestions regarding this manuscript. The authors would also like to thank Dr. Loke Yiing Jia for her comments on the questionnaires. All remaining flaws are the authors' responsibility and the usual disclaimer applies.

References

- Caselli, F. and Coleman II, W.J. (2001) "Cross-country Technology Diffusion: The Case of Computers", *American Economic Review*, 91(2): 328-335.
- Chinn, M.D. and Fairlie, R.W. (2007) "The Determinants of the Global Digital Divide: A Cross-country Analysis of Computer and Internet Penetration", *Oxford Economic Papers*, 59(1): 16-44.
- Cutler, S.J., Hendricks, J. and Guyer, A. (2003) "Age Differences in Home Computer Availability and Use", *Journals of Gerontology: Series B*, 58(5): S271-S280.
- Dholakia, R.R. (2006) "Gender and IT in the Household: Evolving Patterns of Internet Use in the United States", *The Information Society*, 22(4): 231-240.
- Dwivedi, Y.K. and Lal, B. (2007) "Socio-economic Determinants of Broadband Adoption", *Industrial Management and Data Systems*, 107(5): 654-671.
- Greene, W.H. (2007) *Econometric Analysis* (6th ed.), New York: Prentice Hall.
- Korupp, S.E. (2006) "No Man is an Island: The Influence of Knowledge, Household Settings and Social Context on Private Computer Use", *International Journal of Internet Science*, 1(1): 45-57.
- Loke, Y.J. and Foo, C.S. (2010) "Computer Ownership and Home Usage: The Case of Malaysia", *International Journal of Consumer Studies*, 34(1): 96-104.
- Losh, S.C. (2003) "Gender and Educational Digital Chasms in Computer and Internet Access and Use over Time: 1983-2000", *IT and Society*, 1(4): 73-86.
- Ono, H. (2005) "Digital Inequality in East Asia: Evidence from Japan, South Korea, and Singapore", *Asian Economic Papers*, 4(3): 116-139.

- Ono, H. and Zavodny, M. (2005) "Gender Differences in Information Technology Usage: A US-Japan Comparison", *Sociological Perspectives*, 48(1): 105-133.
- Shotton, M.A. (1991) "The Costs and Benefits of 'Computer Addiction'", *Behaviour and Information Technology*, 10(3): 219-230.
- Yin, W., Devaney, S.A. and Stahura, J. (2005) "Determinants of Household Expenditure on Computer Hardware and Software", *Journal of Consumer Affairs*, 39(2): 254-275.