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The Influence of Product Signalling on Adverse Selection in Smartphone Market

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Abstract: *Technological innovation has significantly shaped Telecommunication industry. In turn, Smartphone market has grown exponentially globally. Nowadays, people no longer stay away from their Smartphones because of multiple functions, apart from communication. As an essential tool for communication and other uses, smartphone quality is an important aspect among customers. The ongoing overflow of unknown and known smartphone brands has put consumers' right of choice in dilemma. Unfortunately, studies on business and economic problems of information asymmetry in smartphones market dwell unexplored. The study aimed to uncover the influence of product signalling on adverse selection in smartphone market. Two groups of smartphone owners were developed; those with product information before shopping and those who got informed at the shop. The findings show that smartphone owners who had product information before shopping perceived higher quality products than owners who did not have information prior. The results also show that, the higher the smartphone quality, the higher is the smartphone price a customer has to pay for. Further, the study found that, pre-informed customers were not willing to buy low quality phones even when the prices were low. This means that, product signalling is highly correlated to adverse selection in smartphone purchases. The study suggest that, smartphone vendors should ensure high quality products and avail product information to customers for adverse selection reduction and improvement of customers' welfare.*

Keywords: *Adverse Selection; Customer Choice; Product Signalling; Smartphone Market.*

1. INTRODUCTION

Smartphone has turned into a source of knowledge and social interaction among academic and non-academic individuals to the extent that some people feel incomplete without the device (Alfawareh & Jusoh, 2017). Far distance family members can now remain virtually close (Madianou, 2014). Telemedicine technology, enhanced by smartphone, has also expanded medical services (Allaert, Legrand, Abdoul Carime, & Quantin, 2020) including increased patient administration, medicine learning and facilitation of medical researches in health centres (Atherley, Hu, Teunissen, Hegazi, & Dolmans, 2021). Businesses improve their sales, and employees access job vacancy through internet (Waryoba, 2022; Dammert, Galdo, Galdo, & Galdo, 2015). Even with learning enhancement capability in colleges, most students are spoiled by unethical Smartphone uses (Ifeanyi & Chukwuere, 2018, Tago, 2020).

The gross sales from smartphones have recently surpassed the sale of any other computing devices in the world (Iqbal & Bhatti, 2020), growing rapidly worldwide at a staggering rate (Stanley, Waxberg, & Russell, 2015) with an increasing replacement rate. The replacement speed of Smartphone has grown up to an average of less than a year (Cordella, Alfieri, Clemm, & Berwald, 2021). For instance, from 2007 to 2018, i-Phone had seen multiple series in the industry, with a total of 360 series in the United States, 326 in Taiwan, 322 in Japan and 99 in South Korea (Son & Kim, 2021). The rapid replacements show that smartphone ownership beyond communication reasons. Brand and device make cannot outdate communication within a year. This durability issue also has an environmental implication which is beyond the reach of the current study.

Smartphone market is expanding due to its technological driving advantage. Worldwide, China is the leading smartphone market followed by India. The Indian government framed a policy to produce at least one billion smartphone gadgets by the year 2025. Even though, smartphone market is still less than feature phone market in India. In suburban areas, internet enhanced feature phones dominate the market (Kathuria, Kedia, & Bagchi, 2019). In Czech Republic (Mirvald, 2015), the growing demand for smartphone and asymmetric information among buyers has increased the introduction of fake smartphone or their accessories.

Existence of several smartphone brand and quality information sources offers customers an opportunity to be informed. Friends, other people, or website can easily bridge the seller-customer information gap. However, some customers still complain on quality-price mismatch. This study analyses the influence of product signalling on adverse selection in smartphone market by answering the following questions: *Are smartphone quality perceptions between informed and uninformed customers different? If quality perceptions significantly differ, which group of customers has a positive attitude?*

The next sections of the study is structured in the following order: Section 2 reviews studies of consumer behaviour, signalling, and adverse selection. The research methods are explained and described in section 3. Section 4 provides the research findings and discussions. And last but not least, the study ends with section 6, conclusion and recommendations.

2. LITERATURE REVIEW

The founders of reasoned action theory (Icek Ajzen and Martin Fishbein in 1975), later on, made an improvement over the information integration theory (Ajzen & Fishbein, 1975), thereby separating behavioural intention from behaviour (Nickerson, 2022). However, because it is not falsifiable, the theory has received criticism (Trafimow, 2009). Despite criticisms, the theory is useful in explaining consumer's purchase decision making behaviour. Consumer behaviour theory centres the association amid marketing and pre-existing feelings consumers convey to their purchasing verdict. Accordingly, consumers act on behaviours that will create or receive a fastidious outcome, familiar or otherwise. As such, logical decision-making is the principal component of what forces consumers to make purchases.

George A. Akerlof, who formalized the adverse selection problem with his market for Lemon, revealed that dishonest in the market can lead into nonexistence of market (Akerlof, 1970). Akerlof (1970) also noted that underdeveloped countries suffer from information asymmetry than developed countries. But, that licensing practice and brand names provision can reduce quality uncertainty thereby mitigating information asymmetry problem. Insurers apply various methods to attract good consumers associated with less expected cost and avoid bad consumers whose expected costs are high. That is, picking cherry or skimming cream, and dropping lemon (Einav, Finkelstein, & Mahoney, 2021).

From investment perspective (Michaely & Shaw, 1994), asymmetric information is a situation where some investors are better informed than others about prospective returns of an investment. The outside informed investors possess better knowledge about firm's future prospects than uninformed investors. As a result, they will bid for more shares of the more successful firms, leaving the uninformed investors with a disproportionate amount of the less successful issues. Nevertheless, given the fact that the allocation is not on a pro rata basis, the bias against uninformed investors can be even larger if the investment bankers favour the informed investors. Given the rationality of market participants, the uninformed investors require a higher average return to compensate them for their allocation disadvantage leading into under-pricing in the Initial Public Offering (IPO) market. However, if there are issues in which the ignorant investors have a prior knowledge that the knowledgeable investors will not participate, there is no allocation disadvantage, and under-pricing is irrelevant.

In the job hiring market, uncertainty is very high. The employer is not certain bout the productive capability of job applicants (Spence, 1973). In his easy, Michael Spence showed how employers learns about signals in the hiring process making it as a circle. The applicant incurs cost in signalling, for instance education. The cost of signalling will determine the signalling decisions by the applicant, that is, maximization of return net of signalling costs. After being hired, the employer will start observing the relationship between marginal product and signals of employees. This will shape the employer's conditional probabilistic beliefs thereby reframing the offered wage schedule as a function of signals and indices. In his essay, indices are characteristics which the applicant cannot discretionarily alter such as sex, age, and race. However, he argued that a signal cannot distinguish one applicant from another,

unless the costs of signalling are negatively correlated with productive capability. This condition is important because, if it does not hold, then given the offered wage schedule, everyone will invest in the signal in exactly the same way, so that they cannot be distinguished on the basis of the signal. Signalling costs, in the job market goes beyond direct monetary costs including psychic, and time.

de Andrés, Correia, Rezola, & Suárez, (2022) analysed the role of funding portals as signalling offering quality in investment crowd funding. Using Probit model in estimation, they uncovered that when the issuer fee does not include securities, there is a negative effect on the success of the offering. But, when this fee combines a gross fee and financial securities, the sign of the coefficient becomes positive and statistically significant. They observe that, the results highlight the relevance of the signal sent by the portals regarding offering quality as a mitigating factor of the adverse selection problem.

In insurance market, Puelz & Snow, (1994) tested the hypotheses that equilibrium in the insurance market entails low-risk types selecting contracts with higher deductibles, and insurance firms offering nonlinear pricing of insurance coverage. They revealed a strong relationship between risk type and deductible choice. Their results show that low-risk types signal by selecting higher deductibles and are being compensated for doing so by paying a lower average premium for insurance coverage. The insurers are therefore able to identify the risk types from the signalling implied by choice of deductibles. In their study, signalling played a great role in reducing the adverse selection problem.

Signalling (Sadeh & Kacker, 2020) was found to negatively affect firm performance due to attraction of low quality potential partners. This attraction is due to the fact that signalling makes firms disclose their Financial Representation Performance (FRP). They argue that the negative effect of signalling might be due to the fact thatf the signalling cost is higher compared to the benefits of signalling. Due to fear of other enterprises copying the information disclosed, firms must ensure quality in signalling which is costly. However, their findings show that when signalling is combined with screening, firm's performance improves thereby mitigating the adverse selection problem.

Signalling among online traders (Mavlanova, Benbunan-Fich, & Koufaris, 2012) seem to varied depending on their quality. Low–quality sellers tend to avoid expensive, easy-to-verify signals and use fewer signals than do high–quality sellers. Online customers who are aware of using signals can easily identify sellers of low quality products from those who sell high quality products. In their study, website has been used as a means of sending signals to customers and therefore a source of data collection. The signals sent by sellers were used as unit of analysis. Unlike other studies reviewed, their study is closely linked to the current study only that customers are not involved.

Using detailed data on loan characteristics and borrower repayment, Kawai, Onishi, & Uetake (2022) studied how signalling affects equilibrium outcomes and welfare in an online credit market. They built and estimated an equilibrium model in which a borrower may signal her default risk through the reserve interest rate. Comparing markets with and without signalling relative to the benchmark with no asymmetric information, they revealed that signalling can restore up to 78 percent of the damage caused by adverse selection. They found that adverse selection destroys as much as 34 percent of total surplus.

The extant literature concentrated on how signalling reduce adverse selection. Using eBay Smartphone vendors' product information, Waryoba (2018) revealed that signalling offsets adverse selection. The current study has compared quality perceptions between informed and uninformed customers.

3. METHODOLOGY

3.1. Research Approach and Design

The study is a mixed research approach, both qualitative and quantitative information were gathered and analysed at the same time. Molina-Azorin (2016), claims that mixed research approach improves research skills and data quality. The use of qualitative and quantitative approaches together enhances a better understanding of complex research problems than studying either approach alone (Creswell & Piano Clark, 2007).

The current study used a simultaneous or convergent parallel approach (Morse, 1991; Molina-Azorin, 2016) with large portion of quantitative data and one question on qualitative data. Quantitative data were taken on prices of the Smartphone where respondents were required to state the monetary cost of the gadget. Attitudes of the respondents concerning Smartphone quality were also collected. The study also inquired customers' views on Smartphone market information improvement.

3.2. Data Collection and Data Analysis

The study used Snowball sampling technique where University students' class representatives were given the link for Google forms. Due to large population size, Cochran sample calculation resulted into a sample size of 384 respondents. However, due to non-response the study managed to survey only 75 respondents.

T-squared approach (Sepanski, 1994) below was used to analyse quality mean differences between informed and uninformed customers:

$$T_n = \frac{\sum_{i=1}^{n}(X_i - \mu)}{\left(\sum_{i=1}^{n}(X_i - \bar{X}_n)^2\right)^{1/2}} = \frac{\sqrt{n}(\bar{X}_n - \mu)}{S_n} \Rightarrow N(0,1) \quad (1)$$

Where $\bar{X}_n = n^{-1}\sum_{i=1}^{n} X_i$ and $S_n^2 = n^{-1}\sum_{i=1}^{n}(X_i - \bar{X}_n)^2$

A classical necessary and sufficient condition which is weaker than finite variance is that there should exist $a_n \to \infty$ such that $\frac{1}{a_n}\sum_{i=1}^{n}(X_i - \mu) \Rightarrow N(0,1)$ is given by

$$\lim_{n\to\infty} \frac{t^2 P(|X| > t)}{EX^2 I[|X| \le t]} = 0 \quad (2)$$

The law of X denoted as $\ell(X)$ is in the domain of attraction (DOA) of the normal law. In this case, a_n can be chosen to satisfy the relation $a_n^2 = nEX^2 I[|X| \le a_n]$. The normalizing sequence, a_n, may be unknown, and it is true that equation (2) is equivalent to the condition $a_n^{-2}\sum_{i=1}^{n}(X_i - \bar{X}_n)^2 \to 1$. This leads to the same conclusion as in equation (1). The condition of fullness is the multivariate analogue of none degeneracy. The condition for law of X to be in the domain of attraction (DOA) of a full multivariate normal law is exactly as in equation (2) with norms replacing absolute values. In which case, we have $a_n^{-1}\sum_{i=1}^{n}(X_i - \mu) \Rightarrow N(0, C)$, for some non-singular covariance matrix C. In applying the central limit theorem we encounter a problem of having a_n which depends on X, and may be unknown. Another problem which has been added is the appearance of C in the limit which may also be unknown. This leads into consideration of the multivariate analogue of T_n.

The quantity we are normalizing by in the univariate T_n is $\sqrt{n}S_n$. The multivariate analogue of this is now the matrix $C_n^{1/2}$, where $C_n = \sum_{i=1}^{n}(X_i - \bar{X}_n)(X_i - \bar{X}_n)^T$. In formulating the univariate t-statistic, we divide by $\sqrt{n}S_n$, which suggests multiplying by $C_n^{-1/2}$ and therefore considering $T_n = C_n^{-1/2}\sum_{i=1}^{n}(X_i - \mu)$. Although, $S_n > 0$ we are not 100 percent sure that C_n is invertible. This is one minor drawback to the proposed method. Steven J. Sepanski proposed two ways to circumvent the problem of C_n lacking to being invertible. For some sequence $b_n > 0$, he defined

$$D_n = C_n + b_n I \quad (3)$$

Such that if b_n approaches zero at a very fast rate, $D_n = C_n$. Alternatively, the relationship becomes as in equation (4).

$$D_n = \begin{cases} C_n & \text{If } C_n \text{ is invertible} \\ I & \text{Otherwise} \end{cases} \quad (4)$$

In this case, C_n is the covariance matrix and is a nonnegative symmetry. It is this C_n which turns the statistics from a univariate into a multivariate statistics. With the assumption that C_n is measurable, D_n is also measurable. Therefore, either equation (3) or (4) is a useful ingredient for the multivariate t-statistics given in equation (5) below.

$$T_n = D_n^{-1/2} \sum_{i=1}^{n} (X_i - \mu) \quad (5)$$

From the multivariate *t*-statistics, with other assumptions (Sepanski, 1994), taken into consideration, Hotelling's T^2 statistics is given as in equation (6).

$$H_n^2 = n^2 (\bar{X}_n - \mu)^T C_n^{-1} (\bar{X}_n - \mu) \quad (6)$$

If the original sample is from a normal population then H_n is distributed as $((n-1)d/(n-d))F_{d,n-d}$ where $F_{d,n-d}$ denotes a random variable with F distribution with *d* and *n-d* degrees of freedom. Under the weaker hypothesis of generalized domain of attraction (GDOA), the modified Hotelling's T^2 statistics is given as in equation (7).

$$H_n^2 = n^2 (\bar{X}_n - \mu)^T D_n^{-1} (\bar{X}_n - \mu) \quad (7)$$

The Hotelling's T-square statistics is a multivariate version of the t-statistics which is testing the null hypothesis that,

$$H_0 = \frac{\mu_j}{\mu_{0j}} = 1$$

Against the alternative that

$$H_a = \frac{\mu_j}{\mu_{0j}} \neq 1$$

That is the mean ratios between groups are equal against the alternative that the mean ratios are not equal.

4. Findings and Discussions

4.1. Signalling and Quality

The Hotelling's T-squared generalized means test is used to make comparison between informed and uninformed customers. The study had four attitude questions; one concerning the quality of Smartphone. This question asked whether the owner considered the quality of his or her Smartphone was worth its price. The responses were arranged as; strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, and strongly agree = 5. The respondent who strongly agreed that the quality was worth the price is considered to have Smartphone of the highest quality and vice versa. The rest of the questions were concerned with features that customers consider to judge quality of Smartphone that is, camera resolution, processor and capacity.

Table1. *Mean differences between informed and uninformed customers*

	Quality information status		**Test Statistics**
Attitude	Informed	Uninformed	2-group Hotelling's T-squared
quality	3.983	2.933	19.030967
Camera	3.867	3.133	F test statistic:
Processor	4.383	3.467	((75-5-1)/(75-2)(5)) x 19.030967

capacity	3.417	2.867	F(5,69) = 3.5976
Price	421500	275000	Prob > F(5,69) = 0.0060
respondents	60	15	

Source: Field data

In the survey, 60 customers were informed on quality before shopping, while 15 customers were uninformed. The Hotelling's T-squared test shows that the two groups of customers have their means different from one another. The test statistics are significant at all levels of significance.

From the assumption that quality is a positive function of attitude. It is also clear that Smartphone quality is on average higher among informed customers compared to their uninformed counterparts. Customers informed just at the vendor's site had less Smartphone quality information as compared to customers who had information prior to shopping. Informed customers tend to have the same information as that of the vendor. If a customer had information before, his or her questions concerning the device will inform the vendor not to lie about the quality aspects of the product. Such customers are not easy to deceive as far as quality is concerned. On the other hand, customers who come to the shop uninformed can be easily deceived concerning the quality of a product, especially for electronic products like Smartphone. They come to realize that the quality does not meet their expectation later after they have started using the device.

Customers who searched for Smartphone quality information before reaching to the vendor knows how good the product is. Even when they try to bargain the vendor will not reduce the price at a substantially lower level. The vendor will try to convince the customer to buy another model at a relatively lower price. But since the customer is well informed about the quality, he or she will not go for the alternative choice suggested by the vendor. On the other hand, uninformed customers will go for the vendor's suggested alternative versions. That is why we even see that the average price for informed customers is higher than the average price for uninformed customers. Meaning that, informed customers purchase high quality devices which are expensive and therefore pay higher prices.

From Table 1, we see that signalling is important in reducing adverse selection. If the product does not reflect its price, the customer has made an adverse selection due to lack of proper information concerning the product quality. On average, adverse selection is reduced when information concerning the commodity is released. Customers who were much informed had their Smartphone devices worth the price. The utility of owning Smartphone is higher because they do not regret on their purchase decision.

Therefore, Smartphone vendors should increase their effort to display information concerning the quality of these electronic devices. On the other hand, customers should have their personal initiatives to search for product quality information before reaching to the vendor. This will save time spent on asking questions concerning quality.

4.2. Attitude towards Factors Determining Quality

The study investigated on factors which customers considered as representing quality. This was a five scale showing how they considered quality. The scale was; strongly agree, agree, neutral, disagree, and strongly disagree with the scales of 5, 4, 3, 2, and 1 respectively. Four questions were asked concerning attitude of respondents. Three questions were about factors that determined quality and one question was about considering their Smartphone quality worth the price.

The study hypothesizes a mean score of 3 which is neutral from the arrangement thereby described. We reject the null hypothesis if the statistics is significant. From the analysis, the alternative hypotheses were that the empirical mean is above the hypothesized mean, that is, above 3. As shown in Table 2, only one attitude question is insignificant which shows that the calculated mean score is not statistically different from the hypothesized null mean score. The rest of questions shows mean scores different from the hypothesized mean score. Nevertheless, the calculated mean is above the mean score of 3. This is on the side of positive attitude.

Table2. *Customer's Attitude towards Quality*

	Quality information status		**Test Statistics**
Attitude	Male	Female	2-group Hotelling's T-squared = 4.9146045 F test statistic:
quality	3.681	3.929	((75-5-1)/(75-2)(5)) x 4.9146045

Camera	3.617	3.893	F(5,69) = .92906222
Processor	4.298	4.036	Prob > F(5,69) = 0.4677
capacity	3.255	3.393	
Price	364893.6	438035.7	
Respondents	47	28	

Source: Field data

The first question considered whether Smartphone owners considered camera resolution for quality. Female respondents have higher score on camera consideration for quality. The t-statistics for female is large compared to the t-statistics for male respondents. This shows that the difference between hypothesized mean and calculated mean is more significant for female than for male Smartphone owners.

The study also considered phone processor for quality. As it can be shown in the table above, the difference between hypothesized and calculated mean is very significant compared to other categories which have been considered. The positive difference shows that Smartphone owners consider processor to assess the quality of a Smartphone. Nevertheless, the difference is much bigger for male respondents than for female respondents implying that male owners are much more concerned with phone processor than female owners. However, the overall rating shows that phone processor has more scores in determining the quality of the phone than other two factors namely camera and capacity. And for the case of capacity the difference between hypothesized mean and calculated mean is statistically insignificant.

The last question, in Table 2, inquired information concerning how Smartphone owners regard their Smartphone quality with respect to their prices. Contrary to what was reflected in the second question where we see male owners considering processor for quality assessment, their perception concerning the quality of their Smartphone is less significance compared to the female counterpart. There is no consistence between what has been declared in question two and the quality perception. However, female owners have shown consistence between their consideration of processor for quality and the overall quality of their phone. For male respondents the difference in statistical significance is very huge. This implies that even after considering processor for quality judgment, male owners did not find the quality reflecting the price of their phones. Although, the analysis still revealed that the difference between their perception for phone quality and the hypothesized difference is positive and statistically significant.

4.3. Smartphone Price Difference According to Attitude

The following table shows the difference in Smartphone price according to owners' consideration of processor for quality. Those owners who favoured much processor for judging the quality of Smartphone are considered to have more technical information concerning the quality of Smartphone. We analyse price differences according to their attitude on processor being considered for quality. From the descriptive analysis, the findings shows that those who strongly disagree in considering processor for quality assessment were only three, the same number as those who just disagree on the same judgment. Therefore, only 6 respondents out of 75 respondents did not consider processor for quality judgment.

For the group that strongly disagreed on the judgment of quality basing on processor, the lowest first percentile paid one hundred and twenty thousand Tanzanian Shillings for the Smartphone, while the highest ninety ninth percentile paid two hundred and eighty thousand Tanzanian Shillings for Smartphone. For the group that disagreed, the lowest first percentile paid twenty thousand Tanzanian Shillings for the phone and this is not a Smartphone but rather featured phone. The highest ninety ninth percentile paid three hundred thousand Tanzanian Shillings for the Smartphone.

In the survey, eight respondents were undecided on the consideration of processor for quality assessment. These were neutral in their consideration of processor for quality assessment. The lowest first percentile for this group paid one hundred and eighty thousands for the Smartphone, while the highest ninety ninth percentile paid one million Tanzanian Shillings.

Another group is those who agreed and strongly agreed that when considering Smartphone quality, processor was an important factor. The group who agreed consists of 23 respondents whose lowest first

percentile paid thirty thousand Tanzanian Shillings for the Smartphone, while the highest ninety ninth percentile paid one million and four hundred and fifty thousand Tanzanian Shillings for the Smartphone. The group that said they strongly agree that when purchasing Smartphone, processor is considered for quality assessment, the lowest first percentile paid one hundred and twenty thousand Tanzanian Shillings for their Smartphone. The highest ninety ninth percentile paid one million and six hundred thousand Tanzanian Shillings for the Smartphone.

On average, as customers considered processor for Smartphone quality assessment, the price of a Smartphone kept increasing. This is to say that higher processor attracted higher price because of higher quality. From the simple regression analysis, customers who strongly supported the argument of processor being an indicator of quality paid about 43.53 percent higher price than the rest of customers. When the analysis was reversed to make those who disagree with the statement, we find out that they paid about 177 percent less price than the rest of the respondents. The rest categories on the processor argument were not statistically significant and on considering all the categories together, no single category is statistically significant. Clearly, processor consideration when purchasing Smartphone reflects quality consideration. That means, the quality of a Smartphone is reflected in its price.

To certain on the argument of price and quality, Table 3 provides simple estimates from linear regression analysis on the attitude differences concerning quality and the price. Panel (a) is the analysis showing attitude variation on processor consideration for quality and the price of a Smartphone. For model 1 which exposes all attitude levels, strongly disagree is taken as the base variable from which comparison is made. Model 2, 3, and 4 are taken to make comparison of one attitude against the rest. It is only significant attitudes which have been considered for the later models, that is, models 2, 3 and 4.

When considering processor for quality assessment, owners who disagreed paid 117 percent lower price than owners who strongly disagree. The difference is significant at 10 percent levels of significance, which however is insignificant when confidence interval is considered.

Those with neutral response and those who agreed seem to have a positive and economically significant different price than those who strongly disagreed to consider processor for quality assessment. But, the different is statistically insignificant. Owners who strongly supported the argument that processor is considered for quality assessment, had to pay 75.16 percent higher price than those who strongly disagree with the statement. The difference is statistically significant at 10 percent levels of significance, but insignificant with confidence level consideration. The insignificance comes in because the confidence interval crosses zero.

In the same processor category, Model 2 shows that those who disagree with quality assessment using processor significantly pay a lower price than the rest of the customers. Likewise, Model 3 cements on the results in Model 2 by clearly showing that those who strongly support the argument that processor were used for quality assessment paid about 43.53 percent higher price than the rest. The implication here is that higher processor Smartphone is sold at a higher price. Alternatively, customers who value much on the processor of a Smartphone prefer higher processor Smartphone than lower processor Smartphone. As a result, they are willing to pay higher price for the Smartphone with higher processor. As for the processor case, the same trend is depicted when considering other categories namely camera and capacity. Those owners who had less consideration of these features paid lower price than owners who much considered the categories.

Table3. *Price difference according to attitude*

(a) Processor	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Strongly Disagree	Base			
Disagree	-1.172*(.5905)	-1.780***(.4304)		
Neutral	.5318(.4896)			
Agree	.4767(.4440)			
Strongly agree	.7516*(.4337)		.4353**(.1804)	
Constant	12.05***(.4176)	12.66***(.0861)	12.37***(.1284)	
R-Square	0.2383	0.1897	0.0739	
Adj. R-Square	0.1948	0.1786	0.0612	
(b) Capacity				
Strongly Disagree	Base			

Disagree	-.9295**(.3638)	-1.010***(.3245)		
Neutral	-.1060(.3044)			
Agree	.1373(.2610)			
Strongly agree	.1770(.2407)			
Constant	12.59***(.1819)	12.67***(.0918)		
R-Square	0.1325	0.1170		
Adj. R-Square	0.0829	0.1049		
(c) Camera				
Strongly Disagree	Base	-.8156**(.3319)		
Disagree	.3290(.3885)		-.4938*(.2585)	
Neutral	.8491*(.4259)			
Agree	.8456**(.3480)			
Strongly agree	.9836***(.3467)			.3570*(.1924)
Constant	11.84***(.3125)	12.65***(.0939)	12.66***(.0990)	12.47***(.1133)
R-Square	0.1465	0.0764	0.0476	0.0450
Adj. R-Square	0.0977	0.0637	0.0346	0.0320
(d) Quality				
Strongly Disagree	Base	-.8438**(.3624)		
Disagree	.4314(.4485)			
Neutral	.6087(.4077)			
Agree	.8122**(.3729)			
Strongly agree	1.117***(.3766)		.4847**(.1927)	
Constant	11.80***(.3426)	12.65***(.0936)	12.43***(.1090)	
R-Square	0.1455	0.0691	0.0798	
Adj. R-Square	0.0967	0.0564	0.0671	

Source: Field data

The argument is raised that these factors reflect quality of Smartphone. However, in order to be assured with this statement, the study went further asking Smartphone owners if their quality reflect the price paid. Just as it was for the case of categories explained before, owners who said strongly supported the arguments that their Smartphone quality was worth the price, paid about 112 percent higher price than the owners who strongly disagreed with the statement. The implication is that as far as Smartphone is concerned, higher quality attract higher price.

Table4. *Price difference influence of attitude for combined factors*

Attitude	Coefficient	Ho: Constant variance	
Strongly agree that quality reflect price	.3937**(.1793)	Chi2(1) = 2.21	
Disagree that processor is considered for quality	-1.593***(.4151)	P-Value = .1371	
Disagree that capacity is considered for quality	-.6252**(.3067)	Ho: Model has no omitted variables	
Strongly agree that camera resolution reflect quality	.0745(.1772)	F(3,67) = 3.64	
Constant	12.55***(.1151)	P-Value = .0171	
R-Square	0.3165		
Adjusted R-Square	0.2775		

Source: Field data

The simple linear regression analysis for combined factors is somewhat consistent to the single factor dummy variable analysis. The analysis in Table 4 shows some of the factors and attitude. The selection is based on the significance of single factors. The model analysed in the table has undergone a robustness check for inclusion of the selected variables. The inclusion of selected variables provides the best model in terms of the significance levels of individual variables but also from heteroskedasticity point of view. Many variables have proved to bring a model free from heteroskedasticity, but with many insignificant variables compared to the one presented below. Nevertheless, the model specification test

of the current model provides a slightly higher probability than others, even though the model is still miss-specified. So, on the specification point of view the current model is a lesser evil compared to other models that have been tried.

From Table 4, Smartphone owners who strongly agreed that their phone quality was worth the price paid 39.37 percent higher price than Smartphone owners who replied otherwise. Other things being equal, the difference is statistically significant at 5 percent levels of significance.

5. CONCLUSION

The findings ascertained higher Smartphone quality satisfaction among informed customers than uninformed fellow. This implies that, more product signalling improves consumer choice in smartphone market. Informed customers were not willing to buy low quality devices even if they had to save some money from buying low priced smartphones. While, uninformed customers were easily deceived by low prices, thereby choosing low quality devices. For such customers the price-quality mismatch is later discovered after the payment.

To avoid purchasing devices of lower than anticipated quality, customers should increase efforts in prior-to-shopping information search. Nevertheless, customer care improvement among sellers can be achieved by providing clear product information. Smartphone warrant provision could lessen substandard products in the market. The warrant guarantees customers, a refund within acceptable period once price-quality mismatch is discovered. Since sellers are not product manufacturers, the warrant will force traders to procure high quality smartphones from trusted manufacturers.

The small sample size in the analysis, however, may limit results accuracy and inferential generalization. Nevertheless, from results follow-up point of view, convergent parallel may not have meaningful results as would have been the case for sequential approach. Nonetheless, face to face interview may have received a healthier response than the current online survey.

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