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ESSAY ON NON-LINEAR PRICING IN E-COMMERCE

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Abstract

The primary objective of the paper is to identify the pattern of non-linear pricing in the E-Commerce market and its usage. This paper also investigates whether the post-digitalization tying as a non-linear pricing strategy is an option or a compulsion, through formation of trust. Das and Jadhav (2021) take effort to understand the non-linear pricing in modern e-commerce. This work takes similar effort to analyse the usage of non-linear pricing by e-commerce firms. The researchers have used theoretical model using empirical evidence to find a new pattern of non-linear pricing strategy and its impact on e-commerce market behaviour.

Key words: *Non-linear Pricing, Trust, Antitrust Law, E-Commerce, Fuzzy preference*

JEL Codes: *L11, L41, L81*

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INTRODUCTION

The paper studies how the nonlinear pricing strategy has been created through the formation of trust in online payment methods. To start with the identification of strategy a field study has been done in Pune, India and built a theoretical model. A survey by Regalix found that Pune city spends the most on digital platforms in India. The report documented an average digital payment of Rs. 16,513/- per person, per month in the city. Thereby, Pune has been selected to conduct the survey and use the responses to study the nature of digital payment and new strategies.

To start with the paper by Peha and Khamitov (2004) who argue in favour of a user-friendly, application-based mode of transaction under internet banking. Their attempt was to bring e-commerce to individuals who do not own computers or do not know how to use computers. A second challenge was to create a wallet that was specifically designed to run on a publicly-accessible, user-friendly kiosk, somewhat similar to ATM machines (Peha & Khamitov, 2004). This type of publicly-accessible user-friendly kiosk is available today. There is a positive relationship between e-service quality, customer satisfaction and loyalty (Wang, Shi, Zhang, Zhang, & Guo, 2019). There is a high level of consensus among researchers that trust among the factors, including perceived usefulness, perceived risk, social influence, trust and perceived ease of use, have a significant impact over consumers' intention to use mobile payment (Liu, Ben, & Zhang, 2019).

The next task would be to build user's trust. Trust is a belief that has an impact on the acceptance of Internet banking (Suh & Han, 2002). It helps to enhance the understanding of customer acceptance of internet banking. This situation is particularly conspicuous in the case of internet banking, which is one of the areas of electronic commerce. There exists a positive relationship between a customer's trust and the intention to use internet banking. In a stochastic model of e-customer behaviour a state of being a collection of one or more pages of the website which perform

similar functions. The number of states in the model of a website depends solely on the analyst. An analyst be may define a state by fusing a number of functions or may explode a function into a number of states (Jenamania, Mohapatraa, & Ghoseb, 2003). Here is a chance of tying with the different other states from where the service provider can get banalities. People are more likely to purchase from the web if they perceive a higher degree of trust in e-commerce and have more experience in using the web (Corbitta, Thanasankit, & Yi, 2003). Customers esteem life value is positively associated with online store attribute evaluations (Koo, 2006). Product assortment has a positive impact on online store loyalty.

The goals of agents are not only to maximize total revenue subject to clients' risk preference, but also to reinforce trust with their clients (Tang, Winoto, & Niu, 2003). Now the question arises- if an agent could achieve customer's trust, then as a dynamic behaviour is it not possible to be a price maker over time? If affirmative, then that price would be non-linear. And the objective would change to maximizing total revenue subject to clients' risk preference, achieving a target profit and reinforcement of trust with their clients.

Non-linear pricing helps to extract consumer surplus and is a phenomenon of imperfect competition. The antitrust law tries to prevent the practice of non-linear pricing strategy. Bundling and tying are common types of non-linear pricing strategies. Tying is strictly prohibited under Competition (antitrust) law of India[1]. The researchers have attempted to identify a new concealed non-linear pricing strategy of tying in the e-commerce market in India, where tying has been used as an option and not an obligation. Non-quantitative factors under the non-linear pricing strategies have been considered.

[1, 2]The Competition Act 2002, India.

About the Present Study

The basic guide behind restricting the tie-in-arrangement is that monopoly power of one market cannot be transferred to another market. The guideline propounded by the Supreme Court of India and the Competition Commission of India suggests that if the firm has monopoly power or dominance in one market and that firm is trying to make compulsory tie-in-arrangement in another market, then it should be illegal. To identify this structure, the researchers have collected various offers as provided by the e-wallet when food is ordered from the specific food application. Then in a theoretical setting, game theory payoffs have been made to identify the strategy and possible equilibrium. Three payoffs are made-for first time use, second for the use of the cash back money and third for routine use of e-wallet. After drawing the payoffs, the researchers tried to find the equilibrium and optimal strategy so that the theoretical background of tie-in-arrangement could be established.

After that, to prove the existence of the theoretical optimal strategy, the survey has been conducted. The questionnaire was made to find whether the strategy of tie-in arrangement is followed or not. The analysis of the response was done to understand the nature of tying. Theoretical work has been drafted to identify the theoretical background of tying, to find the existence of such kind of tying in practice and to recommend the changes in the given economic and legal framework. This has been divided into four stages – review of the existence literature work, setting the theoretical background, Survey to find the existence of theoretical background and analysis, conclusion and recommendation.

The digital technologies are integrated into everyday life. This integration is known as digitization. Digitazation can be used to remove the barriers in an information system which reduces the asymmetric information. In India, digitalization was initially carried out by the market forces to increase the efficiency of the market. In 2015, the Government of India launched the "Digital India" campaign to expand the area of services. It comprises digital infrastructure based on the security and

stability and direct delivery of government services and universal digital literacy. Digitalization was one of the main aims of the demonetization that was introduced in 2016. The Indian Government attempted to encourage people to use the digital mode for day-to-day life. There is a rising trend of internet-based banking and financing in the era of digitization. For example, Payment banks were established in 2015. Application-based service providers, like Foodpanda, Zomato, Swiggy, etc. have come into existence. People are increasingly using internet-based payment modes.

This new combination has some economic advantages and disadvantages. In this competitive world, firms are using tying as an option to survive. *Tying* is an agreement by a party to sell one product but only on the condition that the buyer also purchases a different (or tied) product or at least agrees that he will not purchase that product from any other supplier (Economides, N. (2012)). Tying reduces consumer surplus. There are three types of tying - Intra-product price discrimination, Intra-consumer price discrimination; and Inter-product price discrimination (Economides, N. (2012)). For example, the food delivery application, Swiggy, offers additional discount on food bill if the consumer uses PayTm wallet for payment. This paper aims to identify the pattern of tying and its usage. It also tries to find whether the post-digitalization tying is option or compulsion.

In India, the Competition Commission of India (CCI) issued a penalty order against Hyundai Motors of Rs 87 Crores for violation of tie-in arrangements between Hyundai and dealers for engine oil recommendation for cars (COMPETITION COMMISSION OF INDIA, Case Nos. 36 and 82 of 2014). CCI defines *tying* as the condition of the situation where consumers buy a commodity they want (the tying product) but are required (forced) to buy another commodity (the tied product) from the different market that they may not want. If tying is optional and it is not preventing the other firm from entering the market, then it is not illegal. In Case No: 24/2011 (Shri Sonam Sharma vs Apple

Inc. USA (OP1), Apple India Pvt. Limited (OP2), Vodafone Essar Limited (OP3), Bharat Airtel Limited (OP4)), CCI examined the market power of the firm in given market and its ability to transfer that power into another market to create the entry barrier. If it is observed, then it is illegal as it is a threat to the competition.

In this paper, the researchers investigate whether the existing firm in payment services is creating the entry barrier or not. Whether the food provider services and their payment mode have developed the tie-in-arrangement has also been examined.

Armstrong, M., and Vickers, J. (2010) finds that non-linear pricing has a strong impact on consumer, producer and social surplus. The two-part tariff can reduce the net consumer surplus but increase the profit margin (Yin, X. (2004)). For consumers, if the surplus increases but social-welfare declines then the consumer would buy different goods from different firms (Armstrong, M., and Vickers, J. (2010)). Co-operative pricing can be used to increase welfare (Buxmann, P., Strube, J., and Pohl, G. (2007)). Non-linear pricing increases the producer surplus and welfare but reduces the consumer surplus in the one-stop shopping model (Armstrong, M., and Vickers, J. (2010)). Thanassoulis, J. (2007) finds that consumer surplus for the consumer with shop specific tastes is reduced and profit is increased by using competitive mixed bundling. The society may fail to understand the negative impact of monopoly bundling or society may fail to find the source of negativity (Adams, W. J., andamp; Yellen, J. L. (1976)). Quality distortions are reduced and more consumers get participated in the market when the market structure changes from monopoly to competitive (Yang, H., and Ye, L. (2008)). Stole, L. A. (1995) points out that quality distortions reduce with increasing the competition. Price and quality rang are declined with the competition. Bundling offered by monopolies is not social optimal (Adams, W. J., andamp; Yellen, J. L. (1976)). Bakos, Y., and Brynjolfsson, E. (2000) finds that bundling can generate the economies of aggregation for information goods with low marginal cost. Bundling

can be used by an entrant to enter the market as well as can use to increase the market share. The bundling discount is more beneficial than cutting the linear prices to increase the market share (Armstrong, M., and Vickers, J. (2010)). Bundling can be used as an effective entry-deterrent strategy (Nalebuff, B. (2004)). Gain from bundling more due to entry-deterrent effect compare to price discrimination. Stole, L. A. (1995) finds that entry can increase social welfare by increasing the consumer surplus by practicing price discrimination. In the new era of information technology, the traditional market barriers have disappeared. But online markets also contain the concerns related to the anti-competition. The internet markets are more dynamic than traditional markets (Haucap, J., and Stühmeier, T. (2016)). The firm like Amazon aggressively used the profit to become the dominant player in the era of e-commerce. The new business practices and market dominance is threat to the competitive environment (Khan, L. M. (2016)). The current antitrust acts are unable to understand the risk of the predatory pricing and the nature of integration across the businesses. The new business strategies have created suspicion as far as monopolization is concerned. Edelman, B. (2015) doubts about Google's tying practices. The tying strategy of Google can reduce the choices in future. It can also affect the innovation and quality standards and of course can increase the price level.

This paper aims to identify the nature of tie-in-arrangement in the context of digitalization. This project tries to find the various methods which are used by the firm to practice the tying by using the opportunities of digitalization.

The Notion of Identifying New Pricing Strategies

According to a recent study, tying is often combined with bundling, albeit optional, to avoid antitrust laws (Das, 2016). Tying ("tie-in arrangement")" is not allowed because it is under antitrust law[2]. In this study, tying will not be considered as an agreement or in other words

compulsion is not there to tie in the sale or tie-in products. This is not a tying, but near tying. Consumer freedom is there, and no obligation is there to buy a particular product with the desired one. It is a quantitative phenomenon, i.e. identifiable readily. But the formation of trust is a qualitative phenomenon. The gain of trust for a firm to some consumer group is nothing but playing with some information that the firm shares with some consumer and don't with the others. Here we would try to identify how the firms use trust as a tool to sell the products. Here the entire study considers offers in the e-commerce market as a product. Then we show how the products tie with others and consumers are free to choose that option. Trust element is acting as a tool to create uncontested demand in the monopolistic competitive market. F(n) is the probability that, the time required to be trustworthy x, is x less than n. F(n) is the cdf. There, could be a case that a particular firm does follow a strategy that, when the market price changes then the firm wait for some time to adjust the price change and others. This means that the firm waits for some time so that price may readjust to the old price level. This will reduce consumer surplus. The probability distribution F(n) is known to the firm.

The Strategy of the Firms

Storability imposes novel constraints on a monopolist's ability to extract the surplus. Storability of the consumer reduces the ability to extract the profit by the monopolist. Here non-linear pricing is not suitable (Hendel, Lizzeri, and Rokets, 2014). The latest theory to avoid that would be to divide the products into two parts; storable and non-storable and use bundling and tying both. Imagine non-storable food products, especially vegetables that have regular demand. The strategy is that impose bundling on the storable and the advantage of this bundling extend to non-storable products with the use of tying as an option. That means bundling helps to buy more of storable. If a consumer buys a certain quantity of storable then that consumer will get a discount on non-storable in the next two periods(for example). This strategy ensures that the consumer will use bundling in the present and

next period also. In period one consumer will buy in a bundle to buy more at a non-linear price and gets discount in the non-storable or food products. In the second period, again consumers will spend on storable using bundling (at a non-linear price) to get the discount in non-storable. This will go on in the infinite horizon. Using this strategy monopolist would be able to overcome the constraints of storability and would be able to create a committed buyer. Therefore, we set two hypotheses below:

(1) Options to purchase a combination of two or more products act as a source of the non-linear transaction and that in turn increases the degree of monopoly power to a firm.
(2) The consumer will have more preference towards that option rather than any compulsion.

To identify the new selling strategy, we collect the primary data. The questionnaire was made on the basis of the theoretical understanding of the strategies. Respondent was asked about online food servicing applications, mode of payment, uses of the application, digital payment etc. Total 102 responses are received. As from theoretical modelling we understood that the E-wallet firms had converted the infinitely repeating game into single stage-game by giving the cash-back incentives. Therefore, we have made a questionnaire for the one-stage game.

Identification of Trust Variable: A Few Examples from Real Life

Trust attitudes, is the factor that may affect a population's propensity towards sharing. The firm can leverage society's attitude towards collaborative consumption and design its product portfolio to maximize the extraction of consumer surplus (Razeghian & Weber, 2019). Heterogeneity of customer profitability in different segments has been explained by Morisada, Miwa, Dahana (Morisada, Miwa, & Dahana, 2019) in their recent paper. They categorize customers into several segments based on the purchase rate, lifetime duration, and average spending

estimated from purchase history data. The behavioral characteristics of their members use to identify trustworthy consumer. Drawing upon trust building framework and innovation diffusion theory, a study examines the significant antecedents that promote customers' trust and continuance intention in third-party mobile payments. The study investigates whether there exist significant differences between female and male consumers regarding various trust building mechanisms in the context of mobile payment (Shao, Zhang, Li, & Guo, 2019). Therefore, building trust and setting price for a product bundle the qualitative variables are important. For example, pay-per-click is one of the three main pricing policies that have established in the online advertising community: pay-per-impression (PPI), pay-per-click (PPC), and pay-per-transaction (PPT). The pay-per-click policy is behavioral in nature. Vragov, Shang, Smith, and Porter,(2019) derives the two important aspects ; the first behavioral effect is that buyers often tend to click on more ads than predicted by theory. The second behavioral effect is that advertisers learn their optimal behavior faster under PPC. From the organizational perspective, the management of collaboration among several organizations is recommended to follow best practices and methodologies, such as Six Sigma, PRINCE2, related ISO standards, and so on (Lukác, Sabol, Tomášek, & Furdík, 2017).

Example 1 (Tying as a Trust)

Ghee is a type of liquid butter used in cooking in India which is made from the cow or buffalo milk and clarified by boiling. High quality ghee supply has inelasticity. Confectionery in India uses ghee as tying products. The condition is if a consumer buys regularly in bulk from that shop then, ghee will be sold to them only. But this confectionery is small in size, relative to the multibrand retail store.

Example 2 (Tying as a Trust)

Consolidator collects high quality products from small farmers with a relatively higher price. At the time of sell to the LT's collection centre, the LT grade them again. And buys a fraction of the total brought in high

quality products by the consolidator. But consolidator agrees to sell the fraction of the high quality products only when the LT agrees to pay compensation for the rest.

Here, this agreement to pay for the rest is acting as tying for getting high quality products. So that consolidator agrees to sell LT in the next period. This is the basis of trust. The demand for rest relatively low quality products has low demand. Supply of high-quality products has an inelastic supply.

Example: 3 (Tying as a Trust)
If two shops are equally distant in terms of time, quality, the price of a given product, then from where, that consumer will buy?

The answer will be given by the trust in the relationship between the consumers with the two shops. It is possible to show that both shops cannot be equally trustworthy to the consumer. Because to be trustworthy it is required some time and if that be a constraint, then, anyone can be trustworthy. Here, one thing must be clear, that the two shops owner may be well known to the consumer and personal relationships may be well. This does not mean that, they are equally trustworthy.

Example 4 (Tying As A Trust)
Two tea shops are present in front of the Bank. It is observed that Bank employees do prefer only a specific shop and ignore other. The Bank employees may have to wait in the queue, but refuse to go to the other shop. Here the variable Trust is present. There, may be some shorts of trust is there between that particular shop and the Bank employees.

Example 5: Information Sharing as a Source of Trust (Tying as a Trust)
Information sharing between two parties who are involving in the transaction, affects positively in forming a trustworthy relationship

between them. It will be clear with the help of a case. Let, there are two small retailers in a given geographical area. According to the existing theories of duopoly, both the retailers will sell an equal quantity of product. But if we consider the trust element in the transaction then the solution could be different. Let, $R \in (R_1, R_2)$ are the two retailers, C is the consumers and It is assumed, a range of consumers with a total mass of one distributed uniformly over a unit interval i.e. $\Theta \in U$ [0, 1].

Here, we set the information set I like the possible change in prices in the next month. By sharing the information with C, retailers will try to create trust so that the consumers can commit future purchase. Say for example, R_1 may share with a fraction of C the information that, the prices of cereals and oil will increase in the next month. Therefore, that fraction of C can buy in advance at a lower price.

Example 6: (Tying with No Obligation but Option)
Gift voucher is a tool for giving a discount on tying products. This means, the consumer is free to use that discount voucher. But if use that then a discount is there with other commodities.

Example 7: (Tying with No Obligation but Option)
The market structure of mobile network providers is oligopolistic in nature. It is their practice to offer two types of recharge cards for consumers. One normal recharge and another is power recharge. It is not mandatory to recharge both at a time. But the call rate is higher for normal recharge only than recharge of both cards at a time. Here power recharge is acting as a tying expenditure to reduce call rate in the power recharge. Moreover, power recharge confirms the repeated purchase.

Theoretical framework
Das and Jadhav (2021) discuss the theoretical framework. This work uses same theoretical framework to understand how people to use the digital mode of payment under digitalization. This leads to establishing more e-

wallet like paytm, mobikwik etc. To attract more users and increase the customer base, these e-wallet companies provide attractive offers.

Table 1: Offers Provided by Paytm as on April 2018

Box8	(1) 20 percent off on purchase of Rs 250, Valid for repeat users. (2) Up to Rs.200 cashback when you pay using Paytm at Box8 (3) Voucherworth Buy for Rs 300 (4) Voucher worth Buy for Rs 1000 (5) Voucher worth Buy for Rs 500 (6) Up to Rs.200 cashback when you pay using Paytm at Box8 (7) Voucher worth Buy for Rs 300 (8) Voucher worth Buy for Rs 1000 (9) Voucher worth Buy for Rs 500
Fassos	(1) Up to Rs.200 cashback when you pay using Paytm at Faasos
Foodpanda	(1) Pay using Paytm and Get Free Delivery
Swiggy	(1) Upto Rs.100 Cashback at Swiggy (2) Upto Rs.50 Cashback when you pay using Paytm at Swiggy (3) Up to Rs.100 cashback when you pay using Paytm at Swiggy
Ubereats	(1) Rs.100 Off on first 2 orders when you pay using Paytm at Uber Eats
Zomato	(1) Flat 20 percent off Max discount of Rs 150 (2) Up to Rs.250 cashback + 50 percent off when you pay using Paytm at Zomato (3) Up to Rs.50 cashback when you pay using Paytm at Zomato

Table 2: Offers Provided by Mobikwik as on April 2018

Box8	(1) Earn up to Rs 100 Supercash
Fassos	(1) Flat Rs.100 SuperCash on every alternate order
Foodpanda	(1) Flat Rs.100 SuperCash on every alternate order
Swiggy	(1) Flat Rs.100 SuperCash on every alternate order

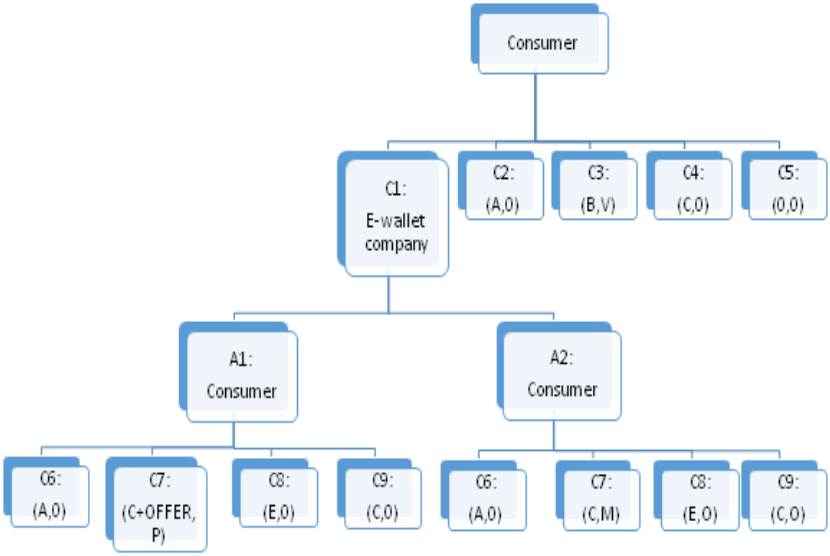
Table 3: Offers Provided by the Free Charge as on April 2018

Box8	(1) 50 percent off +25 percent cashback on box8 FC50 Max 50 Cashback
Faasos	(1) 25 percent cashback on Faasos Maximum cashback of 50 Also get 50 percent Faasos cashback Maximum 100
Swiggy	(1) 25 percent cashback on Faasos Maximum cashback of 50

Above tables give the information about limited offers provided by e-wallet companies when a consumer uses these wallets to pay the amount. The offers like providing the E-wallet credits (money) are subjected to further expenditure which actually increases the spending (Das, D. (2015)). By providing these offers, indirect, optional tie-in arrangement can be established. Optional tying is not illegal but if it is compulsory then it is illegal under the Indian Competition Act, 2002 (section 3 (4) (a)). However, these offers like discounts and cashback can incentivize consumers to use the specific wallet for payment during order commodities. It can make tying compulsory.

First Time Decision Tree

Figure 1: Decision Tree for 1st Time



C1: Consumer's first strategy: Use application to order food

C2: Consumer's second strategy: Use card payment at hotel

C3: Consumer's third strategy: Use wallet payment at hotel

C4: Consumer's fourth strategy: Use cash payment at hotel

C5: Consumer's fifth strategy: Not buying

A1: Offers Provided by E-wallet for ordering from given application

A2: No Offer Provided by E-wallet

C6: Card Payment

C7: E-wallet

C8: Internet Banking

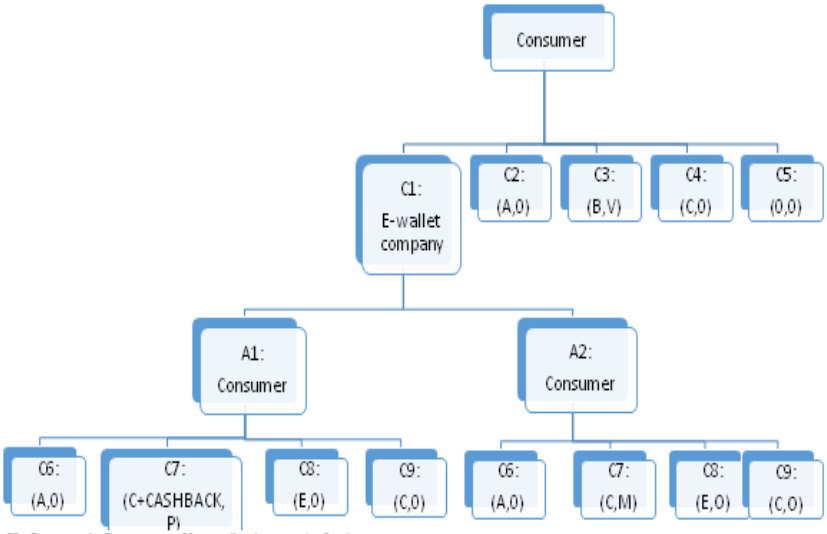
C9: Cash on Delivery

Assume that A, B, C, E, P, M, V are the utilities the corresponding player receives. In above case Nash equilibrium will be dependent on the values of *A, C, E* and the utility perceived by the consumer from the offer. If *A< C+Offer* and *E < C + Offer*, then buying by making payment

through e-wallet after ordering food from applications will be beneficial to consumer therefore e-wallet payment will be selected. The offers provided by e-wallets are in the form of cashback or discount.

3.2 Second time decision tree

Figure 2: Decision Tree for 2nd Time



C1: Consumer's first strategy: Use application to order food

C2: Consumer's second strategy: Use card payment at hotel

C3: Consumer's third strategy: Use wallet payment at hotel

C4: Consumer's fourth strategy: Use cash payment at hotel

C5: Consumer's fifth strategy: Not buying

A1: Offers Provided by E-wallet for ordering from given application

A2: No Offer Provided by E-wallet

C6: Card Payment

C7: E-wallet

C8: Internet Banking

C9: Cash on Delivery

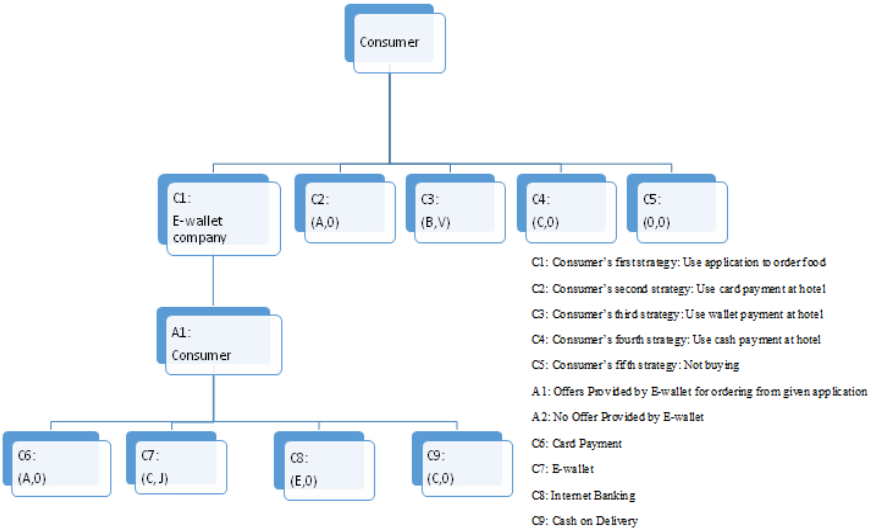
In the above case, depending on the relationship between the *A, C+cash back and E*, the consumer will choose *A, C+cash back* and *E*. Now again depending on the condition of *A, C* and *E*, the consumer will choose *A, C* and *E*

Now the firm has two choices – Provide an offer or don't provide.
Again if *C*>A and *C>E* then the consumer will choose (C, M)
And if *C+cash back*> Aand *C+cash back*> *E* then the consumer will choose (*C+cash back, P*).

Now depending on the condition of the *M* and *P*, the firm will decide whether to provide an offer or not. Depending on the relationship among *A, C+cash back*, *B, C* and *zero*, the consumer will choose the mode of ordering the food.

Third Time Decision Tree (Infinite Time Period)

Figure 3: Decision Tree (3rd time (infinite time period))



It is assumed that the offer is provided for the first user since it can be observed that most of the offers are provided for the first users only. So after first use and after using the cashback, now there won't be any different in cash on delivery and E-wallet payment.

Therefore, now there is no option of providing the offer as there is no incentive.

For the third time there is no difference between e-wallet and cash payment. The e-wallet firm provides the offers in terms of cashback to reduce the continuous game into one stage game as by providing the cashback, e-wallet firm forces the user to use the same mode of payment for next time. And for the third time or infinite time, there is no difference in E-wallet and cash payment so for convenience; E-wallet might be used.

Analysis and Identification of Tying Pattern

Majority of the respondents use the paytm for payment which is highest among all e-wallets as well as the other mode of payment. Overall E-wallet is used for more time than the cash payment.

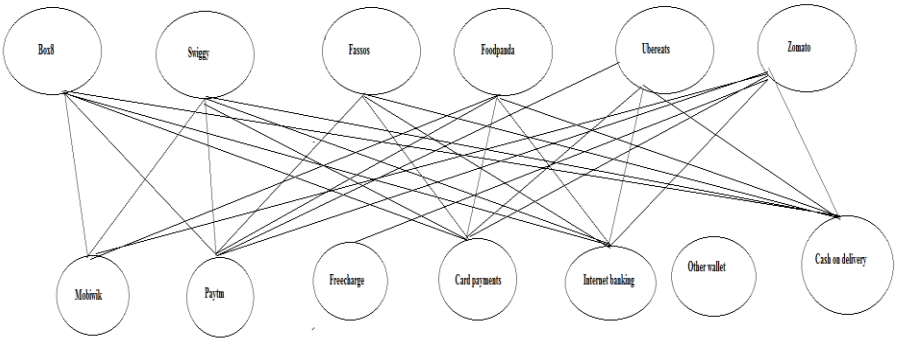
When consumers visit the hotel then most of the consumers use cash payment. It means for the given sample space, $C>A$ and $C>B$.

When consumers order food from applications then most of the time e-wallet is used. It means $C+offer>A$, $C+offer>C$ and $C+offer>B$ for most of the respondents. Therefore, according to the backward induction method, ($C+offer, P$) i.e. order food through the application and making payment by e-wallet will be a Nash equilibrium.

The survey is conducted by using google form and personal interviews in Pune. Respondent was asked about online food servicing applications, mode of payment, uses of application, digital payment etc. The result shows that 82.4 percent of total 4240 respondents order the

food online. 68 percent of total respondent says that they use online payment mode to order the food. 31 percent of total respondents say that they use e-wallet to pay which is highest among all payment modes. Card payment is often used when a consumer visits the hotel. 50 percent of total respondents consider the offers provided by the e-wallet while the majority of the respondents uses e-wallet because it is an easy way to pay. When consumers visit the hotel then most of the consumers use card payment. It means for the given sample space, A>C and A>B. When consumers order food from applications then most of the time e-wallet is used. It means C+offer>A and C+offer>B for most of the respondents. Therefore according to backward induction method, (C+offer,P) i.e. order food through the application and making payment by e-wallet will be Nash equilibrium. It is found that paytm is a wallet which is tied with every application successfully.

Figure 4: Tying Pattern



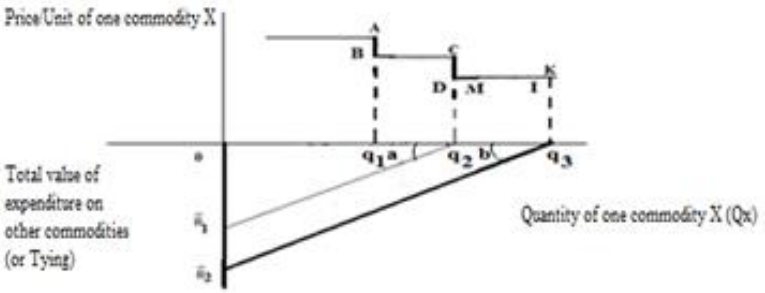
It is found that paytm is a wallet which is tied with every application successfully. And since online payment and e-wallet payment is preferred, the Nash equilibrium will be choosing paytm for payment. This suggests that the "voluntary tying arrangement" can be converted into "indirect compulsory tying arrangement".

Theoretical Understanding

We present here three cases with the help of our three papers (Das, 2015(a), 2015(b), February 26-27, 2016), and explain that tying as an option. We explain here that when Tying is an option then the optimizers that minimize the expenditure is not present or solution does not exist in the expenditure minimization problem. The weierstrass theorem is used here to explain.

Case 1 – Tying Strategy with Repeated Tying Expenditure

Figure 5: Tying strategy with Repeated Tying Expenditure



Price and expenditure analysis of one commodity, based on the strategies set by the firm due to quantity discount.

For Oq_1 quantity purchase (from figure-2) the actual payment or price per unit is

$$P_{q_1} = Aq_1 \tag{1}$$

Here the term Aq_1 is the price per unit based on the price curve above to buy Oq_1 unit of the commodity X.Therefore, if that particular consumer buys Oq_2 units of food item X then the real payment or price per unit would be as given in the equation (2).

$$P_{q_2} = Cq_2 + \mu \frac{\overline{OR_1}}{q_2} \tag{2}$$

Here the term Cq_2 is the price per unit based on the price curve above to buy Oq_2 unit of the commodity X. The term $(\overline{OR_1} / Oq_2)$ is the per unit price clubbed into the price paid for buying other commodities other than X, where $\overline{OR_1}$ is the total amount paid on buying other commodities other than X. As tying is there so the expenditure $\overline{OR_1}$ includes a price paid in advance to get r percent discount on the food item. Let this extra payment be μ, where $0 \leq \mu \leq 1$. So the per unit payment in advance for Oq_1 commodity buys is $(\overline{OR_1} / Oq_2)$. In other word total expenditure, $\overline{OR_1}$ includes a share of other commodities and share on food items X. This can be shown as below.

$$(\overline{OR_1})\,\mu + (\overline{OR_1})\,(1-\mu) = \overline{OR_1} \qquad (3)$$

Here μ be the payment in advance to avail the discount on food items purchased and (1-μ) be the real amount spent on buying other commodities other than food item X. Now look for Oq_2 units' food item buy. There is no limit on buying food item X for getting a discount. This means the discount is not limited to the food item buy in terms of quantity or value of the purchase. Therefore, if that particular consumer buys Oq_3 units of food item X then the real payment or price per unit would be as given in the equation (4).

$$P_{q_3} = Kq_3 + \mu \frac{\overline{OR_2}}{q_3} \qquad (4)$$

Expenditure Equations

Now with the help of price equations above, we can derive the expenditure equations.

$$E(q_X) = \{p_1 q_X\} \text{ for } 0 < q_X \leq q_1$$
$$E(q_X) = \{p_2 q_X + \mu\overline{OR}_1\} \text{ for } q_1 < q_X \leq q_2 \quad (5)$$
$$E(q_X) = \{p_3 q_X + \mu\overline{OR}_2\} \text{ for } q_2 < q_X \leq q_3,$$
$$\text{Where, } \overline{OR}_1 + \overline{OR}_1 = \overline{OR}_2 \text{ Fixed, and, } Aq_1 = p_1, Cq_2 = p_2, Kq_3 = p_3.$$

From the expenditure equations above it is clear that, if you buy other commodities then, the consumer will have a reduced per unit price of the vegetables. Here we can see that quantity discount is related to the tying expenditure.

Here, $D = [0, q_3]$ is the constraint set and f or $E(q_X)$ is the expenditure function as explained above for $q_X \in [0, q_3]$. Note that *D* is compact, but f fails to be continuous at just two points q_1 and q_2. Consequently, f fails to attain a minimum on *D*. Here discontinuity is due to tie.

Heaviside function:

Let Heaviside function is given by $u_{q_i}(q_x)$.

$$u_{q_i}(q_x) = \begin{cases} 0 \rightarrow if\ 0 < q_x \leq q_i \\ 1 \rightarrow if q_i < q_x \leq q_j \end{cases} \quad (6)$$

The Heaviside function of the expenditure equation above is written as below:

$$E(q_x) = p_1 q_{x_1} + [p_2 q_{x_2} + \mu\overline{OR_1} - p_1 q_{x_1}] u_{q_1}(q_x) + [p_3 q_{x_3} + \mu\overline{OR_2} - p_2 q_{x_2} - \mu\overline{OR_1}] u_{q_2}(q_x)$$

$$\therefore E(q_x) = p_1 q_{x_1} + [(p_2 q_{x_2} + \mu\overline{OR_1}) - p_1 q_{x_1}] u_{q_1}(q_x) + [(p_3 q_{x_3} + \mu\overline{OR_1}) - p_2 q_{x_2}] u_{q_2}(q_x)$$

The general form is:

$$\therefore E(q_x) = p_i q_{x_i} + [(p_j q_{x_j} + \mu\overline{OR_i}) - p_i q_{x_i}]u_{q_i}(q_x) + [(p_k q_{x_k} + \mu\overline{OR_i}) - p_j q_{x_j}]u_{q_j}(q_x) \quad (7)$$

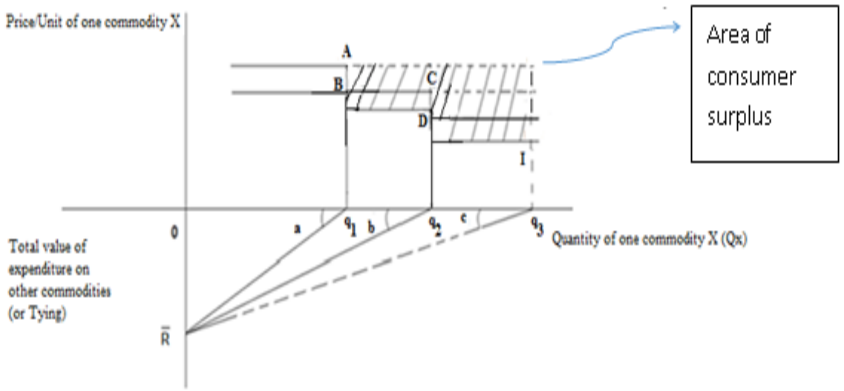
(q_{x_i} is the quantity at price p_i ,where, i<j<k)

This is a non-linear increasing expenditure function in q_x. The reduction of per unit price increases the expenditure on that commodity x and on other commodity y, i.e. $\overline{OR_i}$. As the consumer spends already on another commodity of the amount $\overline{OR_i}$, therefore, the consumer would try to utilize fully and would buy more quantity and these are non-linear increments. Here $\overline{OR_i}$ is present in every successive expenditure. Therefore, the degree of preference of the consumer should be high enough to maintain that extra expenditure. And the trust is high towards that firm.

Case 2 – Tying Strategy with One Time Tying Expenditure

Here if the consumer spends a lump sum amount on another commodity then the price line will be again a step function reduced form at an equal discount than before.

Figure 6: Tying Strategy with One Time Trying Expenditure



Price and expenditure analysis of one commodity, based on the strategies set by the firm due to quantity discount.

Here to buy q_1 units of commodity x per unit price was A q_1. If that consumer spends $\bar{R}$ the amount on other commodities then the price reduces to P_{q_1}. Likewise for q_2 and q_3 units the price equations are (2) and (3) respectively.

$$P_{q_1} = Bq_1 + \mu \frac{\overline{OR}}{Oq_1} \tag{8}$$

$$P_{q_2} = Dq_2 + \mu \frac{\overline{OR}}{Oq_2} \tag{9}$$

$$P_{q_3} = Iq_3 + \mu \frac{\overline{OR}}{Oq_3} \tag{10}$$

Expenditure Equations

Now with the help of price equations above, we can derive the expenditure equations.

$$E(q_X) = \{p_1 q_{X_1} + \mu\overline{OR}\} \text{ for } 0 < q_X \leq q_1$$

$$E(q_X) = \{p_2 q_{X_2} + \mu\overline{OR}\} \text{ for } q_1 < q_X \leq q_2$$

$$E(q_X) = \{p_3 q_{X_3} + \mu\overline{OR}\} \text{ for } q_2 < q_X \leq q_3,$$

$$Where, \overline{OR} = Fixed, and, Bq_1 = p_1, Dq_2 = p_2, Iq_3 = p_3. \quad (11)$$

Here, $D = [0, q_3]$ is the constraint set and f or $E(q_X)$ is the expenditure function as explained above for $q_X \in [0, q_3]$. Note that D is compact, but f fails to be continuous at just two points q_1 and q_2. Consequently, f fails to attain a minimum on D. Here discontinuity is due to tie.

Heaviside Function

Let Heaviside function is given by $u_{q_i}(q_x)$.

$$u_{q_i}(q_x) = \begin{cases} 0 \rightarrow if\ 0 < q_x \leq q_i \\ 1 \rightarrow if q_i < q_x \leq q_j \end{cases} \quad (12)$$

The Heaviside function of the expenditure equation above is written as below:

$$E(q_x) = [p_1 q_{x_1} + \mu\overline{OR}] + [(p_2 q_{x_2} + \mu\overline{OR}) - (p_1 q_{x_1} + \mu\overline{OR})]u_{q_1}(q_x) + [(p_3 q_{x_3} + \mu\overline{OR}) - (p_2 q_{x_2} + \mu\overline{OR})]u_{q_2}(q_x)$$

$$E(q_x) = [p_1 q_{x_1} + \mu\overline{OR}] + [p_2 q_{x_2} - p_1 q_{x_1}]u_{q_1}(q_x) + [p_3 q_{x_3} - p_2 q_{x_2}]u_{q_2}(q_x)$$

The general form is:

$$E(q_x) = [p_i q_{x_i} + \mu\overline{OR}] + [p_j q_{x_j} - p_i q_{x_i}]u_{q_1}(q_x) + [p_k q_{x_k} - p_j q_{x_j}]u_{q_2}(q_x) \quad (13)$$

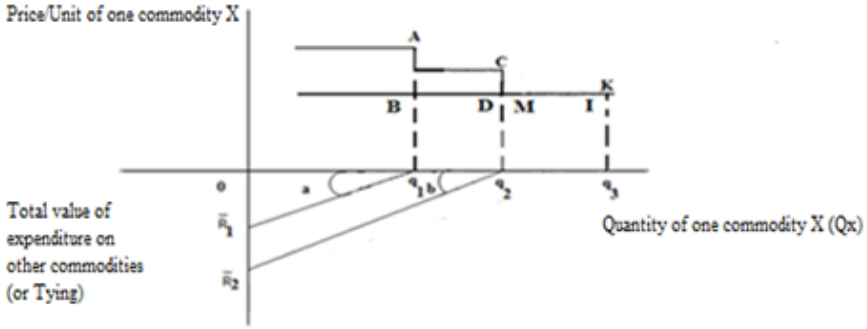
(q_{x_i} is the quantity at price p_i ,where, i<j<k)

This is a non-linear increasing expenditure function in q_x. The reduction of per unit price increases the expenditure on that commodity x and on other commodity y, i.e. $\overline{OR}$. As the consumer spends already on another commodity of the amount $\overline{OR}$, therefore, the consumer would try to utilize fully and would buy more quantity and these are non-linear increments. Here $\overline{OR}$ is present in the first transaction, and this is high enough and the offer lasts for a long time. Once the consumer spends that amount then it would be a rational decision to maintain purchase from them to avail the offers. Therefore, the degree of preference of the consumer should be high enough to maintain that extra expenditure. And the trust is high towards that firm. This strategy will help to build new trust with the new firm.

Case 3 – Tying Strategy with Repeated Tying Expenditure

Here if the consumer spends twice on another commodity then the price line will be horizontal axis forever.

Figure 7: Tying Strategy with Repeated Tying Expenditure



Price and expenditure analysis of one commodity, based on the strategies set by the firm due to quantity discount.

$$P_{q_1} = Bq_1 + \mu \frac{\overline{OR_1}}{Oq_1} \tag{14}$$

$$P_{q_2} = Dq_2 + \mu \frac{\overline{OR_2}}{Oq_2} \tag{15}$$

$$P_{q_3} = Kq_3 \tag{16}$$

Expenditure equations for quantity discount with tying expenditure:

$$E(q_X) = \{\bar{p}\, q_{X_1} + \mu \overline{OR_1}\} \text{ for } 0 < q_X \leq q_1$$

$$E(q_X) = \{\bar{p}\, q_{X_2} + \mu \overline{OR_2}\} \text{ for } q_1 < q_X \leq q_2$$

$$E(q_X) = \{\bar{p}\, q_{X_3}\} \text{ for } q_2 < q_X \leq q_3,$$

$$\text{Where, } \overline{OR_1} + \overline{OR_1} = \overline{OR_2}, \text{ and, } \bar{P} = p_1 = p_2 = p_3, \tag{17}$$

The Weierstrass theorem is used here. Here, in all the above case, $D = [0, q_3]$ is the constraint set and f or $E(q_X)$ is the expenditure function as explained above for $q_X \in [0, q_3]$. Note that *D* is compact, but f fails to be continuous at just two points q_1 and q_2. Consequently, f fails to attain a minimum on *D*. Here discontinuity is due to tie.

From the above analysis we can draw the following propositions. Heaviside function:

Let Heaviside function is given by $u_{q_i}(q_x)$.

$$u_{q_i}(q_x) = \begin{cases} 0 \rightarrow if\ 0 < q_x \leq q_i \\ 1 \rightarrow if q_i < q_x \leq q_j \end{cases} \tag{18}$$

The Heaviside function of the expenditure equation above is written as below:

$$E(q_x) = [\bar{p}q_{x_1} + \mu\overline{OR_1}] + [(\bar{p}q_{x_2} + \mu\overline{OR_2}) - (\bar{p}q_{x_1} + \mu\overline{OR_1})]u_{q_1}(q_x) + [(\bar{p}q_{x_3}) - (\bar{p}q_{x_2} + \mu\overline{OR_2})]u_{q_2}(q_x)$$

$$E(q_x) = [\bar{p}q_{x_1} + \mu\overline{OR_1}] + [(\bar{p}q_{x_2} + \mu\overline{OR_1}) - \bar{p}q_{x_1}]u_{q_1}(q_x) + [(\bar{p}q_{x_3}) - (\bar{p}q_{x_2} + \mu\overline{OR_2})]u_{q_2}(q_x)$$

$$E(q_x) = [\bar{p}q_{x_1} + \mu\overline{OR_1}] + [(\bar{p}(q_{x_2} - q_{x_1}) + \mu\overline{OR_1})]u_{q_1}(q_x) + [(\bar{p}(q_{x_3} - q_{x_2}) + \mu\overline{OR_2})]u_{q_2}(q_x)$$

The general form is:

$$E(q_x) = [\bar{p}q_{x_i} + \mu\overline{OR_i}] + [(\bar{p}(q_{x_j} - q_{x_i}) + \mu\overline{OR_i})]u_{q_i}(q_x) + [(\bar{p}(q_{x_k} - q_{x_{2_j}}) + \mu\overline{OR_j})]u_{q_j}(q_x) \quad (19)$$

(q_{x_i} is the quantity at price p_i ,where, i<j<k)

This is a non-linear increasing expenditure function in q_x and this is non-convex in nature. The reduction of per unit price increases the expenditure on that commodity x and on other commodity y, i.e. $\overline{OR_i}$. As the consumer spends already on another commodity of the amount $\overline{OR_i}$, therefore, the consumer would try to utilize fully and would buy more quantity and these are non-linear increments. Here $\overline{OR_i}$ is increasing in every successive expenditure. Therefore, the degree of preference of the consumer should be high enough to maintain that extra expenditure. And the trust is high towards that firm. This strategy is helpful for those consumers who are already a committed consumer and wants to maintain that.

Two firms cannot share the same information with the same consumers. This is so, because each firm always tries to differentiate its products from others. Making trust to two or more parties at the same time is not possible, as selecting one party is a mutually exclusive event and transaction cost is not feasible. This means, let consumer has to choose either firm one or firm two, but not both. Choosing both will

increase transaction costs. Minimum expenditure is required to get that extra discount or cashback. It would not be feasible for any consumer to make a tying expenditure with the two firms to get the same discount from the two firms. The minimum time is required between the firm and the consumer so that firm can share information with the consumer.

This is true, because if you maintain some fixed transaction with any particular firm then it will take time to complete that. If you could complete that then that firm to which you have trusted start sharing latest discounts, or cashback offers.It is not possible for any consumer to make trust equally with the two firms.This is because though tying is an option but if you maintain some fixed transaction with a particular firm then that firm will give you some cashback offer. Therefore, options strategy acts a hidden trust to create a trustworthy consumer. A minimum expenditure is required to get a further discount for a future transaction. This minimum expenditure includes the trust element.

Proposition: 1

Options to purchase a combination of two or more products act as a source of the non-linear transaction and that in turn increases the degree of monopoly power to a firm.Proof.

The most important part is trust in a transaction is a dynamic phenomenon. From the above three equations (7), (13) and (19) we can conclude that they are non-linear. Non-linearity indicates presence of monopoly power in the market.

$$E(q_x) = p_i q_{x_i} + [(p_j q_{x_j} + \mu\overline{OR_i}) - p_i q_{x_i}]u_{q_i}(q_x) + [(p_k q_{x_k} + \mu\overline{OR_i}) - p_j q_{x_j}]u_{q_j}(q_x)$$

(from 7)

This is an increasing function with both marginal and fixed rate of increase. Marginal is due to $(p_j q_{x_j} - p_i q_{x_i}), (p_k q_{x_k} - p_j q_{x_j})$ and fixed due to $\overline{OR_i}$.

$E(q_x) = [p_i q_{x_i} + \mu\overline{OR}] + [p_j q_{x_j} - p_i q_{x_i}]u_{q_1}(q_x) + [p_k q_{x_k} - p_j q_{x_j}]u_{q_2}(q_x)$ (from 13)

This is an increasing function with a marginal rate of increase after incurring a high amount on another commodity. Marginal is due to $(p_j q_{x_j} - p_i q_{x_i}), (p_k q_{x_k} - p_j q_{x_j})$ and fixed due to $\overline{OR}$ This is almost increasing and concave function. That is why this is the best strategy to create new consumer and trust.

$E(q_x) = [\bar{p}q_{x_i} + \mu\overline{OR_i}] + [(\bar{p}(q_{x_j} - q_{x_i}) + \mu\overline{OR_i})]u_{q_i}(q_x) + [(\bar{p}(q_{x_k} - q_{x_{2_j}}) + \mu\overline{OR_j})]u_{q_j}(q_x)$ (from 19)

This is an increasing and convex function with both marginal and fixed rate of increase. Marginal is due to $(p_j q_{x_j} - p_i q_{x_i}), (p_k q_{x_k} - p_j q_{x_j})$ and fixed due to $\overline{OR_i}$ which is increasing at an increasing rate. This is almost increasing and convex function. This is the best strategy for that consumer who became trustworthy to the firm. Consumer surplus would be much lower here.

In all of the above three equations expenditure functions are increasing at an increasing rate. The slope is more than one. We have to show the convexity conditions using Laplace Transformation that the consumer will be able to minimize the cost of a low quantity purchase.

Discontinuity in Consumer Expenditure and Non-Concavity

The quality attribute changes the market structure. The change in the market structure changes the pricing strategy. The presence of

quality attributes in food products leads to non-linear pricing strategies (Das, 2016). This, in turn, changes the consumption expenditure. Figure 7 and explain the discontinuous expenditure function, and that is because of non-linear pricing strategies as explained above. Here the average expenditure between $E_1(X)\,\&\,E_2(X)$ is not available. Let the expenditure set is $\mathrm{E(X)}$ then for any $\{\lambda : 0 < \lambda < `\}$; $\lambda E_1(X) + (1-\lambda)E_2(X) \in \mathrm{E(X)}$.Therefore, the consumer either has to buy a lower quantity with non-linear price or higher quantity with lower price plus a compulsory tying expenditure (i.e. again non-linearity regarding tied in other commodities). This means either you have to spend a low amount or high amount. Low expenditure will not give you any cashback benefit but high expenditure will. The expenditure is high and non-linear. The expenditure functions below that are unavailable; this means that the consumer has to buy at a higher cost. The low and average expenditure is missing. Figure 9 explains the discontinuous expenditure function because of quantity discount (DeSalvo and Huq, 2002).

Figure 8: Quality Discount with Recursive Tying Expenditure

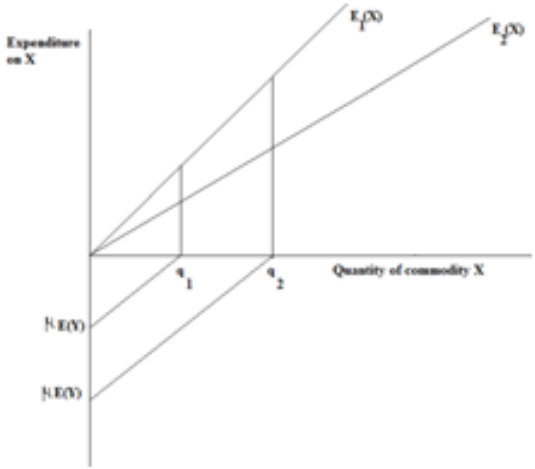


Figure 9: Quantity Discount with One Time Tying Expenditure

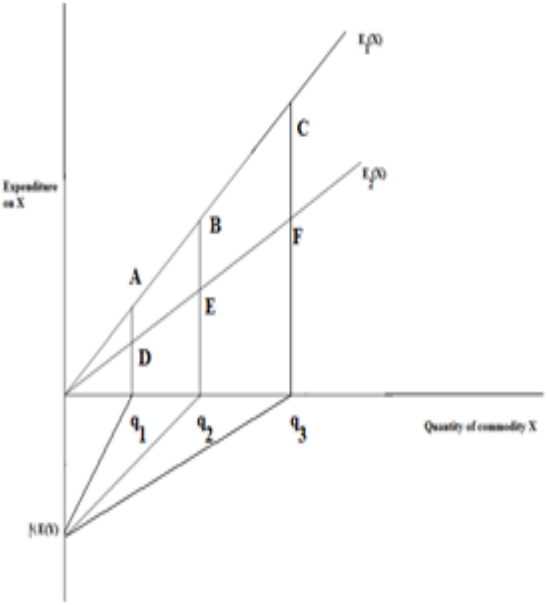
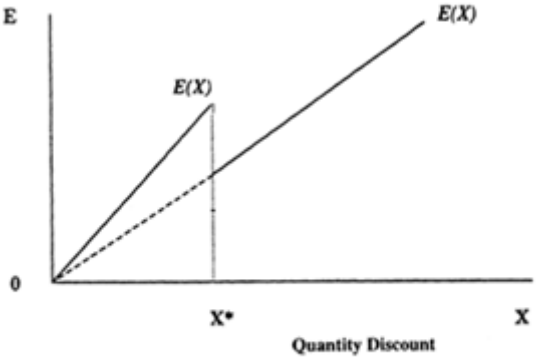


Figure 10: Quantity discount with One Time tying expenditure



We have identified the non-linear pricing strategy for the firms in the e-commerce market, and that was static analysis. As we know about the spatial price dispersion, i.e. several states offer the identical item at different prices. Most retail markets are instead of "Law of one price"

characterized by a large degree of price dispersion" (Varian, 1980). We find that firms use tying as an option abiding by the antitrust law and have anticipated that firms are following the formation of trust as a new strategy.

Proposition: 2

The consumer will have more preference towards that non-linear transaction that is as an option and not compulsion.

Proof

A consumer would always try to minimize the expenditure or maximize the net benefits for a sequence of transactions. Law of single price fails because of imperfect competition. The market price is not a competitive price. Therefore, uncertainty to have a lower price sequence is there. In this scenario a consumer always tries to minimize the sequence of future prices for the commodity bundle. This can be achieved only when uncertainty of getting lower price can be minimized. In other words, a consumer would always try to create the event possible lower price from probable lower price.

The objective is to maximize the probability of selecting the best offer when all $n!$ orderings of the offers are assumed to be equality likely. Letting *V(i)* denote the best we can do in this position. Therefore, the objective functional can be considered as,

$$V(i) = \max[\, P(i), G(i)\,] \text{ ,} i=1,2,3,\ldots,n$$

Where *P(i),* the probability that the best offer will be realized if the i^{th} is accepted, and *G(i)* represents the best we can do if we reject the i^{th} offer.

The purchase decision is dynamic in nature and attached with some uncertainty in each state in terms of market behavior, viz. price,

supply, quality etc. A consumer always tries to minimize the uncertainty about the availability of a particular product at some affordable price. If this is possible then we would say that the event is possible and uncertainty becomes almost zero. Therefore, a consumer in this case tries to make the event possible than probable.

Let there are two options to the consumer from a firm, *A* and *B*. If that consumer spends any amount say *E* on any commodity bundle till today, then from that firm say option *A* becomes availability of a particular product at some affordable price. Then we would say that the event is possible and not probable. Say possibility is denoted by π and probability by *p*. So, the consumer would be happy to have that, because the event becomes possible and rewards or net benefits would be higher. This is because the possibility is the upper limit of probability (Zadeh, 1978).The possibility is related to those propositions which are consistent with the information set. Moreover a serious possibility may coherently bear 0 creedal probability (Levi, 1989).Possibility distribution is known to the consumer. Therefore, certainty that price would be lower in option *A* would be lower than *B* would be higher. Therefore, consumer would buy option *A* and not *B*. Therefore, we can write as below.

$\{W(i) = \max[\,\pi(i), G(i)]\,\} > \{V(i) = \max[\,P(i), G(i)]\,\}, i=1,2,3..,...,.n$

$(\because \pi(i) > p(i))$

$\pi(i) > p(i)$ is possible only when the consumer becomes a regular buyer of that firm. This choice is based on the uncertainty related to the *G(i)* and not on the present expenditure incurred. From our initial analysis it is clear that non-linearity increases the expenditure and this is because of expenditure on other commodities. Once this becomes possible to make the probable event to possible the consumer would be tempted to maintain his or her preference on that firm though this would require high expenditure. Empirically we have proved that with these possibilities consumer prefers more to the firm in question.

From the above analysis it is clear that if the consumer accepts the non-linear contracts then expenditure will be a non-linear function with respective to quantity. Moreover, constant fixed costs would be there to reduce future price. The consumer has to be trustworthy to the firm. So the next question is whether the consumer would accept these non-linear contract or not. If yes, what would be the degree of preference towards that firm? The next section will try to give the answer.

Proposition: 3

More restrictive a possibility distribution is, the more informative is the proposition with which it is associated

Proof.

The above analysis shows that the Paytm has created the well-defined tying arrangement with all food servicing application. Paytm indeed has been able to tie other service providers and this creates information to the consumer group that using Paytm minimization of the price is possible. According to Zadeh, (1978) if p is a proposition of form $p \overset{\Delta}{=} X$ is F and $q \overset{\Delta}{=} X$ is H[3], then p is at least as informative as q, expressed as $I(p) \geq I(q)$, if $F \subset H$. Here $I(p)$ implies the information conveyed by *p* and $I(q)$ for *q*. The partial ordering of the I(p) defined by

$F \subset H \Rightarrow I$ (X is F) $\geq$ (X is H).

The above equation suggests that more restrictive a possibility distribution is, the more informative is the proposition with which it is associated. In this case the above orderings can be written as,

[3]The symbol $\overset{\Delta}{=}$ stands for "denotes" or "is defined to be".

I(Paytm gives more cashback) $\geq$ I(Online payment modes give cashback) Provided (Paytm $\subset$ (Set of online service providers).

Concluding remarks

Offer provided by e-wallet companies is very useful to get tied with food servicing applications indirectly. The consumer thinks about the offer provided by e-wallet before ordering. We find that e-wallet is often used when a consumer orders food online but offline, cash payment is preferred. Therefore, the offer does matter for the consumer. Therefore, the offer can be used to make a tie-in arrangement. Theoretical framework gives useful insights about how "indirect tie in arrangement" is happening. Empirical analysis does have limitation due to data availability. The primary survey can be extended to increase the respondent to get more clear picture.

Paytm is the largest firm in the E-wallet market which shares of 9 percent (According to Reserve Bank of India). This share is too less. It shows that there is fair competition in the E-wallet market. Therefore, even if there is a tie-in arrangement in online food servicing application, Competition Commission of India can restrict such practice as for illegal tying, the firm has to have the monopoly power in one market and there should be compulsory tie-arrangement in another market. But it doesn't mean that E-wallet tie-arrangement can't be ignored as the monopoly power in online food servicing market can influence the market share in the E-wallet market. Tie-arrangement is also important as the consumer has to spend more under cash back offer conditions which reduce the long run gain of consumers.

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