



**Purchase Frequency and Price dispersion:  
The Case of Drug Retail Market in Bangkok.**

**Presents**

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## **Abstract**

This study aims to accomodate the experimental essence of price dispersion arising from consumer search by inspecting the drug retail prices in Bangkok. Based on a theory of imperfect information, purchase frequency and price dispersion. The increase in propensity to price shop for frequently purchased drugs are likely to decrease the drug price dispersion in the focused market. The researcher had applied empirical studies in order to analyze and synthesize the relationship of purchase frequency and price dispersion. The price information are acquired through shop visit by directly inquiring the information. Other variables focused such as purchase frequency and reference price are synthesized through mathematical specification. The results had affirmed the theoretical forecast that the paper had been following through. Purchase frequency had shown statistical significance between the relationship with drug price discrimination. From the results, the increase in drug purchase frequency would decrease drug price dispersion in the focused market of Bangkok.

## **Introduction**

In a certain market with exact same goods or so called homogeneous goods, theoretically it should be sold in the same price due to its homogeneity. However, prices are usually found to be different for the same good from distinct retailers, an incident occurring in various of markets (Stigler, 1961). This incident is known as price dispersion. Price dispersion occurs when same goods sold from different sellers were sold in different prices in that given market. The dispersion rises from the imperfect information of the customer that the lowest price available for that good has been unknown. Those customers had such search costs to bear in order to seek for the lower or lowest price therefore in that given market such price dispersion does remain (Salop, 1977).

To exhibit the observational importance of price dispersion rooting from the imperfect information this research aims to examine and investigate the retail market for drugs in Bangkok. The influential factor that is mainly focused as a foundation of this study is the purchase frequency of the drug. Purchase frequency is a factor that reflects the nature of the medication usage for that certain illness. Chronic disease indicates such frequent drug purchasing activity, which has been contrasted to a disease or symptom that are to be cured by an occasional purchasing activity by requiring single or several dosages of medication for the cure. Hence the drugs are considered into two main groups of chronic disease drugs and regular drugs. Furthermore, the purchasing activity does exhibits into a frequently purchase and an occasional purchase form. Price information must also be acquired in order to examine the presence of price dispersion, with such difference in prices provided from the retailers it shall induce the approvement of the presence of price dispersion in the focusing drug market.

This research would emphasize on drug purchase frequency that the increase in such frequency will decrease price dispersion for those given drugs in Bangkok's drug retail market. Following an intuition of the search activity, the purchasing frequency compels the consumer to increase the propensity to concern more on about the costs of those drug that those customers must purchase, which is generally called price shopping. Therefore, the incentive to price shop should be more intense for such medication that must be purchased frequently, for example the drugs used for alleviating chronic diseases. With the increase in propensity to price shop the consumers will gradually acquire price information and likely to be able to acquire medication in such lower prices available in the market. Retailers then could not be able to markup the drug prices in a substantial immensity, which would probably lead to less dispersion of price. Hence

this frequently purchase activity should lead to less price dispersion for such given drugs. This research paper is following the research question and methodology of Sorensen (2000).

The contribution of this research paper conducted is that it would likely to create awareness for the readers to be able to realize about the mechanisms and the process underlying in the pricing system of the drug market in Bangkok, providing evidence for the emphasis of the essence and existence of price dispersion.

## **Objective of the Study**

This study aims to find and justify the effect of purchasing frequency on price dispersion of the drug retail market in Bangkok.

## **Scope of the Study**

This study will be limited to 300 drug samples of 10 different kinds of drug from 30 pharmacies in Bangkok. Focusing on the price dispersion from one time purchased drugs and frequently purchased drugs. The drugs focused are divided into 4 main categories by the properties and the production type of drugs, consisting of branded drugs used for treating chronic disease and branded drugs used for treating non-chronic disease, vice versa.

## **Literature Review**

1. S. Salop and J. E. Stiglitz (1982), The Theory of Sales: A Simple Model of Equilibrium Price Dispersion with Identical Agents

The paper focuses on the examination of the equilibrium in a competitive market, which information acquisition is costly. The sole market equilibrium might have been characterized by price dispersion for a homogeneous product. The model explains that imperfect information rises from the market itself. The consumers that receive a high price only purchases for the immediate

need and would re-enter later. But for the lucky consumers who receives low price would purchase more than the immediate and store the remain supply for further usage.

## 2. Kenneth Burdett and Kenneth L. Judd (1983), Equilibrium Price Dispersion

In this paper the study had aimed to define and characterize the equilibrium in a market for consumer goods. The firms set their own prices and consumer has cost in order to acquire information. Equilibrium with dispersed price exist in the atmosphere with rational agents on both sides of the contracting party. And the equilibrium price dispersion may occur in a long phenomenon not only arising from short run shocks of difference in cost and consumer rationality.

## 3. George T. Stigler (1961), The Economics of Information

The paper had stated that prices will change with the varying frequency in the market. No one will ever know all of the price quoted by the sellers which could vary day by day. Price discrimination is found everywhere even for the homogeneous goods. Such discrimination reflects the level of ignorance by the consumers in the market. If the cost of search is equal to the expected marginal return the optimal amount of search would be found.

## 4. Bev Dahlby and Douglas S. West (1986), Price dispersion in an Automobile Insurance Market

The paper had applied empirical studies to address the impact of consumer search in order to explain price dispersion. The dispersion in automobile insurance market is based on only costly consumer search. The variance of real premiums decreases by the increase of number of firms in the market, which it increases with the lost cost of each car insured and also the amount of car insured.

## 5. John A. Carlson and R. Preston McAfee (1983), Discrete Equilibrium Price Dispersion

The paper had focused on the creation of equilibrium price dispersion model. Claiming that most of the dispersion reflects equalizing price differences assigned to the different in characteristics of products given to the consumers. For the firms that has a low production cost it tends to set price lower compared to other firms and will contribute to a higher quantity demand. The demand would be linear with a function of difference between firm's price and the average price of other firms due to the consumer search.

#### 6. Arthur Fishman and Rafael Rob (1995), The Durability of Information, Market Efficiency and the Size of Firms

This paper analyzes the relationship between repeat purchasing action of consumers and the firm's cost. The market focused has a homogeneous product that has many buyers and sellers. The importance of search activity is that it would might promote long term relationships. The imperfect information is affected by the monopolistic power which leads to a price dispersion. The high cost firms would sell the products to the high search cost consumer and the low cost firm sells the products to the low search cost consumer. The consumer propensity to search for a low price when that certain product is purchased frequently, which this would increase the search activity and bring the price provided in the market to be closer to its marginal cost.

#### 7. Theresa Van Hoomissen (1988), Price Dispersion and Inflation: Evidence from Israel

In this paper the author considers whether imperfect information could explain the phenomena of price, quality and function differentiation under certain inflationary period. The author rejects the hypothesis that multiple characteristics is the mere determinant of price dispersion. Stating the optimally imperfect situation that when search is costly the return to search will be decrease for such consumers. If the dispersion had occurred by the ignorance of

consumers then it should be the same for inflation. The rate of inflation had been founded to increase the price dispersion from the significant statistic.

8. Arthur Fishman (2011), A Consumer Search Theory of Sticky Prices and Asymmetric Price Adjustment

The paper focuses on the stickiness of price in which it arises from the cost change. The reaction to the increase in cost change is more higher than the decrease in cost change. The assumption is that the consumer would not observe the producer's cost but will know that the cost is positively related and correlated among the producers. In equilibrium condition the increase in price would likely to increase consumer search where it is to elaborate the sticky price phenomena.

9. John W. Pratt, David A. Wise and Richard Zeckhauser (1979),

Price Difference in Almost Competitive Markets

The paper indicated that a stable equilibrium are likely to arise from the positive cost of search. The paper stated that the consumer has the none of the knowledge of probability distribution of the sellers but to have prior beliefs about it. Once a buyer stops searching the rice acquired will be the lowest for that certain customer because it would lie below the reservation price. The large difference among the price observed are merely implied by positive search costs or the difference in beliefs.

10. R. Manning and P.B. Morgan (1982), Search and Consumer Theory

In this paper the author states that search activity is not sequential because of the gain of knowing the offers sequentially is small if the cost of delaying the time that the offer is taken into consideration. A search action requires a financial cost, considering the money left at the end of the search the consumer will use that amount of money to maximize itself utility. The author had

used the search problem from Stigler to generally formulate the incident and problems focused. The effects of price, wealth and search cost varies by the search length also including the case when the distribution of selling price is scaled (Manning, 1982).

## **Theoretical Framework**

Imperfect information is a theory elaborating on the nature of information awareness, in which a situation that two sides, buyer and seller, has different or unequal information of that certain focusing good. In other words, imperfect information is a situation where each of the transacting parties had not gain all of the core information in order to make the best acquisition decision for that given good or product. It occurs in a wide range of markets in the economy and is a situation that promotes imperfect competition. With perfect information the market would theoretically be in a perfect competition because every single player in the market has the same complete set of that certain information (Perfect, 2018). Generally, in this situation the sellers or producers are oftenly the better in information gain because of the higher familiar with the products or good that it is currently providing. The functions of the good, considering the cost, quality and etc, are to be known by the provider or seller of that given good. However; in the contrasting aspect of consumers where there are less knowledge known on these goods such exceptional purchase decision are not to be able to be done. The higher the information gain creates a higher advantage for oneself as it assures one purchasing activity with lower cost, if the search costs are low or lower compared to the benefit from acquiring price information (Karla, 1991).

Price dispersion is an extent of alteration in the price of the same goods provided by different sellers in the market. Such dispersion theoretically violates the law of one price and emphasizes the limited existence of the phenomenon. Price dispersion occurs when a given

customer knows only one price of that focusing good and thus that certain seller has a availability to charge price the same infinitely until that customer had gained more price information (Ed, 2006). The acquaintance to avoid or being let loose from this incident is to acquire price information through searching, for example by foot, calling, etc. Despite of search costs, price discrimination would be eliminated through the increase in price knowledge or information. But in reality search costs do exist and it prevent the customer from acquiring price information, thus such dispersion remains. Homogeneity of good does not assure the indenticalness in price of a certain good provided by sellers because of the presence of imperfect information (Salop, 1977). This allows the seller to discriminate price and resulting in price dispersion. Hence imperfect information leads to a disperse in price and obstructing the market from achieving the perfect competition status where the law of one price performs.

## **Methodology**

The methodology in this following paper is based on the method scheme from Sorensen (2000).

### **1.) Research Method:**

In this paper quantitative research is used as the main research method. The research is a survey or inquiry-based method, which numerical data of drug prices are mainly focused.

### **2) Source of Data and Data Collection:**

The source of data used in this research is a primary data. The data focused for collection in this paper are the price information, reference price or standard price for the medication and the purchase frequency. Price information collected directly from the source of data which are the pharmacies that are chosen to study in Bangkok. The researcher had directly inquire price information of 10 different drugs from 30 randomly chosen pharmacies around the downtown and non-downtown area in Bangkok.

For the purchase frequency information, the researcher had indicated the collection method from an illustration as of Sorensen (2000). The dosage data used as the reference is from [www.drugs.com](http://www.drugs.com), which is then used to calculate the expected number of purchasing times within a 1 year time frame. For example, the dosage for amlodipine is 1 tablet per day with a therapy duration within 1 year. Therefore purchasing 60 tablets (one box mostly consist of 60 tablets) at once would need to be purchased  $(1 \text{ per day} * 365 \text{ days}) / 60 \text{ tablets}$ , which will equal to 6.083 times. Thus approximately around 6 times of drug purchase per year. For the drugs that are used to treat non-chronic disease the purchase frequency will be restricted at 1 time, due to the therapy duration of these non-chronic diseases that are only in a day, a few days or only weeks.

The reference price used in the data evaluation and analysis are derived from the medication standard price issued by the Comptroller General's Department of Thailand. The researcher had calculated the reference price by using the rule of three, comparing the price and proportions as of stated in the standard price issued. For example, 500 tablets of a 500 mg Amoxicillin is quoted as 795 baht. Where the exact collected information of amoxicillin is a 20 tablet box with 500 mg amoxicillin. Therefore according to the standard price 20 tablets of amoxicillin would cost  $(20 \text{ tablets} * 795 \text{ baht}) / 500 \text{ tablets} = 31.8 \text{ baht}$ . With this calculation method the standard price of all medication substance including Amoxicillin, Paracetamol, Metformin, Cetirizine, Simvastatin (10 mg), Simvastatin (20 mg), Amlodipine and Atenolol are 31.8, 2.06, 3.74, 3, 4.7, 7, 9.4 and 2.3 baht, respectively.

### 3). Price Samples to Study:

In this part 10 different kinds of drugs are focused for the collection of drug prices. The drugs are divided into 4 main categories. Consisting of 2 kinds of branded drugs for treating chronic disease, 4 kinds of non-branded drugs for treating chronic disease, 2 kinds of branded

drugs for treating non-chronic disease, 2 kinds of non-branded drugs for treating non-chronic disease. For the first two kinds of drugs that are branded and used for treating chronic disease are Glucophage and Norvasc. Glucophage is a brand name drug that contains the medical substance called metformin used for treating diabetes. Norvasc is also a brand name drug that contains the medical substance called amlodipine used for treating coronary artery disease and hypertension (high blood pressure).

Next are the 4 kind of drugs that are non-branded drugs and used for treating chronic disease, consisting of Bestatin, Amlopine, Prenolol and Zimmex. Bestatin and Zimmex are both contained with the same medical substance named Simvastatin used for treating cholesterol and triglycerides. Prenolol is based from atenolol which is used for treating angina (chest pain) and hypertension (high blood pressure). Amlopine is a generic for norvasc, which it contains the same medication of amlodipine used for treating coronary artery disease and hypertension.

The next 2 kinds of drugs are branded drugs used for treating non-chronic disease consisting of Amoxil and Zyrtec. Amoxil or amoxicillin is used to treat different types of infection based from bacteria. Zyrtec is based on cetirizine which are used to treat the effects of histamine which causes allergic symptoms. The last two kinds of drugs are Sara and Zensil, which are non-brand drugs and used for treating non-chronic diseases. Sara is a generic for tylenol where it contains the same medical ingredient of paracetamol used to relieve pain and fever. For Zensil, it is a generic for Zyrtec and contains the same medical ingredient of cetirizine used to treat histamine based symptoms.

#### 4). Sampling Method:

In this research the researcher had randomly selected 10 pharmacies in the central business area or downtown of Bangkok to collect the focused price information. Furthermore, 20

pharmacies that are in Bangkok but not in the downtown area are randomly selected and inquired for the focused price information. Hence 10 of the pharmacies chosen are in downtown and the other 20 are not in downtown. Merely store visit for price information inquiry had been done in this pharmacy random sampling for the data collection process of this research, which it allows the researcher to directly interact and inquire further information about the medication as a foundation knowledge for understanding the nature of each diseases related to the focused drugs. The price information compiled by using this certain sampling method is collected in May, 2018.

Several times of this random price inquiry had faced certain issues obstructing the process of data collection where some pharmacies did not provide all of the 10 focused drugs. The researcher had resolved the issue by collecting the missing price information from the pharmacies nearby, considering the equivalence of location in order not to alter the potential underlying impact of location difference (downtown or non-downtown).

##### 5). Data Evaluation and Analysis:

The researcher had adopted regression analysis method as the data evaluation and analysis appliance in this paper. Mainly finding the relationship significance factors between drug purchase frequency and price dispersion. The econometrics specification used for this studying the effects of the determinants that affects price dispersion is stated below.

$$Y = \beta_0 + \beta_1PRICE + \beta_2REFPRICE + \beta_3PCFREQ + \beta_4B1 + \beta_5B2 + \beta_6DT + \varepsilon$$

PRICE is a quantitative variable that represents the price of sample, which in this paper there will be 300 price samples collected. REFPRICE is a qualitative data that refers to the reference price for different kinds of drugs focused. This reference price is a standard price of

drugs which is issued by the Comptroller general's department of Thailand. PCFREQ is a quantitative variable that represents the purchase frequency of the given drugs. B1 is a dummy variable that represents a brand name drug that has generics. B2 is a dummy variable that represents brand name drugs that has no generics. To have no generic could be implied that the patent of that certain brand name drug is not yet expired. But if the drug focused are not both B1 or B2 it will be a non-brand name drug (generic drug). DT is a location dummy variable that represents for the location of the pharmacy whether it is in downtown or not in downtown. To indicate the area of downtown or generally so called as the CBD (Central Business District) the researcher had used the criteria from CBRE Thailand, which had stated that Silom, Sathorn, Rama IV Road, Ploenchit, Wireless Road, Asoke and the early-Sukhumvit (Sukhumvit Road up to Soi 24) are the CBD area of Bangkok (Fresh, 2017). Thus none of the area stated above are considered as non-downtown area and implies the value of 0 for this DT dummy variable.

## **Results**

The statistics results from the regression analysis are shown in the table 1. The dependent variable is the sd\_price where it infers to the focused drug price dispersion. The number of observation is 300 with a mean of 7.708887 and a standard deviation of 6.709456. The minimum and maximum value of this certain price dispersion are 1.6344 and 24.68943, respectively. The independent variable PRICE implies for the price of the drug sample collected. PRICE has a number of observation of 300 samples with a mean of 68.85667 and a standard error of 73.54963. The minimum and maximum value of drug price are 9 and 250, respectively. The independent variable REFPRICE or reference price infers to the standard price for the drug price samples gathered. The number of observation is 300 with a mean and standard deviation of 7.64 and 8.480995, respectively. Consisting with a minimum and maximum reference price ranging

from 2.06 to 31.8. PCFREQ is an independent variable abbreviated for drug purchase frequency. Purchase frequency has a number of observation of 300 and a standard error of 5.204834 with a mean of 7. The minimum and maximum value are 1 and 12, respectively.

The dummy variable B1 implies for a brand name drug that has a generic. The number of observation for dummy B1 is 300 with a mean of 0.4 and standard deviation of 0.4907165. The minimum and maximum value is 0 and 1, respectively. The value for a dummy variable is only 0 or 1, thus the minimum and maximum value for this B1 dummy variable is 0 and 1. B2 is a dummy variable abbreviated for a brand name drug that has no generic. It consists of 300 number of observations with a mean of 0 and a standard deviation of 0. The minimum and maximum value of B2 are 0 and 0, respectively. All of these statistics value of B2 are zero because the collected drug price samples are all brand name drugs with generics or is a non-brand name drug, which the value calculated will only show a zero for this B2 dummy variable. The dummy variable DT is a location dummy that infers to a location of purchase that whether it is in downtown or not in downtown. The numbers of observation is 300 samples with a mean of 0.3333 and a standard deviation of 0.4721922. The minimum and maximum value are 0 and 1, respectively. The values are only 0 and 1 for a dummy, therefore the minimum and maximum value for DT are 0 and 1.

In this particular part the researcher would discuss on the regression analysis results. The statistics data are shown in table 2. The numbers of price information used for the econometrics evaluation is 300. The regressed results shown that the R squared is equal to 0.8997, which it determines the fit of data to the regression line. With a R squared of 0.8997 it implies that the model adopted explains 89.97 percent of variability of the data around the mean. If the coefficient of determination or R squared is 100 percent it would be able to explain all of the

variance and the fitted value would be all equal to the observed value. Thus, all of the data would fall on the exact regression line in the incident of R squared equal to 1. Due to the Prob > F = 0.0000 from the regression analysis it means that the overall regression model is jointly significant.

Considering all of the independent quantitative variables focused, including PRICE, REFPRICE and PCFREQ. The coefficient for variable PRICE is 0.0162223, which it could be implied that every unit increase in PRICE (price of drug) would increase the sd\_price (price dispersion) by 0.0162223 standard deviation. With the positive relationship between PRICE and sd\_price it infers that when price of drug increases the price dispersion would also increase. The variable PRICE is statistically significant because it indicates a P-value of 0.0000, which is lower than 0.05. Inferring that the change in price has significant impact on price dispersion. The coefficient for variable REFPRICE is 0.4337445, which implies that one unit increase in REFPRICE (reference price) would increase the sd\_price (price dispersion) by 0.4337445 standard deviation. The increase in reference price would increase the price dispersion due to the positive relationship between the two variables. The variable REFPRICE is statistically significant because it indicates a P-value of 0.0000, which is lower than 0.05. Indicating that the change in reference price has significant impact on price dispersion. The coefficient for PCFREQ (purchase frequency) is equal to - 0.3851115, which it could be implied that when the purchase frequency is increase by 1 unit the sd\_price (price dispersion) would decrease by 0.3851115 standard deviation. These two variables has a negative relationship between each other, thus when the purchase frequency increases the price dispersion decreases. The variable PCFREQ is statistically significant because it indicates a P-value of 0.0000, which is lower than 0.05. Showing that the change in purchase frequency has significant impact on price dispersion.

The dummy variables in this regression model are B1, B2 and DT. Dummy variable B1 is a variable indicating that a drug is branded and has generic when it equals to 1, but if not as stated it would have a value of 0. The coefficient for dummy variable B1 is 3.867824, which it implies that when the drug is branded and has generics the value of sd\_price (price dispersion) would increase by 3.867824 standard deviation. Dummy B1 and sd\_price has positive relationship, hence when B1 equals to 1 such price dispersion would increase. The dummy variable B1 is statistically significant because it infers a P-value of 0.0000 in which the value is lower than 0.05. Dummy variable B2 is a variable indicating that a drug is branded and has no generics when it equals to 1, but if not as stated it would have a value of 0. However; in this particular research data collection process none of the drugs information collected are branded that has no generics, therefore all of the values gathered for B2 is equal to 0. As shown in the linear regression table that the variable B2 has a coefficient of 0, showing that it has no effect from the change of its own value on the sd\_price (price dispersion). The dummy variable DT is a location dummy, included into the regression model in order to justify whether location has certain impact on the price dispersion or not. From the regression analysis the variable DT is not statistically significant because its P-value is 0.856, which is higher than 0.05. Indicating that drugs sold from pharmacies in the downtown area (CBD) had such insignificant impact on the price dispersion. The standard errors term is assumed to follow a white noise process. The regression estimation had applied robust standard error option to correct heteroskedasticity, which may arise with the use of dummy variables and the bias that might be occurred from the size of sample.

The variables in the econometric specification showing the level of significance are listed in table 3, consisting of the independent variables and dummy variables. Independent variable

PRICE is statistically significant at the 99% confidence interval because its P-value is lower than 0.01 with a robust standard error of 0.00257. REFPRICE is statistically significant at the 99% confidence interval because its P-value is lower than 0.01 with a robust standard deviation of 0.0151. Variable PCFREQ is statistically significant at 99% confidence interval due to its P-value of 0.0000 which is lower than 0.01. It has a robust standard error of 0.02777 and has a negative relationship with the dependent variable sd\_price (price dispersion) due to its negative coefficient value. The dummy variable B1 is statistically significant at 99% confidence interval because its P-value is lower than 0.01 with a robust standard deviation of 0.408. The dummy variable B2 has none of the statistic available because its value is 0. Thus, the dummy B2 has no coefficient value and no robust standard deviation. The dummy variable DT is not statistically significant at any level of confidence interval because its P-value exceeds 0.01, 0.05 and 0.1.

## **Conclusion & Suggestion**

This research paper had adopted econometrics evaluation and analysis with the appliance of regression analysis in order to study and synthesize the relationship between price dispersion and the independent variables. From the research fundamental information acquired, it could be concluded that the increase in purchase frequency will likely to decrease price dispersion in the focused area of Bangkok. This empirical practice that the researcher had compassed have had a favorable result in which it had fitted exceptionally with the prediction based on the theory and research referenced from Sorensen (2000). The theory elaborates that the increase in propensity to do price shopping of the consumers due to the high expected benefit of price shopping from the drugs that must be purchased frequently would decrease the drug price dispersion in that certain market (Sorensen, 2000). The study of Sorensen had focused on the drug retail market of New York, which in this particular paper the results of Bangkok's drug retail market analysis are

found to be in the same way as of Sorensen's. However; according to the resulting statistical analysis location had not been a matter of consideration for the impact on price dispersion in Bangkok. It might likely occur from the slight distinct in density of pharmacies in the CBD and non-CBD area of Bangkok (จำนวนร้าน, 2559). Further studies with the expansion of sample size should likely to emphasize and stabilize the results of study. With the knowledge and understanding of the relationship between purchase frequency and price dispersion leading from imperfect information further developed policies should be proposed to centralize price information and might result in lower dispersion and prices for the consumer (Sorensen, 2000).

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## Appendix

Table 1

| Variable | Obs | Mean     | Std. Dev. | Min    | Max      |
|----------|-----|----------|-----------|--------|----------|
| sd_price | 300 | 7.708887 | 6.709456  | 1.6344 | 24.68943 |
| PRICE    | 300 | 68.85667 | 73.54963  | 9      | 250      |
| B1       | 300 | .4       | .4907165  | 0      | 1        |
| B2       | 300 | 0        | 0         | 0      | 0        |
| REFPRICE | 300 | 7.64     | 8.480995  | 2.06   | 31.8     |
| PCFREQ   | 300 | 7        | 5.204834  | 1      | 12       |
| DT       | 300 | .3333333 | .4721922  | 0      | 1        |

Table 2

Linear regression

|               |   |         |
|---------------|---|---------|
| Number of obs | = | 300     |
| F(5, 294)     | = | 1803.49 |
| Prob > F      | = | 0.0000  |
| R-squared     | = | 0.8997  |
| Root MSE      | = | 2.143   |

| sd_price | Coef.     | Robust<br>Std. Err. | t      | P> t  | [95% Conf. Interval] |           |
|----------|-----------|---------------------|--------|-------|----------------------|-----------|
| PRICE    | .0162223  | .0025691            | 6.31   | 0.000 | .0111662             | .0212784  |
| B1       | 3.867824  | .4082042            | 9.48   | 0.000 | 3.064452             | 4.671197  |
| B2       | 0         | (omitted)           |        |       |                      |           |
| REFPRICE | .4337445  | .0150854            | 28.75  | 0.000 | .4040555             | .4634335  |
| PCFREQ   | -.3851115 | .0276877            | -13.91 | 0.000 | -.4396026            | -.3306203 |
| DT       | -.0475314 | .2618856            | -0.18  | 0.856 | -.5629393            | .4678766  |
| _cons    | 4.442559  | .3328215            | 13.35  | 0.000 | 3.787544             | 5.097573  |

Table 3

|              | (1)       | (2)       |                                       |
|--------------|-----------|-----------|---------------------------------------|
| VARIABLES    | sd_price  | sd_price  | Robust standard errors in parentheses |
|              |           |           | *** p<0.01, ** p<0.05, * p<0.1        |
| PRICE        | 0.0162*** | 0.0162*** |                                       |
|              | (0.00257) | (0.00257) |                                       |
| B1           | 3.868***  | 3.868***  |                                       |
|              | (0.408)   | (0.408)   |                                       |
| o.B2         | -         | -         |                                       |
|              |           |           |                                       |
| REFPRICE     | 0.434***  | 0.434***  |                                       |
|              | (0.0151)  | (0.0151)  |                                       |
| PCFREQ       | -0.385*** | -0.385*** |                                       |
|              | (0.0277)  | (0.0277)  |                                       |
| DT           | -0.0475   | -0.0475   |                                       |
|              | (0.262)   | (0.262)   |                                       |
| Constant     | 4.443***  | 4.443***  |                                       |
|              | (0.333)   | (0.333)   |                                       |
|              |           |           |                                       |
| Observations | 300       | 300       |                                       |
| R-squared    | 0.900     | 0.900     |                                       |