FSRG Working Paper 2002-8

Price Dispersion, Search, and Market Power

by

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Funding for this project made available through the Food System Research Group, Special Grant 2001-34101-10526.

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Abstract

The purpose of the research presented in this study is to examine the relationship of price dispersion to search costs, store choice, and market power in the food-retailing sector. The study used consumer level demographic information and brand level fluid milk consumption data from 33 U.S. metropolitan areas. Overall, the study found strong evidence of search cost related strategic firm and consumer behavior. Our results show that purchase frequency has a negative and significant relationship with price dispersions and with measures of price cost margins. We also find that the price of fluid milk was an important factor in explaining whether or not consumers return to the same store. Demographic factors such as income and race were important in explaining price dispersions, which suggest different willingness to search across population sub-groups.

Key Words: search cost, price dispersion, retail, milk, store choice**.**

Price Dispersion, Search, and Market Power

Introduction

Price dispersion is a term used to describe persistent price differences for the same product for a given market and time frame. The persistence of dispersed prices suggests the possibility of a market condition structured to extract rents from consumers that involves strategic firm behavior built upon expensive consumer search costs. Despite the common observances of price dispersion in hundreds of retail markets, very little research has been conducted to explore its role on consumer behavior and welfare or its implications for antitrust and merger policies.

The theories to explain price dispersion began with Stigler (1961) who drew linkages to consumer's lack of complete information about existing prices in the market and price dispersions. Diamond (1971) showed that if buyers and sellers are homogeneous and if search costs are strictly positive, then the unique equilibrium is the monopoly price. Imperfect information makes it possible for firms to "capture" customers and act as local monopolists because consumers must incur positive costs of finding lower prices. Without buyer/seller heterogeneity, each firm has an incentive to lower price and capture all the consumers from the rest of the firms in much the same way a pure Bertrand pricing game operates. Rothchild (1974) suggested a more complex game. Firms recognize consumer search costs as an opportunity to extract rents across varying product lines. Equilibrium models by Wilde and Schwartz (1979), Salop and Stiglitz (1976), Burdett and Judd (1983) and Carlson and McAfee (1983) all formally link dispersion in homogeneous goods to various assumptions about search costs.[1] Varian (1980) hypothesizes that price dispersion is generated due to strategic high-low pricing behavior firms regardless of any specific assumption concerning consumer search costs. If retail stores in a market randomly put some products on sales then search costs for the least cost retailer by the consumer can be high enough, in equilibrium, high and low priced firms will co-exist.

The purpose of the research presented in this paper is to explore price dispersion in the U.S. food markets. Anecdotal information suggests price dispersion is the norm in most food markets, and the specific nature of supermarket pricing and business strategies is a very complex issue. Retail food markets have also undergone considerable structural change in recent years. The increased role of large supermarkets and food supercenters has transformed the nature and competition of food retailing in the U.S. National concentration levels of food retailing have risen dramatically in the 1990's, but are not to the level that draws much attention from antitrust authorities (Dhar and Ray; 2002). However, food retailing operates in tight spatial markets and regional concentration data indicate much greater reason for concern. For example, Cotterill (1999) reports the state of Florida maintains a 2-firm concentration ratio of 70%.

[1] In the classic models of Hotelling (1929) and Chamberlin (1933), products are assumed to differ only in their location, which in turn leads to price dispersion without search costs.

Supermarkets sell hundreds of product lines offered via thousands of brand names and private labels. While it may be useful to consider price dispersion in a multi-product setting, there are a plethora of possible problems that tend to limit the empirical viability of such an approach.[2] For this study, we chose to evaluate fluid milk markets for one simple reason: fluid milk is one of the most homogeneous of all retail food groups. Fluid milk quality and processing attributes are federally mandated through FDA and USDA. Fluid milk also represents a grocery product that has not undergone any major product, packaging, or marketing innovations in the past several decades. As a result, with fluid milk, the need to control for major product quality changes and/or differences is much less.

The present study develops two approaches for analyzing price dispersion in U.S. retail fluid milk markets. First, we estimate a model to evaluate the role of market structure, store type, region, and consumer demographics on explaining price dispersion. We generated both the measure of dispersion and purchase frequency from household purchase data across 33 major metropolitan statistical areas in the U.S. for branded milk purchases. The household dataset also contained important demographic, economic and geographic information about each consumer, which allowed us to measure the impacts of various factors on price dispersion and search costs. The results of the first study point

[2] For example, it would be necessary to control for product quality differences and container sizes within and across product lines.

to strong support for the inverse relationship between frequencies of purchase and price dispersion, mark-ups and average prices.

A second analysis was constructed to evaluate the role of milk pricing in causing consumers to switch stores. Because each consuming household in the database reports chronologically their purchasing patterns, we were able to directly estimate a model to determine if fluid milk pricing was an explanatory factor in encouraging consumers to switch stores. The results of this analysis found that milk prices do affect consumer's willingness to switch stores.

The next section contains a brief review of the literature. The third section contains a full description of the database. Section 4 presents the empirical models; section five contains the results from the analysis and section six provides concluding comments.

A Brief Literature Survey

Empirically the relationships between product differentiation and market power have been quite extensively explored. It is only recently researchers, with more appropriate databases, have begun to explore empirically the implications of the economics of price dispersion, information, and search costs. Bayliss and Perloff (2002) studied the internet market for digital cameras and flatbed scanners. Despite the apparent low levels of search costs, access to product information and pricing, and that the market is comprised of branded but homogeneous product lines, they found little support for models of competitive behavior or that pricing was linked to service premiums or discounts. Neither the law of one price, or price undercutting that leads to different firm price rankings could be supported. They essentially concluded that internet firms charge higher prices to consumers that are ignorant about better opportunities. Morgan, Orzen and Sefton (2001) evaluated price dispersion on the internet book market. They found that although the presence of price-comparison web sites decreased the degree of dispersion, it did not eliminate it.

Lach (2002) tests the basic findings of Varian's (1980) mixed strategy sales model. Varian (1980) showed that it is optimum for retailers to increase and decrease prices relative to other retailers price using mixed strategy pricing rules, which make it difficult and more expensive for consumers to search for the lowest price retailers. Lach (2002) evaluated three food items (chicken, flour, coffee) and one durable good (refrigerators) in the Tel Aviv consumer market. Not surprising was the fact that the least amount of dispersion occurred in refrigerators. While purchased infrequently, its durability characteristic implies high frequency of use over a long time. A refrigerator also represents much higher share of a consumers' budget relative to the other goods.[3]

One key linkage to consumer search theory is the inverse relationship between per unit search costs and purchase frequency. Sorenson (2000) found that long-term medications (i.e. high frequency usage) generated statistically

[3] Goldberg and Verboven (1998) found a similar result in evaluating price dispersions in durable goods. They were able to explain international price differences in automobiles principally due to market policies, quality characteristics, and currency valuations. Hayes and Ross (1997) found limited price dispersion in airline ticket prices, a market with high nominal price relative to consumer non-durables and easy access to competitor rates.

significant reductions in price dispersions, average prices charged, and in price margins compared to single-use or low frequency drug sales. He also identified an inverse relationship between frequency of drug purchases and price-cost margins, which is the first finding we are aware of that establishes an empirical relationship between search costs and an established measure of market power.[4] Sorenson (2001) also found that intensity of search for pharmacy drugs was quite low but significantly increased with the anticipated frequency of medicine use. One problem with the prescription drugs markets studied by Sorenson (2000) was the inability to account for the influence of heterogeneous health insurance programs. Another issue was that frequency of purchase could only be inferred from drug prescription manuals.

Description of the Data

The data used in this analysis consists of a household consumer panel data set that contains fluid milk purchase data on a purchase occasion basis over the February 1991 to June 1993 period. A.C. Nielsen chooses representative households from 76 different dominant market areas (DMA) in the U.S. to collect consumption data on food and other items.[5] Households in the database are provided with scanning tools that remain in their homes. Each time a household

[4] Sorenson also that found that pharmacies could not be categorized as low-cost or high-cost rejecting a notion that service levels solely determine pricing.

[5] DMA is the AC Nielsen's definition of a geographic market area. This definition approximates the census definition of metropolitan area. For example, the New York DMA includes all the counties of New York City and also includes neighboring counties of Connecticut and New Jersey served by New York City retail distribution centers.

member purchases a product, they scan the universal product code (UPC), and they supply the database with additional detailed information related to the purchase (store, who made the purchase, the date, the time, and the optional use of a coupon). From this broad database we extracted data on milk purchases and aggregated purchases for a weekly basis from 33 of the DMAs. For each DMA, a UPC is included in our analysis if there are at least two transactions involving this UPC during a particular week. As will be noted below, UPC-related price dispersion measures were generated from the observed purchase data for each DMA. DMA's were dropped from the analysis either because of the low number of households in each DMA or the low frequency of purchase.

The milk database was formed using data for 6,688 households. These households shopped at 273 different stores (i.e., 204 supermarket food stores, 20 convenient type stores, and the remainder from *other* types of store including mass merchandising clubs). Consumers in the database bought 2,724 unique milk products (i.e. different sizes, brands, etc.). Given the number of purchase occasions, unique UPC's, and weeks encompassed by the data, 365,690 observations were used in the analysis.

Figures 1 and 2 plot important variables of our analysis by income group and race, respectively. The *Mean Price* variable measured the mean price paid by a consumer for a given UPC, week and DMA. Similarly, *Price Range* represents the difference between the maximum and minimum prices. *Package*

Size is the average size of container purchased (in gallons). Retail price variable shows the most variation, which suggests income and race may have significant explanatory powers in our analysis of price dispersion.

Empirical Models

Similar to the approach used by Sorenson (2001) three unique analyses were undertaken. The first analysis had as its objective the analysis of price dispersion directly. That is we estimate a series of linear regressions where alternative definitions of price dispersion were used as the dependent variable. A second set of regression models were then estimated where the dependent variables are alternative measures of price-cost margins.

Finally we undertake a unique analysis of store switching to examine the impact of price changes on the consumer search process. To investigate this question we develop a logistics model to evaluate consumer patterns of store choice over time.

We can represent the linear regressions used to model price dispersion via the following:

$$\mathrm{PD_k} = \mathrm{f(PF, QTY, STORE, SEAS, DMA, INC, COUP, COOP)} \quad (\mathrm{k} = 1, 2) \qquad (1)$$

where PD_k is the kth measure of price dispersion. Two variables were used as measures of price dispersion. One was price range (highest price minus lowest price in each DMA in a given week for a given UPC). The second is standard deviation of all prices in each DMA in a week for a given UPC. These two regressions were estimated over all 365,690 purchase occasions.

In terms of the assignment of the dependent variables to a particular household, all households in a DMA purchasing a particular milk UPC during a particular week were given the same value of PD_k. In similar manner we assign the value of our measure of frequency of purchase (*PF*) to each household associated with the purchase of a particular UPC on a particular purchase occasion. Our frequency of purchase measure is the number of sample purchase occasions for a given UPC within a city (DMA) for a particular week. *STORE* is a binary variable representing one of three store types (Grocery Stores, Convenience Stores and Other Stores). *QTY* represents the average quantity purchased per purchase occasion. The variable *SEAS* represents the use of four quarterly seasonal binaries to control for seasonal patterns in fluid milk consumption. *DMA* represents a collection of 33 binary variables identifying the DMA where each household resides. Income is accounted for via the use of 17 income-based binary variables representing household income less than $5000 to more than $100,000. The variable *COUP* is the value of any coupon used to purchase the item. *COOP* represents the monthly average milk price received by farmer cooperatives, which acts as a proxy measure for the price of wholesale milk. The actual price paid by processors in any given market tend to be either this price or close to this price. This *COOP* variable varies by DMA and calendar month.

As noted above we estimated a second set of regressions where we attempted to quantify the determinants of DMA-specific price-cost margins. These regressions can be represented as:

$$PC_m = f(PF, QTY, STORE, SEAS, DMA, INC, COUP, COOP) \quad (m = 1, \ldots, 3) \qquad (2)$$

where PC_m represents the mth price-cost margin measure. In the first specification, we consider only average product price (*PRICE*) as the dependent variable and keep *COOP* as an independent variable. The second margin measure is represented by the variable, MARGIN which is calculated as: *MARGIN = PRICE -COOP*. Where again MARGIN is calculated weekly for each DMA and UPC. For the third definition of our price-cost margin, we develop a rough measure of the Learner Index, which is calculated as: *LEARNER=(PRICE – COOP)/PRICE*. For the second and third specifications, *COOP* was not used as an independent variable. While these are clearly not models of price dispersion, they are closely related. If we think of a market in which all prices are above marginal costs, then it is clear that wider price dispersions could easily translate to higher average prices, margins, or learner index. These models begin to address the important questions linking search costs and implicit market power (Sorenson, 2001).

The empirical evaluation of search cost theory must specify some way for consumers to attain information. In the case of low cost food items, information about price and quality of store services is usually attained through repeated store visits, through food retailer newspaper inserts, or other media forms. Data on consumer information via newspaper inserts were not available through the Neilsen database. However, we were able to track food purchasers to see if they shop from the same store consistently or if they move from store to store. There might be many reasons that consumers shop from store to store in a given time period that are not directly related to search benefits (store locations, number of stores, total planned expenditure, store services, time of day, etc.) However, if the shopping patterns are simply related to these other factors, then higher prices and other search cost related variables should not be a significant factor in shifting from a store in which a purchase was made in the previous period.

From the perspective retail managers, milk has long been considered as a gateway product to attract consumers into stores. In marketing and trade literature it is frequently termed as a products that builds store traffic. Milk in some situations is advertised and sold below cost because consumers are thought to be quite sensitive to its price. To this end, we propose to examine the process by which consumers switch the purchase location across consecutive purchase occasions. We use a logistic regression to examine the importance of milk price on the probability of store switching:

$$\Pr\left(\mathrm{SCB}=1\right)=\mathrm{f}(\mathrm{PRICE\_L},\mathrm{COUP\_L},\mathrm{PS},\mathrm{QTY\_L},\mathrm{HHSIZE},\mathrm{RACE},\mathrm{SEAS},\mathrm{INC},\mathrm{DMA}) \quad (3)$$

where, *SCB* is defined as a binary variable equal to 1 if a household purchases milk from a different store than the store used in the previous purchase occasion, zero otherwise. So the dependent variable, Pr(*SCB*=1), represents the probability that a household switches purchase location. The variable *PS* represents the size of package purchased by the household on each purchase occasion. If price changes generate search then the parameter associated with the retail price (*PRICE_L)* variable should be negative and statistically significant. An increase in retail price decreases the probability in the same store.

Table 1 and provides an overview of the variables contained in each of the sets of regressions represented by (1) and (2). Table 2 provides descriptive statistics of the variables used in (3).

In the regression analysis, we normalize our measure of price dispersion and frequency of purchase at the per gallon basis. For example: for a given UPC, price dispersion for quart milk package is .20 cents then we multiply the price dispersion measure by 4 (as 4 quarts is equivalent to 1 gallon). Similarly we normalize our measure of frequency of purchase. As a result, purchase of a gallon package is measured as frequency of 1 and the purchase of a gallon of milk in quart size containers is given a purchase frequency of 4. This helps us to control for multiple purchase in one purchase occasion.

Results

Dispersion as dependent variables [Equation 1]: Table 3 presents the regression results with price dispersion measures as dependent variables. Several major findings are forthcoming. There were significant negative relationships between price dispersion measures and measures of purchase frequencies, which conform to the finding of Sorensen (2000) for the New York prescription drugs market. However, Sorensen (2000) found an elastic relationship between his measures of price dispersion and purchase frequency. In this study, the relationship is highly inelastic and equal to approximately -0.04. One reason for this difference is that our study looked at much shorter term impacts (weekly) versus the Sorenson study, which calculated frequency on an annual basis. Theoretically it is also expected that income effect for higher priced items (such as drugs) the impact of frequency of purchase on price dispersion will be much larger than in the case of lower priced items (such as: fluid milk).

Supermarket grocery store sales (i.e., the food store binary) had a negative impact on price dispersions and convenience stores had a positive impact. This is not surprising given that convenience stores probably compete along a different set of non-price related set of services, such as location. Both the mean coupon value (*COUP*) and quantity bought (*QTY*) are both positively related with price dispersion measures. We do not find any strong relationship between cooperative milk price and price dispersion. This conforms to the widely held belief that farm-retail price relationship is either weak or weakening. Three quarterly binaries were significant and positive.

We used 17 income binaries to capture the relationship between household income and price dispersion. Low-income binaries (income binaries 2 to 7) are significant and negative while high-income binaries (i.e., income binary 8 and above) are either positive or negative but statistically insignificant. This is an important result because low-income groups are expected to be highly price conscious and, therefore, may tend to shop around more. Our findings generally support such a hypothesis. It appears that milk brands purchased heavily by low-income households are based on comparative information across stores and/or stores are more competitive in the milk market for low-income consumer market shares. Finally, we found statistically less price dispersion within the white race subgroup (the binary is equal to 1 if it is white and 0 otherwise). In the case of city binaries, the result is varied. Such variability does suggest possibly that market structures (i.e. concentration), city cultures, tax policies or perhaps other variables explain these differences. In future research we plan to explore these issues in more detail. Clearly, the issue of differing market structures across metropolitan areas is a likely reason for spatial differences in price dispersion.

Price-cost margins as dependent variable [Equation2]: Table 4 presents regression results with measures of price and price margins as dependent variables. In terms of price and price margins we find results similar to Sorensen (2001). Of the three regressions, the models using nominal price margin as the dependent variable fits better. The overriding result from all three models was that markets for frequently purchased items tended to be less dispersed price or price cost margins than the market for less frequently purchased items.

Store Switch Binary as Dependent Variable [Equation 3]: Table 5 presents results of our logistic regression. As noted above, we use this regression to test for the presence of search costs in a much more direct manner. The dependent variable for this model is the probability of a consumer switching shopping location. If the shopping patterns of consumers across stores are completely random then variables that are known to affect consumer's search cost will not be significant in this regression analysis.

In the regression we find that milk price, value of the coupon used and package size negatively impact same store shopping. The negative price relationship we found implied that an increase in price in the current store could cause consumers to switch stores. The negative and significant coupon value and package size parameter implies consumers using coupons and buying in larger package sizes tend to shop around more, consistent with our expectations. Similarly, negative and significant household size implies large households tend to shop around more. Larger households tend to buy more food products and spend a larger share of their income on food.

In terms of race, we found that white population (first race binary) was less likely to change stores. Similar to our previous regression analyses we found income and city binaries are significant. We also found that higher income households were less likely to switch stores than compared to lower income households as shown by the relative logisitic coefficient values. Finally, city binaries in this regression have varying level of significance and signs, which suggests structural difference across city.

Concluding Remarks

The research in this study was exploratory in nature and involved an extensive analysis of the U.S. fluid milk: a market with relatively high purchase frequency and generally strong price awareness. We found strong evidence that search cost related strategic firm and consumer behavior exists in the U.S. fluid milk market. Our results show that purchase frequency had a negative and significant relationship with price dispersions and measures of price cost margins during the study period. This negative relationship implies market for milk products that are bought at a higher frequency were more competitively priced. Given that consumers willingly use fluid milk to partially determine their store decision, it is surprising the degree of price dispersion noted in our study. Clearly, if food retailers are willing to price milk to extract rent in the overall scheme of confusing pricing and promotion strategies that are at work, it only seems likely that more extensive forms of price dispersion strategies are used on less frequently purchased food items.

Our logistic regression analyses also suggest that there are significant levels of price-related search on part of consumers. Both income group categories and race have significant effect on all our regression analysis, suggesting different groups have differing ability to search for food. More detailed studies on consumer welfare and search cost are needed to uncover the specifics of these apparent differences and the subsequent firm-level responses.

Future research is also suggested to uncover more specifically the mechanisms of consumer search in food retail markets. Another relevant issue is the decomposition of the retail level mark-ups into search cost related rents and premium generated by product differentiation.

Table1: Descriptive Statistics of Variables used in Linear Regressions

Variable	Units	Name	Mean	Std. Dev.
Frequency of Purchase	# Purchase Occasions	*PF*	80.9	106.2
Coupon Value	$/gallon	*COUP*	0.0089	0.0466
Average Quantity Purchased	gallons/purchase occasion	*QTY*	1.23	0.32
Cooperative Price of Milk	$/gallon	*COOP*	1.28	0.12
Price	$/gallon	*PRICE*	2.53	1.07
Price-Cost Margin	$/gallon	*MARGIN*	1.25	1.07
Relative Price-Cost Margin	#	*LERNER*	0.468	0.26
Price Range	$/gallon	*RANGE*	0.54	0.45
Price Std. Deviation	$/gallon	*PR_STD*	0.045	0.16
Store Type Food Store Convenience Store Other	% of Purchases % of Purchases % of Purchases	FOOD Store: 88.52% of Purchases; Convenient Store: 4.94%; Others: 6.54%		
Household Pre-Tax Income	% of Purchases	Income Group 1-8: 34% and Income Group 9-16: 66% Households		
White, Non-Hispanic Household	%of Purchases	White consumers: 91.07% of Purchase occasions		

Note: Except for the Income and race variables, the above means are the average of the DMA/UPC specific weekly averages.

Table 2: Descriptive Statistics of Continuous Variables used in the Logistic Regression

Variable	Units	Name	Store Choice Binary	Mean	Std. Dev.
Price	$/gallon	*PRICE_L*	1 0	2.52 2.53	1.08 1.06
Coupon Value	$/gallon	*COUP_L*	1 0	0.008 0.010	0.012 0.015
Package Size	Unit/Gallon	*SIZE*	1 0	0.71 0.72	0.29 0.29
Quantity	Gallon	*QTY_L*	1 0	1.24 1.19	0.69 0.61
Number of Household Members	#	*HHSIZE*	1 0	2.93 2.98	1.45 1.46

Note: In contrast to the values shown in Table 1 the above are calculated over purchase occasions.

Table 3: Regression Results with Price Dispersion Measures as Dependent Variable

Variable	Dependent Variable	
	RANGE	PR_STD
Intercept	0.3778***	0.1121***
Frequency	-0.00019***	-0.00011***
Food store bin	-0.1167***	-0.0121***
Conv. store Bin	0.0225***	-0.0016
Mean Coupon value	1.6946***	0.1427***
Average quantity	0.0432***	0.0046***
Coop price	0.0423	0.0273***
Coop price (lagged 1)	0.0166	-0.0142
Coop price (lagged 2)	-0.0113	-0.0138
Quarter_1	0.0178***	0.0011
Quarter_2	0.0333***	0.0029***
Quarter_3	0.0238***	0.0006
Income_2	-0.0588***	-0.0080
Income_3	-0.0319**	-0.0095**
Income_4	-0.0206	-0.0057
Income_5	-0.0409***	-0.0069
Income_6	-0.0324**	-0.0017
Income_7	-0.0380***	-0.0059
Income_8	-0.0205	-0.0043
Income_9	0.0160	-0.0036
Income_10	0.0024	-0.0070
Income_11	-0.0040	-0.0055
Income_12	-0.0049	-0.0074
Income_13	0.0073	-0.0052
Income_14	0.0091	-0.0034
Income_15	-0.0242	-0.0050
Income_16	-0.0091	-0.0054
White	-0.0126***	-0.0030***
BALTIMORE	-0.2047***	-0.0549***
CHICAGO	-0.0178	-0.0374***
CINCINNATI	0.1058***	-0.0509***
CLEVELAND	0.0637	-0.0566***
DALLAS	0.0314	-0.0371***
DENVER	-0.0809**	-0.0635***
DES MOINES	-0.0019	-0.0736***
DETROIT	0.1706***	-0.0446***
HARTFORD	0.2173***	-0.0354***
HOUSTON	0.1155***	-0.0312***
INDIANAPOLIS	-0.1121**	-0.0468***

KANSAS CITY	0.1788***	-0.0628***
LITTLE ROCK	0.4114***	0.0195
LOS ANGELES	-0.0608	-0.0669***
LOUISVILLE	0.0270	-0.0349***
MIAMI	0.0215	-0.0530***
MILWAUKEE	-0.0983***	-0.0664***
MINNEAPOLIS	-0.1890***	-0.0711***
NASHVILLE	-0.0836**	-0.0556***
NEW ORLEANS	-0.1019***	-0.0543***
NEW YORK	0.0890	-0.0617***
OKLAHOMA CITY	0.0229	-0.0492***
OMAHA	-0.1641***	-0.0611***
PHILADELPHIA	-0.0902	-0.0721***
PHOENIX	0.1863***	-0.0251**
PITTSBURGH	-0.1944***	-0.0760***
SALT LAKE CITY	0.0889	-0.0454***
SAN FRANCISCO	-0.1788***	-0.0778***
SEATTLE	0.2074***	-0.0104
SPOKANE	0.0426	-0.0374***
ST LOUIS	0.0522	-0.0501***
WASHINGTON	-0.1197***	-0.0580***
	R^2: 0.069 **Adj. R^2: 0.068**	**R^2: 0.019** **Adj. R^2: 0.018**

No. of Observation: 368690.
No. of DMA included in the analysis: 33. Omitted City: Atlanta, Omitted Income level: lowest, omitted store type: all other, omitted quarter: 4th.

Table 4: Regression Results with Measures of Price Margins as Dependent Variables

Variable	Dependent Variable		
	PRICE	MARGIN	LEARNER
Intercept	1.7741***	0.3883***	-0.6205***
Frequency	-0.0029***	-0.0029***	-0.0048***
Food store	-0.0874***	-0.0852***	-0.2529***
Conv. store	0.0381***	0.0401***	0.1039***
Mean Coupon value	0.4884***	0.5104***	1.4909***
Average quantity	0.1036***	0.1036***	0.4757***
Coop price	0.0508	--	--
Coop price (lagged 1 month)	0.0597***	--	--
Coop price (lagged 2 months)	0.0490	--	--
Quarter_1	0.0211***	0.0482***	0.0576***
Quarter_2	-0.0111***	0.0720***	0.1052***
Quarter_3	0.0154***	0.0471***	0.0686***
Income_2	0.0446**	0.0447**	-0.4522***
Income_3	0.0755***	0.0757***	-0.0687
Income_4	0.1111***	0.1083***	-0.0814
Income_5	0.0145	0.0129	-0.0430
Income_6	0.0687***	0.0668***	-0.0402
Income_7	0.0846***	0.0822***	-0.1235**
Income_8	0.1334***	0.1320***	0.1437***
Income_9	0.1565***	0.1559***	0.2020***
Income_10	0.1932***	0.1915***	0.3106***
Income_11	0.1874***	0.1858***	0.3263***
Income_12	0.1932***	0.1916***	0.1801***
Income_13	0.2311***	0.2310***	0.4186***
Income_14	0.2419***	0.2392***	0.3423***
Income_15	0.1604***	0.1593***	0.2157***
Income_16	0.1664***	0.1651***	-0.0587
White	-0.0132**	-0.0118**	0.1371***
BALTIMORE	-0.2642***	-0.2718***	-0.6552***
CHICAGO	0.0070	-0.0062	-0.5234***
CINCINNATI	-0.0990	-0.0509	0.1237
CLEVELAND	-0.3648***	-0.2973***	-0.3117
DALLAS	-0.1645***	-0.1238**	-0.1686
DENVER	-0.0297	0.0049	-0.2572
DES MOINES	-0.0657	0.0306	-0.0692
DETROIT	-0.1202**	.0010	-0.1071
HARTFORD	-0.3904***	-0.3871***	-0.7527
HOUSTON	0.0344	0.0279	0.0322
INDIANAPOLIS	-0.2484***	-0.1975***	0.0605

KANSAS CITY	0.1267**	0.1930***	0.3163**
LITTLE ROCK	0.0271	0.0921	0.0077
LOS ANGELES	-0.3286***	-0.1173**	-0.4052**
LOUISVILLE	-0.0329	0.0646	0.1845
MIAMI	-0.2967***	-0.4829***	-0.6104***
MILWAUKEE	-0.1469**	-0.1481**	-0.3912**
MINNEAPOLIS	-0.1143	0.0493	-0.0866
NASHVILLE	-0.1204**	-0.0683	-0.1635
NEW ORLEANS	0.2499***	0.2376***	0.4114**
NEW YORK	-0.3454***	-0.3488***	-1.0391***
OKLAHOMA CITY	-0.1414**	-0.0676	-0.0898
OMAHA	-0.1908***	-0.1130	-0.2479
PHILADELPHIA	-0.3763***	-0.3955***	-1.0788***
PHOENIX	-0.2628***	-0.1333**	-0.0942
PITTSBURGH	-0.4075***	-0.3495***	-0.6752***
SALT LAKE CITY	-0.0668	0.1093	0.1074
SAN FRANCISCO	-0.5556***	-0.3256***	-0.7601***
SEATTLE	-0.0558	0.0894	0.0037
SPOKANE	0.0967	0.2407***	0.1504
ST LOUIS	0.2361***	0.2604***	0.3956
WASHINGTON	-0.2809***	-0.2998***	-0.6357***
	R^2: 0.155 Adj. R^2: 0.155	**R^2: 0.164 Adj. R^2: 0.164**	**R^2: 0.101 Adj. R^2: 0.100**

Table 5: Results of Logistic Regression of Store Choice

Variable	Parameter Estimates	Odds Ratio
Intercept	0.0905	--
Price	-0.0289***	0.972
Coupon Value	-0.00146***	0.999
Package Size	-0.1989***	0.820
Quantity	0.1171***	1.124
Household Size	-0.0178***	0.982
White	0.00973	1.010
Black	-0.1677***	0.846
Oriental	-0.2146***	0.807
Quarter_1	0.00912	1.009
Quarter_2	0.0827***	1.086
Quarter_3	-0.00613	0.994
Income_2	0.2539***	1.289
Income_3	0.2370***	1.267
Income_4	0.2422***	1.274
Income_5	0.3601***	1.434
Income_6	0.1608***	1.174
Income_7	0.1777***	1.194
Income_8	0.2098***	1.233
Income_9	0.1806***	1.198
Income_10	0.1488***	1.160
Income_11	0.1463***	1.158
Income_12	0.1777***	1.194
Income_13	0.1649***	1.179
Income_14	0.1489***	1.161
Income_15	0.1335***	1.143
Income_16	0.3075***	1.360
BALTIMORE	0.6952***	2.004
CHICAGO	1.0315***	2.805
CINCINNATI	0.5762***	1.779
CLEVELAND	0.5624***	1.755
DALLAS	0.4821***	1.619
DENVER	0.7768***	2.174
DES MOINES	0.6363***	1.890
DETROIT	0.2086***	1.232
HARTFORD	0.5274***	1.695
HOUSTON	0.5283***	1.696
INDIANAPOLIS	1.3924***	4.024
KANSAS CITY	1.0693***	2.913
LITTLE ROCK	0.5665***	1.762
LOS ANGELES	0.5237***	1.688

LOUISVILLE	0.3170**	1.373
MIAMI	1.0937***	2.985
MILWAUKEE	1.2755***	3.580
MINNEAPOLIS	0.6883***	1.990
NASHVILLE	0.6119***	1.844
NEW ORLEANS	0.9387***	2.557
NEW YORK	0.4046***	1.499
OKLAHOMA CITY	0.8541***	2.349
OMAHA	0.8602***	2.364
PHILADELPHIA	0.5258***	1.692
PHOENIX	0.3778***	1.459
PITTSBURGH	0.3855***	1.470
SALT LAKE CITY	0.6332***	1.884
SAN FRANCISCO	0.5909***	1.806
SEATTLE	0.8131***	2.255
SPOKANE	0.6032***	1.828
ST LOUIS	1.4671***	4.337
WASHINGTON	0.5826***	1.791

Association of Predicted Probabilities and Observed Responses

Percent Concordant	55.3
Percent Discordant	43.3
Percent Tied	1.4
Pairs	30068824929

Figure 1: Descriptive Statistics by Income Group

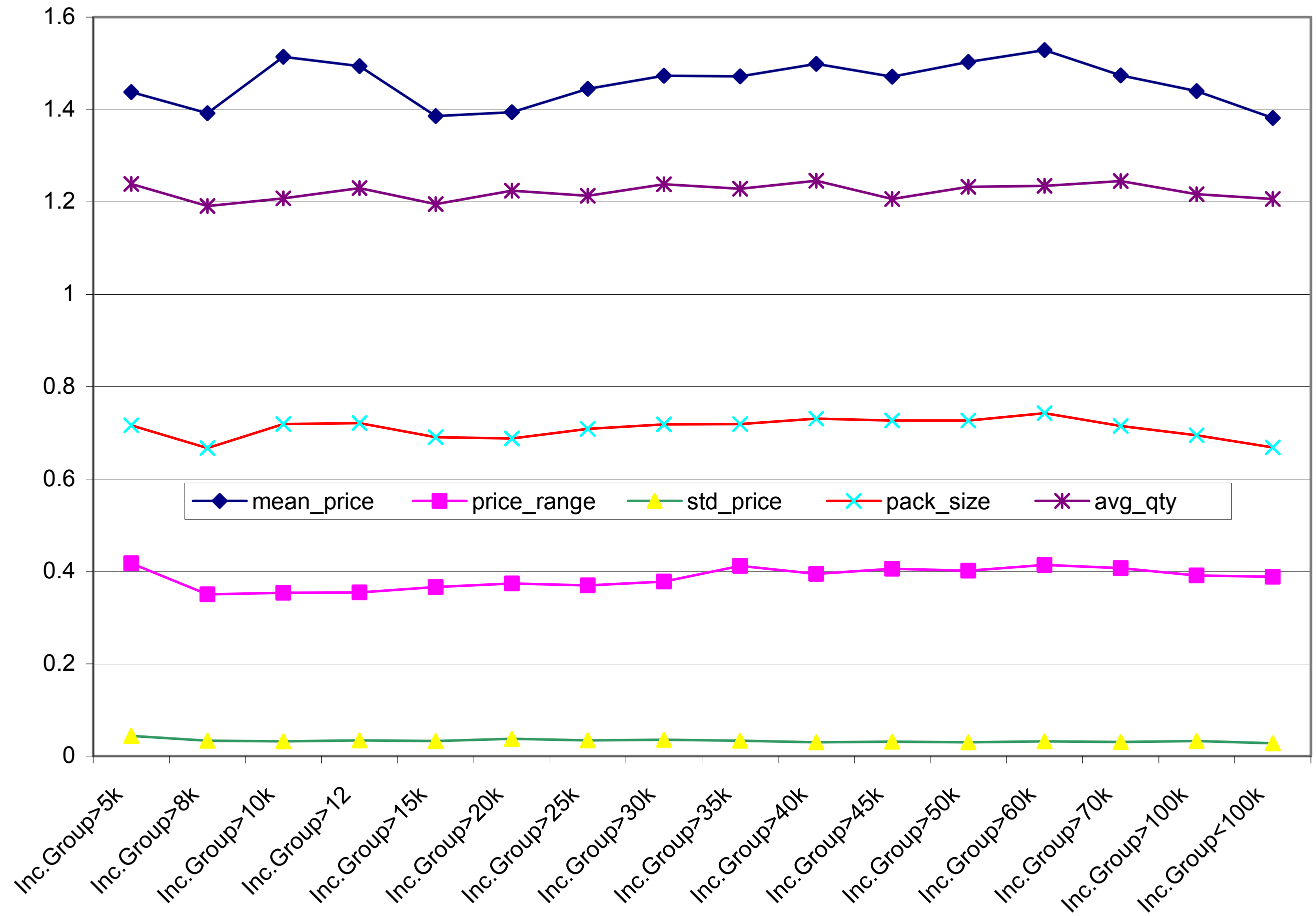
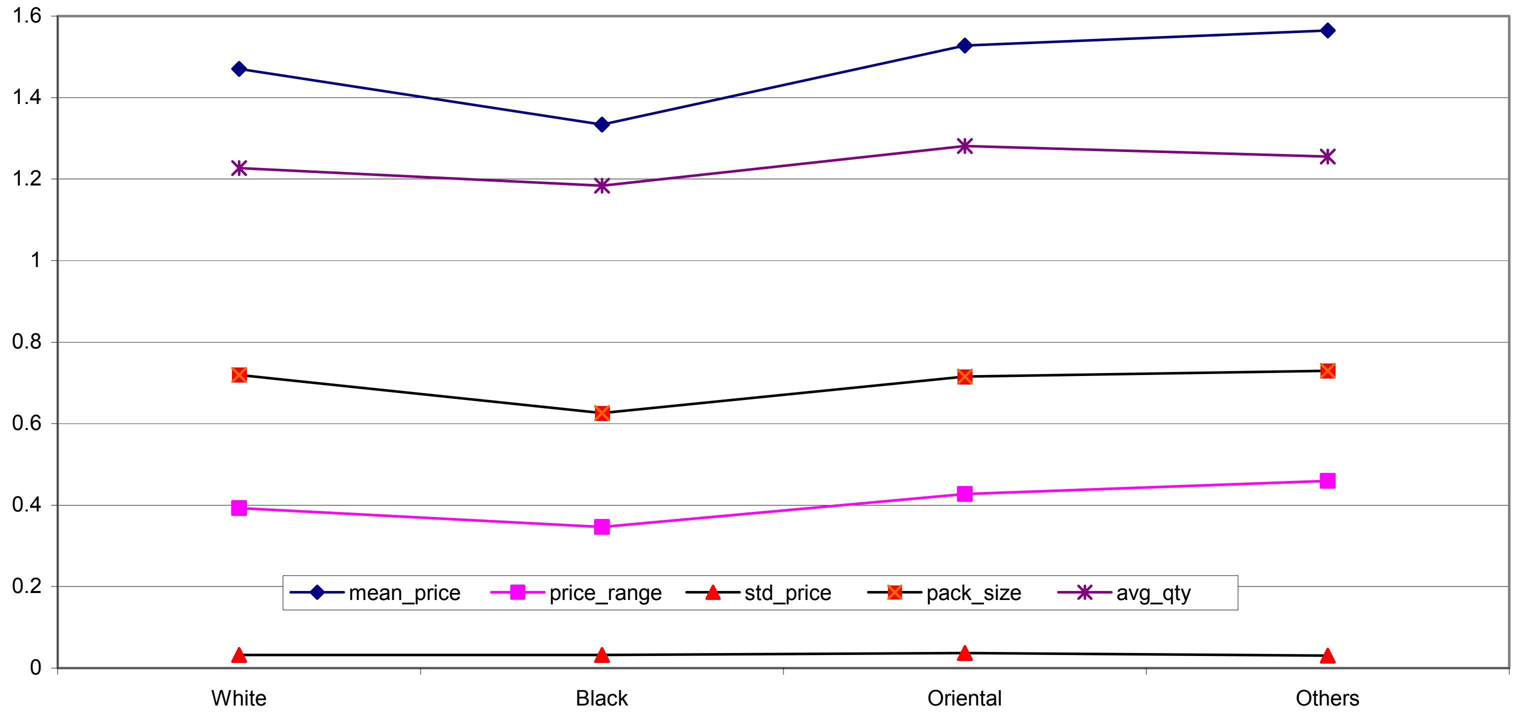


Figure 2: Descriptive Statistics by Race



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