Demand Analysis of Fluid Milk with Different Attributes

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I. Introduction

This study analyzes demand for fluid milk at various levels of the industry. Adopting the multi-stage demand system approach and refined segmentation, we estimate price elasticities at both brand level and commodity group level and provide several policy implications. Consumer responsiveness to price changes measured at various levels provides important economic implications to firms that formulate pricing strategy, and to policymakers who regulate the market and public health through taxation.

For the last decades, U.S. fluid milk market has experienced drastic changes as consumers' perception of the quality of milk changes. First, consumer preference for milk fat has changed. Until the mid-60s, consumers valued whole milk more than reduced fat or low fat milk because they regarded milk with less fat as what was left when the cream was extracted from raw milk to produce butter and cheese. As the concern for cholesterol arose in 1960s, however, consumer taste for milk has moved to lower fat milk. As a result, consumption of lower fat milk started increasing and the amount of lower fat milk sales became larger than that of whole milk by the end of 1980s. In addition, substitutes such as soy milk and rice milk became available in the market, and the consumption of those products has been on the rise. More recently, consumer concerns have moved to issues related to environment, genetically modified organisms and animal welfare (Alviola and Capps 2010). As a result, sales of organic milk increased (Dimitri and Venezia, 2007) since mid-90s while overall consumption milk remained relatively constant over the same period (USDA, Food Availability Data System).

Previous research on demand for fluid milk has made important contributions to the understanding of the changes in the market. Cornick et al. (1994) examined socio-economic factors affecting expenditures of skim milk, reduced-fat milk and whole milk. Gould (1996) found that whole milk, 2% milk, and skim milk are all substitutes for one another. Gould's findings also confirm that demographic characteristics significantly affect milk demand. Dhar and Foltz (2005) considered demand relationships for rBST free milk, organic milk, and unlabeled (conventional) milk through the estimation of a Quadratic Almost Ideal Demand System (QUAIDS). They conclude that rBST free milk and organic milk are complements, conventional milk and rBST free milk are substitutes, and conventional milk and organic milk are substitutes. Additionally, Dhar and Foltz estimate how much consumers benefit from the introduction of rBST free milk and organic milk. Alviola and Capps (2010) analyze demand for conventional and organic milk using household level data. The findings reveal that organic and conventional milk are substitutes.

This study contributes to the literature in several ways. First, by applying more refined segmentation to the fluid milk market, this study provides more precise substitution patterns. While the previous studies categorize milk products with either fat content or organic claim, we categorize them with both fat content and organic claim, and flavor. In this way, our demand analysis reveals different implications on substitution. In addition, this study examines substitutability among products produced by different manufacturers by estimating the demand at brand level. To the best of our knowledge, there has not been any study on brand level demand estimation. Finally, while recent studies focus on demands for organic milk, studies on different fat milk may not reflect current market demand.

Hausman's three stage demand system approach is adopted to estimate the demands for milk at various levels of the industry. The first stage demand is defined as total demand of milk; the second stage is defined as demands for group commodities; the third (lower) stage estimates brand level demands within groups. The econometric functional form of demand equations are specified as Linear Approximate Almost Ideal Demand System (LA/AIDS). In order to control factors that affect consumer preference other than fat content, flavor and organic claim are included when we define the group commodities in the second stage of the model. Heteroskedastic Tobit model is employed at the brand level demand estimation to account for zero purchasing behavior. Unconditional (on the expenditure) elasticities among brands and group commodities are estimated using the methodology suggested by Carpentier et al.(2001). AC Nielsen Homescan data from 2004 to 2005 is used for the analysis.

Descriptive statistics from Nielsen Homescan data are presented in section II. Section III explains model specification and estimation techniques for demand analysis and the results are shown in section IV.

II. Data

As mentioned above, the data used in this study are the Nielsen Homescan panel data. The sample is selected among volunteers based on both demographic and geographic targets. Stratification is done by AC Nielsen to ensure that the sample matches the U.S. Census. The panelist members are required to scan the items purchased with handheld scanner and transfer the information to AC Nielsen each week. Thus, the data are recorded on a weekly basis. Unobserved data should be interpreted as infrequency of sales rather than infrequency of records since it is mandatory for the members to transfer data every week. If a member fails to comply with the rule and does not report more than a month, then the panelist membership is terminated.

The nationally representative sample consists of purchase histories of milk products by 49,114 households from 2002 to 2005. 8,866 households participated in 2002, 18,539 households in 2003, 40,327 and 37,338 households in 2004 and 2005 respectively. The sample contains information on demographics such as income, household size, age of head, number of child, employment, education and race. Demographic distributions are presented in <Table1>. Half of the sample is from under $45,000 income class and the other half is from above $45,000 income class. More than half of the households consist of single or two members, and 75 percent of the sample have no children under 18. 72 percent of male or female household heads are employed more than 30 hours a week and 70 percent of them have at least college degree. The shares of organic milk purchase by different demographic characteristics are provided in <Table 2>. Households with small number of members tend to purchase more organic milk than large families, middle income class is less likely to purchase organic milk than low income and high income classes. Also, the data show that the households only with under-6-year-old children are relatively more likely to purchase organic milk than any other households.

A number of physical product characteristics, weekly market level prices and quantities purchased are also included in the data. Important characteristics to differentiate milk products are fat contents, flavor and organic claim[1]. The fat contents are categorized into five types; non-fat, 1% low fat, 2% reduced fat, whole milk and soy&lactose-free milk. Flavor is categorized into flavored and not flavored. <Table 3> provides the market shares of products distinguished by these characteristics each year. 2% reduced fat milk brings the largest share of milk sales up to 35% during the period, and the market shares of 2% milk and whole milk have decreasing trends while the shares of non-fat, low fat and soy&lactose-free milk have moderately increasing

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[1] Some of variables such as fat contents and flavors are not precisely recorded so that those variables are created from the UPC (Universal Product Code) description.

trends. The share of organic milk vs. non-organic milk also shows an increasing trend in this sample.

In this study, a product is defined at the brand level with three different characteristics of products; fat contents, organic claim, flavored or not. Many kinds of flavors are consolidated into flavored for simplicity. Different fat contents of a brand are treated as different products, and organic milk and non-organic milk of a same brand are treated as different products as well. Different brands with same fat contents and flavor and the same organic claim are, of course, regarded as different products. But different sizes and different types of containers are not distinguished in the products defined in this study. The commodity groups are aggregated across different brands with the same characteristics. For example, the 2% reduced fat-organic-unflavored group commodity milk is an aggregation of different products within the group of 2% reduced fat-organic-unflavored milk. Hence, there are 20 group commodities with the categorization mentioned above. The quantities of group commodities are the aggregation across brand level products with same characteristics and their prices are the price indices of each group. In terms of time frequency, weekly purchase data are aggregated into monthly records in order to minimize infrequency problem. According to the definition of product above, there exist 1,902 products in the nation. However, it is notable that specific brands of milk appear only in specific areas and only a few brands dominate the local markets while a large number of residuals take only 1~5% of market share. Hence, it is concluded that the brand-level milk market is highly localized and dominated by a few brands so this study needs to focus on some specific market. Raleigh-Durham-Chapel hill and Charlotte markets are chosen and brands with market share larger than 1% are considered.

1,634 households participated in the survey from 2002 to 2005 in RDU (Raleigh-Durham-Chapel hill and Charlotte) area. 103 households participated in 2002, 481 households in 2003, 1440 households and 1319 households in 2004 and 2005 respectively. Among the panelists, 471 households participated for one year and 1004 households participated for two years. There are 80 households and 47 households who participated for three and four years, respectively. The demographics in this area show similar features as the national demographics. However, although AC Nielsen established organic variable since 2002, the data before 2004 imply that organic cow milk is not introduced or the consumer perceptions of organic products are lacking in this market. The organic purchases are occurred only in soy milk category according to the data during 2002 and 2003. Therefore, the data from 2004 to 2005 are used to estimate consumer demand and the welfare effects are analyzed under the assumption that organic cow milk is introduced in this area since 2004. The price values of conventional milk prior to 2004 are used to calculate the price effects in the welfare analysis. The shares of each type of milk sales are described in <Table 4>. The figures are similar to the national sample. The organic milk takes about 2.5 percent of the milk market and the 2% reduced fat milk takes the largest share.

There exist 249 products in the area, but only 58 products take more than 97% of the milk market. Hence, only the 58 products are included in this study. The products can be categorized into 20 groups according to the characteristics mentioned above, which are fat contents, flavor and organic claim. Market shares and average prices of products in each group, and the number of brands with larger than 1% of market share within each group are shown in <Table 5>. Conventional non-flavored non-organic milk dominates the market with 92% market share. Soy and lactose free milks are priced higher than cow milk among non organic milk. Organic cow milk has higher per unit prices than conventional cow milk as expected, but soy and lactose free milk are not priced differently between organic and non organic.

III. Model

1) Multi Stage Demand System

Hausman's three stage demand systems approach is adopted to estimate the demands of milk. The first stage demand is defined as total demand of milk; the second stage is defined as demands for group commodities; the third (lower) stage estimates brand level demands within groups. It is assumed that the direct utility function is weakly separable into sub-utilities and the current weighted true cost of living price indices for each groups vary only slightly with corresponding sub-utility levels so that the empirical variation of price index with sub-utilities can be neglected. The latter assumption allows to avoid strong assumptions, such as strong separability or homothetic preference, in the upper stage of demand system (Carpentier and Guyomard, 2001). The econometric functional form of brand level demand equation is specified as Linear Approximate Almost Ideal Demand System (LA/AIDS):

$$(1) \quad w_{it} = \alpha_{it} + \sum_{j=1}^{n} \gamma_{ij} \ln\left(p_{jt}\right) + \beta_i \ln\left(\frac{m_t^G}{P_t^G}\right) + \varepsilon_{it}, i, j \in G, i, j = 1, 2, ..., n$$

where $i = 1, 2, ..., n$ denotes the brands of milk in group G and t denotes time period. p_{jt} are the price of product j consumers face in time period t. m_t^G are total group expenditure on group G in period t, that is, $m_t^G = \sum_{i=1}^{n} p_{it} q_{it}$ and ε_{it} is an error term. P_t^G is the Linear Approximate AIDS price index of brands in group G period t.

In order to estimate the group commodity demand in the second stage, Stone Index is computed for the price indices of each segment using mean values of market shares of each brand. LA/AIDS is used to specify the middle level equation. (Hausman states in his paper that the difference in functional form does not make difference in outcomes.)

$$(2) \qquad q_{mt} = \beta_m \ \log \frac{y_{Bt}}{P_t^B} + \sum_{k=1}^{M} \delta_{ij} \log \pi_{kt} + e_{mt}$$

m = 1, …, M, t = 1, …, T

where q_{mt} is the share of segment m in period t, $y_{Bt}$is total milk expenditure, and π_{kt} is segment price indices in the period of t.

The first level equation, which explains the overall demand for milk, can be specified as

$$(3) \qquad \log u_t = \beta_0 + \beta_1 \log y_t + \beta_2 \log \prod_t + Z_t \delta + e_t$$

where ut is overall consumption of milk, yt is disposable income, πt is price index for milk, and Zt are the variables that account for time trends.

2) Specification and Estimation

As I mentioned above, data used in this study are micro-level survey data. When it comes to demand analysis using this type of data, one cannot avoid the issue that some products are not consumed by at least some economic agents in some periods. Even though the data used in this study for the lower level of multistage demand equation are not disaggregated as to the household level, the data are still disaggregated to some degree of brand level and indicate zero purchases for some brands in some periods.

Setting aside the difficulties of estimating latent dependent variable models, missing regressor difficulties are first encountered because prices are not observed for non purchased products. Three simple solutions for this problem are 1) to discard all incomplete observations and estimate population parameters using the remaining observations, 2) to use zero-order methods which substitute sample means for the missing values, and 3) to use first-order methods which substitute predicted values from simple regression for the missing values. However, these methods are criticized because of sample selection bias. Many researchers suggest various missing value procedures mostly utilizing demographic or product characteristics. For example, Heckman procedure and Amemiya's principle require both regressands and regressors in demand systems to be endogenous so that the variability of regressors can be explained with other exogenous variables. However, in multi-stage demand approach, it is impossible to incorporate quality adjusting price equations because the assumption of separability does not allow volatilities in the exogenous variables that explain price variation, such as characteristics of products. Therefore, a simple regression method seems to be the only feasible approach to treat the missing price problems. The unobserved unit prices are predicted following Perali and Chavas (2000). The unit prices at UPC level were regressed on characteristics variables, time variables, regional dummies, and interaction terms between characteristics and time variables. The least square results show 0.54 of R-square, but statistically significant coefficients.

Another issue with regard to using micro-level purchasing data is to take the zero purchasing behavior of consumers into account in analysis. This indicates corner solution outcomes of consumer utility maximization problem, which are rational decisions of economic agents. Thus, a Tobit model is suggested to explain the corner solutions.

$$w_{it} = \begin{Bmatrix} w_{it}^* & if \;\; w_{it}^* > 0 \\ 0 & if \;\; w_{it}^* \leq 0 \end{Bmatrix}$$

Assuming random utility hypothesis (RUH) and PIGLOG class utility function, the Marshallian uncompensated demand functions at the household level can be specified as follows:

$$(4) \qquad w_{iht}^{*} = \alpha_{iht} + \sum_{j=1}^{n} \gamma_{ij} \ln\left(p_{jht}\right) + \beta_i \ln\left(\frac{m_{ht}^{G}}{P_{ht}^{G}}\right) + \tilde{\varepsilon}_{iht}, i, j \in G, i, j = 1, 2, ..., n$$

where $i = 1, 2, ..., n$ denotes the i's milk product in the demand system, h denotes the household, t denotes the time period. p_{jht} is the price of product j household h faces in time period t. m_{ht} is household h's total group expenditure on milk products in period t, that is, $m_{ht}^{G} = \sum_{i=1}^{n} p_{iht} q_{iht}$ and P_{ht}^{G} is the Linear Approximate AIDS price index for household h in period t. $\tilde{\varepsilon}_{iht}$ is an error term that is heteroscedastic within the share equation for one good and correlated across the share equations for different goods. $\tilde{\varepsilon}_{iht} = \varepsilon_{iht} - \beta_i \sum_j \ln p_{jht} \varepsilon_{jht}$. ε_{jht} is mean zero homoskedastic error term from utility function.

$$(5) \qquad \log P_{ht}^{G} = \sum_{i=1}^{n} w_{ih}^{0} \log(p_{iht}) \text{ where } w_{ih}^{0} = \frac{1}{T} \sum_{t=1}^{T} w_{iht} .$$

Household heterogeneity α_{iht} might be specified as

$$(6) \qquad \alpha_{iht} = \rho_{i0} + \sum_{k=1}^{s} \rho_{ik} d_{kht} + \rho_{i(s+1)} t + \rho_{i(s+2)} t^2 + c_h$$

Since I have aggregate data, however, the demand function above should be aggregated over households. Aggregating (4) over household yields

$$(7) \qquad w_{it}^{*} = \alpha_{it} + \sum_{j=1}^{n} \gamma_{ij} \ln\left(p_{jt}\right) + \beta_i \ln\left(\frac{m_{t}^{G}}{P_{t}^{G}}\right) + \tilde{\varepsilon}_{it}, i, j \in G, i, j = 1, 2, ..., n$$

where

$$w_{it}^{*} = \frac{\sum_{h} m_{ht} w_{iht}}{\sum_{h} m_{ht}}, \qquad \tilde{\varepsilon}_{it} = \frac{\sum_{h} m_{ht}^{G} \tilde{\varepsilon}_{iht}}{\sum_{h} m_{ht}^{G}}, \qquad \alpha_{it} = \rho_{i0} + \rho_{i1} t + \rho_{i2} t^2$$

Therefore, heteroskedastic Tobit model with the two-step estimation approach is adopted for the lower stage demand estimation.

The first and the second stage demand do not require Tobit approach because the aggregated data used in the higher stage do not show the evidence of corner solution outcomes. However, the error terms might not be homoskedastic any longer. Based on the assumption of Random Utility Hypothesis, disturbances of uncompensated demand functions will be heteroskedastic according to the same logic provided above. Hence, the conventional demand systems given in equation (2) and (3) with SUR approach are adopted for the higher stage demand estimation.

Two step estimation

Estimating censored demand system is not an easy task because it involves multiple probability integrals. In the early applications (Wales and Woodland (1983), Lee and Pitt (1986, 1987)), researchers were only able to analyze small systems by taking multiple integrals. Because of recent development in simulation techniques, researchers can numerically evaluate multiple probability integrals and some alternative methods with large system applications are suggested. An application of the simulated maximum likelihood (SML) approach is seen in Kao, Lee and Pitt, and the quasi maximum likelihood (QML) approach which approximates the multivariate likelihood function with a sequence of bivariate function can be seen in Yen, Lin and Smallwood (2003). An alternative that does not involves complicated computational tasks, which is known as two-step estimation, is proposed by Perali and Chavas (2000) and later extended to the panel data framework by Meyerhoefer, Ranney and Sahn (2005). This study adopts Meyerhoefer's two-step estimation because the approach is generalized to the application of panel data while others are applied only with cross-section data and its computational procedure is relatively simple comparing to other approaches.

The basic idea of the two-stage procedure is to estimate an unrestricted heteroskedastic Tobit model equation by equation and find the error correlations, and then recover restricted parameters using the minimum distance method which falls into the GMM framework.

In the first step, the share equation for ith product (7) can be rewritten as follow

$$(8) \qquad w_{it}^{*} = \rho_{i0} + \sum_{j=1}^{n} \gamma_{ij} \ln\left(p_{jt}\right) + \beta_i \ln\left(\frac{m_t^G}{P_t^G}\right) + \tilde{\varepsilon}_{it},\ i, j \in G, i, j = 1, 2, ..., n$$

$$\text{where } \tilde{\varepsilon}_{it} = \frac{\sum_h m_{ht}^G \tilde{\varepsilon}_{iht}}{\sum_h m_{ht}^G}, \qquad \tilde{\varepsilon}_{iht} = \varepsilon_{iht} - \beta_i \sum_j \ln p_{jht} \varepsilon_{jht}\ .$$

ρ_{i0} is product specific fixed effect. As $\tilde{\varepsilon}_{iht}$ is heteroscedastic within each equation and correlated across equations, so does $\tilde{\varepsilon}_{it}$. To get consistent first-step estimates, a heteroscedastic Tobit econometric model is employed for each equation. The variance of the error term is specified using a fairly flexible and general form

$$(9) \qquad Var(\tilde{\varepsilon}_{it}) = \sigma_i^2 \exp\left(z_{it}^{'} \xi_i\right)$$

where z_{it} is a s_z-dimensional vector of variables for product i in period t. Variables of t, t^2, $\log p_{it}$ and $\log \frac{m_t^G}{P_t^G}$ were included in z_{it} at first, but only $\log \frac{m_t^G}{P_t^G}$ is included because the other variables seem to hamper the optimization procedure without improving the goodness of fit of the model. As the estimation is conducted for each share equation separately without imposing cross-equation parameter restrictions implied by demand theory, the estimates I obtain from this step are reduced form estimates. In order to recover restricted estimates, reduced form parameter estimates are collected in the vector $\hat{\pi} = \left(\hat{\pi}_1^{'},...,\hat{\pi}_n^{'}\right)^{'}$, where $\hat{\pi}_i$ is a $(n + s_z + 2)\times 1$ vector of reduced form parameter estimates from the i's equation. In the second step of estimation, the cross equation restrictions implied from demand theory are imposed on the reduced form parameters estimated in the first step, and the structural parameters that are consistent with demand theory are calculated. Denote a q-dimensional vector of structural parameters as ψ, then the structural parameters are obtained from the following GMM estimation procedure

$$(10) \qquad \min_{\psi}\left[\hat{\pi} - h(\psi)\right]^{'} \hat{\Omega}^{-1}\left[\hat{\pi} - h(\psi)\right]$$

where $h(\psi)$ is a nonlinear mapping ψ into π that is used to impose the theoretical restrictions on the reduced form parameters. The number of restrictions imposed is $(n + s_z + 2)\times n - q$, which is equal to (n-1)*n/2+n+2. Under the null hypothesis that these restrictions are correct, the minimized value of objective function (10) is a chi-square distributed random variable with degree of freedom equals to the number of observation minus the number of restrictions.

The difficulty arises in finding a consistent estimate of Ω. Meyerhoefer et al. (2005) states that the covariance-variance matrix for $\hat{\pi}$ takes the form $\Omega = D_1^{-1}D_2D_1^{-1}$ and the proof is provided in his unpublished dissertation (2002). If $g_t = \left(g_{1t}^{'},...,g_{nt}^{'}\right)^{'}$ denotes the vector of univariate scores from all of the n equations corresponding to the observation in period t, and H_{it} the univariate Hessian from the i's equation for the same observation, then $D_1^{-1} = diag\left\{E(H_{1t})^{-1},...,E(H_{nt})^{-1}\right\}$ and $D_2 = E\left(g_t g_t^{'}\right)$. A consistent estimator for Ω can be obtained by replacing the population moments by their sample counterparts. However, this might not work for this study because the data used in this study do not meet with the condition for large sample theory. These are two years' monthly data so that the number of observations for each brand is at most 24. The data for specific types of milk such as organic milk are established recently, thus very short strings of data are available for special types of milk.

The finite sample properties of GMM estimator seem to be an interesting topic among the econometricians in mid 90s. The July 1996 issue of Journal of Business and Economic Statistics is full of papers on the small sample properties of GMM estimator proposing alternatives for consistent estimator of weighting matrix. Although they are looking at slightly different issues of small sample properties, their conclusions converge to one that the equally weighted matrix, which is equivalent to identity matrix, dominates covariance matrix (or the proposed matrix) in terms of the bias of estimator and over identification test statistics. Therefore, the identity matrix is used in this study.

Elasticities

The unconditional expectation for the budget shares including all the observations is

$$E(w_{it}) = \Phi_i(\bullet)\times\left[\rho_{i0} + \sum_{j=1}^{n}\gamma_{ij}\ln\left(p_{jt}\right) + \beta_i \ln\left(\frac{m_i^G}{P_i^G}\right)\right] + \sigma_i^2 \exp\left(z_{it}^{'}\xi_i\right)\times\phi_i(\bullet) \tag{11}$$

$$\text{where} \quad \bullet = \frac{\left[\rho_{i0} + \sum_{j=1}^{n}\gamma_{ij}\ln\left(p_{jt}\right) + \beta_i \ln\left(\frac{m_i^G}{P_i^G}\right)\right]}{\sqrt{\sigma_i^2 \exp\left(z_t^{'}\xi_i\right)}}$$

The uncompensated own price, cross price and expenditure elasticities that are conditional on the group expenditure but unconditional on whether the observed budget share is zero or positive can be derived as

(12)

$$e_{iit} = -1 + \frac{\partial E(w_{it})}{\partial p_{it}} \frac{p_{it}}{E(w_{it})} = -1 + \frac{\Phi_i(\bullet) \times \left[\gamma_{ii} - \beta_i w_i^0\right] - \frac{1}{2}\left[\phi_i(\bullet) \times \sqrt{\sigma_i^2 \exp\left(z_{it}^{'}\xi_i\right)} \times \xi_i \times w_i^0\right]}{E(w_{it})}$$

(13) $$e_{ijt} = \frac{\partial E(w_{it})}{\partial p_{it}} \frac{p_{it}}{E(w_{it})} = \frac{\Phi_i(\bullet) \times \left[\gamma_{ij} - \beta_i w_j^0\right] - \frac{1}{2}\left[\phi_i(\bullet) \times \sqrt{\sigma_i^2 \exp\left(z_{ht}^{'}\xi_i\right)} \times \xi_i \times w_j^0\right]}{E(w_{it})}$$

where $$E_{it} = 1 + \frac{\left[\beta_i \times \Phi_i(\bullet)\right] + \frac{1}{2}\left[\phi_i(\bullet)\xi_i \sqrt{\sigma_i^2 \exp\left(z_{ht}^{'}\xi_i\right)}\right]}{E(w_{it})}$$

The mean of elasticities over time are provided in the results section.

$$e_{ij} = \frac{1}{T}\sum_{t=1}^{T} e_{ijt}$$

Unconditional (on expenditure) elasticities are computed following Carpentier and Guyomard (2001). The relationships between second-stage (i.e., conditional) and first-stage (i.e., unconditional) expenditure and price elasticities are established under the assumptions of weakly separable direct utility function and the approximate independence of the true cost of living indices with respect to sub-utility levels. Carpentier and Guyomard provide formulas with two-stage budgeting application, but the results are generalized to the three-stage budgeting application following Edgerton (1997).

IV. Results

We applied the econometric approach outlined above to the A.C. Nielsen Homescan data to estimate the system of milk demand equations. The estimates of equation (3), top level demand function, directly give the own price elasticity and the income elasticity, which are -0.2 and 0.88, respectively, in the RDU market. The milk price index in this market is calculated with the given data, the regional disposable income is indirectly obtained from Bureau of Economic Analysis (BEA) and Bureau of Labor Statistics (BLS).

Elasticity estimates for the second stage demand system are provided from <Table 6> to <Table 7>. The second stage demand equations are estimated both with and without the variables that account for time trend. The results partly conflict, but overall implications are not different between two models. Thus, the results with time trends are discussed in this section because the model shows better fits. The value of minimization objective function is smaller and the number of significant estimates at 10% level is larger for the model with time trends. <Table 6> and <Table 7> show conditional and unconditional elasticity estimates, respectively. The elasticities are estimated at the mean of variables. Statistical significances are tested for the conditional elasticity and 108 estimates out of 272 are statistically significant at 10% level. The estimates are very similar between conditional and unconditional elasticities. Thus, the analysis provided below is based on the conditional elasticities because the significance tests are conducted for the conditional elasticities.[2]

All types of milk, except the organic-flavored soy/lactose free milk, show negative own price elasticity. Own price elasticities of conventional milk are ranged from -1.36 to -2.71. For example, a 1% increase (decrease) in the price of conventional-unflavored-fat-free milk translates to a 1.81% decrease (increase) in the quantity demanded for the product. The range of own price elasticities of organic milk are larger as between -1.00 and -7.34. For example, the quantity demanded of organic-1%-unflavored milk decrease (increase) by 7.34% as its own price increase (decrease) by 1% while the quantity of organic-2%-unflavored milk decrease (increase) by only 1% against a 1% increase (decrease) of own price. Sensitivities to own price changes

[2] Statistical significances are tested only for conditional elasticities because the test is computationally demanding for unconditional elasticities. Tests for unconditional elasticities can be done upon request.

measured in this study are larger than the sensitivities found in Dhar and Foltz (own price elasticities of conventional and organic milk are -1.04 and -1.37~-4.4, respectively) and Alviola and Capps (own price elasticities of conventional and organic milk are -0.87 and -2.00, respectively).

Cross price elasticities also indicate different substitution patterns from previous studies. First, cross price elasticities between organic and conventional milk with same fat contents and flavor do not confirm the substitutability between organic and conventional milk while Aviola and Capps conclude that the two are substitutes. Organic-1%-unflavored and conventional-1%-unflavored milk have positive cross price elasticities (17.60 and 0.22) implying they are substitutes for each other. On the other hand, organic and conventional unflavored whole milk have negative cross price elasticities (-9.92 and -0.11) suggesting that they are complements to each other. 2% fat milk and soy/lactose-free milk also have negative cross price elasticities between organic and conventional although they are not statistically significant. Therefore, it is hard to conclude that the two types of milk are substitutes to each other. It is notable that the magnitude of substitution is not symmetric implying that the amount of organic milk consumption change when the conventional milk price changes is larger than the amount of conventional milk change when the organic milk price changes. Second, cross price elasticities indicate that only products with similar fat contents are substitutes for one another although it is not always the case, while Gould (1996) concludes that whole milk, 2% fat milk and skim milk are all substitutes for one another. For example, within the group of conventional unflavored milk, our cross-price elasticities indicate that conventional-fat-free-unflavored milk and conventional-low-fat-unflavored milk have significant positive cross price elasticities (1.52 and 2.50) and reduced fat and whole milk also have positive cross price elasticities (2.07 and 1.71) suggesting that fat-free and low-fat, and reduce-fat and whole milk are substitutes respectively. However, whole milk and fat-free milk or whole milk and low-fat milk show negative cross price elasticities that are statistically not significant. The results also imply that soy/lactose free milk is substitutable with fat free milk while it is not substitutable with other types of cow milk.

Elasticity estimates at the brand level are provided in <Table 8>. An implication can be found between private labeled milk and brand milk products. Private labeled milk products (labeled as alphabet B in <Table 8>) are substitutes for the other brand milk products within the same type of products, but not vice versa. For example, within the group of conventional-2%-unflavored milk (group 3 in <Table 8>), the quantity of brand B (private label) demanded increases (decreases) by 0.78% as the price of brand A increases (decreases) by 1% while the quantity of brand A demanded decrease (increase) by 0.57% against a 1% increase (decrease) in the price of private labeled milk.

V. Conclusion

The results from multi-stage demand estimation indicate that organic milk and conventional milk are neither substitute nor complement to each other when milk products are categorized differently from the previous studies. Our finding is consistent with the implications from the welfare (willingness to pay) studies that consumers are willing to pay significantly more to buy organic milk than to buy conventional milk. The magnitude of consumer surplus is in general a function of how closely substitutable consumers view the new products (organic milk) and existing products (conventional milk). A new product that is more closely substitutable with existing products will add less consumer surplus (Hausman and Leonard, 2002).

In addition, this study provides some implications to policy makers whose concern is in fat consumption. As consumers' concern on milk fat increases, some of European countries consider fat tax as part of the solutions to obesity problem. Demark introduced fat tax on milk in 2010, and Britain is also considering the introduction of tax on milk fat. Although this study does not address the effects of fat tax and the fat tax is not currently considered in the U.S., the cross price elasticities estimated in this study can provide implications to policy makers regarding fat policy by examining how consumers would react to the price changes in fluid milk products with different fat contents.

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<Table 1> National Demographic Distribution

Income	%	Size	%	Age	%	Age Of Child	%	Employ ment	%	Edu	%
Under $5000	0.82	Single Member	25.35	Under 25 Years	0.48	Under 6 only	3.78	0	37.78	0	30.2
5000-7999	1.26	Two Members	37.99	25-29 Years	2.9	6-12 only	6.32	1	62.22	1	69.8
8000-9999	1.12	Three Members	15.03	30-34 Years	6.33	13-17 only	8.11				
10,000-11,999	1.65	Four Members	13.17	35-39 Years	8.95	Under 6 & 6-12	3.32				
12,000-14,999	2.95	Five Members	5.55	40-44 Years	12.13	Under 6 & 13-17	0.55				
15,000-19,999	5.39	Six Members	1.93	45-49 Years	13.73	6-12 & 13-17	4.3				
20,000-24,999	7.67	Seven Members	0.6	50-54 Years	13.18	Under 6 & 6-12 & 13-17	0.88				
25,000-29,999	6.74	Eight Members	0.26	55-64 Years	21.48	No Children Under 18	72.74				
30,000-34,999	7.89	Nine+ Members	0.13	65+ Years	20.83						
35,000-39,999	6.92										

40,000-44,999	6.83										
45,000-49,999	6.39										
50,000-59,999	11.03										
60,000-69,999	8.86										
70,000-99,999	15.17										
100,000 & Over	9.29										

<Table 2> Organic vs. Non-organic Shares by Demographics

org	Household Size								
	1	2	3	4	5	6	7	8	9
0	95.43	97.05	98.06	97.66	98.29	99.38	99.89	100	100
1	4.57	2.95	1.94	2.34	1.71	0.62	0.11	0	0

org	Household Income															
	3	4	6	8	10	11	13	15	16	17	18	19	21	23	26	27
0	99.39	97.45	95.37	95.42	99.39	97.22	97.38	98.27	99.06	96.93	96.67	97.68	96.38	98.32	97.42	94.45
1	0.61	2.55	4.63	4.58	0.61	2.78	2.62	1.73	0.94	3.07	3.33	2.32	3.62	1.68	2.58	5.55

Org	Age of Children								Employment		Education		Marital Status	
	1	2	3	4	5	6	7	9	0	1	0	1	0	1
0	97.27	98.07	98.98	96.29	84.8	97.81	99.63	97.05	97.24	97.29	98.65	96.56	95.73	97.79
1	2.73	1.93	1.02	3.71	15.2	2.19	0.37	2.95	2.76	2.71	1.35	3.44	4.27	2.21

Org	Age of Head									Race			
	2.5	2.7	3.2	3.7	4.2	4.7	5.2	5.7	6	1	2	3	4
0	99.75	96.36	98.11	97.02	97.23	98.08	96.54	97.01	97.37	97.54	94.74	96.34	99.41
1	0.25	3.64	1.89	2.98	2.77	1.92	3.46	2.99	2.63	2.46	5.26	3.66	0.59

<Table 3> Market Shares by Fat Contents and Organic Claim

	2002	2003	2004	2005
non-fat	23.89	24.03	24.51	27.63
1% low fat	16.92	17.05	18.17	20.06
2% reduced	35.19	34.68	35.80	29.51
whole	21.41	20.78	18.28	19.00
soy & lactose free	2.59	3.46	3.25	3.80

non-organic	98.38	97.75	97.81	97.53
organic	1.62	2.25	2.19	2.47

<Table 4> Market Share by Fat Contents and Organic Claim in RDU

	2004	2005
non-fat	24.7	27.19
1% low fat	15.2	15.38
2% reduced	30.62	28.38
Whole	25.4	24.44
soy & lactose free	4.08	4.61
Non-organic	97.5	97.23
Organic	2.5	2.77

<Table 5> Description of Group in RDU

group	Fat contents	Organic	Flavor	Share	average price per fluid oz	Number of brands
1	No fat	Nonorganic	No flavor	24.59	0.028274	3
2	1% low fat	Nonorganic	No flavor	14.66	0.028336	3
3	2% reduced	Nonorganic	No flavor	28.59	0.029892	5
4	Whole	Nonorganic	No flavor	24.82	0.031272	7
5	Soy & Lactose free	Nonorganic	No flavor	1.67	0.048348	5
6	No fat	Organic	No flavor	0.18	0.051564	3
7	1% low fat	Organic	No flavor	0.12	0.048173	2
8	2% reduced	Organic	No flavor	0.14	0.052778	3
9	Whole	Organic	No flavor	0.13	0.052442	4
10	Soy & Lactose free	Organic	No flavor	0.84	0.046248	3
11	No fat	Nonorganic	Flavored	0.26	0.050497	2
12	1% low fat	Nonorganic	Flavored	0.3	0.037342	2
13	2% reduced	Nonorganic	Flavored	0.6	0.054402	4
14	Whole	Nonorganic	Flavored	1.21	0.047216	5
15	Soy & Lactose free	Nonorganic	Flavored	0.56	0.041551	4
16	No fat	Organic	Flavored	0	n.a.	0
17	1% low fat	Organic	Flavored	0	n.a.	0
18	2% reduced	Organic	Flavored	0	n.a.	0
19	Whole	Organic	Flavored	0	n.a.	0
20	Soy & Lactose free	Organic	Flavored	1.32	0.045765	3

<Table 6> Conditional Elasticities at the Group Level with Time Trend

Group	expenditure	Fat-free	1% fat	2% fat	whole	Soy lactaid	F-F orgnc	1% orgnc
Fat-free	1.13*	-1.81*	1.52*	-0.50	-0.51	0.57*	0.00	-0.14*
1% fat	0.98*	2.50*	-2.24*	0.66	-1.38*	-0.53*	0.03	0.22*
2% fat	1.11*	-0.41	0.32	-2.71*	1.71*	-0.24	-0.05	-0.19*
Whole	0.75*	-0.41	-0.79*	2.07*	-1.36*	-0.08	-0.09	0.13*
Soy LF	1.03*	4.42*	-2.52*	-2.23	-0.66	-1.43	1.29*	0.50*
F-F orgnc	0.98*	0.04	1.10	-3.74	-6.30	11.61*	-4.08*	-2.67*
1% orgnc	1.16	-18.74*	17.60*	-30.28*	17.24*	8.36*	-4.98*	-7.34*
2% orgnc	1.13	2.15	9.49*	-2.00	-3.45	-4.44*	-0.24	0.93
Whole orgnc	0.60	1.14	-13.97*	19.22*	-9.92*	5.65*	1.27	1.03
Soy LF orgnc	1.14	-0.44	2.41	-2.98	-0.10	-0.95	-0.75*	-0.48
F-F flavor	1.14*	8.08*	0.33	4.69	-8.28*	-3.77*	1.22	1.26*
1% fla	-0.13*	-1.61	3.47	-2.54	0.11	2.55	3.46*	0.57
2% fla	1.10*	-2.15	-1.96	2.90	-0.53	0.89	-0.03	-0.70*
Whole flavor	1.49*	1.44	-4.26*	4.34*	-2.98*	0.42	0.46	1.35*
Soy LF flv	0.43*	-1.93	4.30*	0.04	-2.43	1.09	0.05	0.40
Soy LF org fl	0.78*	-4.60*	0.04	-0.03	5.18*	-0.95	-0.20	0.22

2% orgnc	Whole orgnc	Soy LF orgnc	F-F flavor	1% flavor	2% flavor	Whole flavor	Soy LF flavor	Soy LF org fl
0.03	0.01	-0.03	0.14*	-0.02	-0.10	0.13	-0.07	-0.36*
0.19*	-0.27*	0.24*	0.01	0.05	-0.14	-0.56*	0.23*	0.00
-0.02	0.19*	-0.15	0.07	-0.02	0.11	0.30*	0.00	-0.01
-0.04	-0.11*	0.00	-0.14*	0.00	-0.02	-0.22*	-0.08	0.38*
-0.42*	0.52*	-0.45	-0.52*	0.19	0.31	0.28	0.28	-0.57
-0.20	1.04	-3.22*	1.51	2.32*	-0.10	2.65	0.12	-1.07
1.46	1.58	-3.86	2.91*	0.71	-4.04*	14.35*	1.72	2.16
-1.00*	0.67	4.07*	-1.17	-1.24*	0.82	-4.43*	-1.88	0.58
0.69	-1.91	-0.26	-1.50	0.93	-0.43	0.73	-0.30	-2.98
0.80*	-0.05	-1.11*	1.09*	0.38*	-0.13	0.63	0.53*	0.01
-0.79	-0.99	3.74*	-3.26*	-0.51	0.36	-1.23	-1.79*	-0.20
-1.54*	1.13	2.42*	-0.93	-1.38*	0.78	-4.74*	-0.07	-1.54
0.22	-0.11	-0.17	0.14	0.17	-1.00*	1.60*	-0.21	-0.14
-0.65*	0.10	0.47	-0.27	-0.56*	0.86*	-2.53*	0.42	-0.11
-0.68	-0.10	0.99*	-0.95*	-0.02	-0.28	1.05	-1.78*	-0.19
0.09	-0.46	0.01	-0.05	-0.20	-0.08	-0.10	-0.08	0.43

<Table 7> Unconditional Elasticities with time trend

Group	expenditure	Fat-free	1% fat	2% fat	whole	Soy lactaid	F-F orgnc	1% orgnc
Fat-free	0.99	-1.61	1.65	-0.25	-0.28	0.59	0.00	-0.14
1% fat	0.86	2.68	-2.12	0.87	-1.19	-0.50	0.03	0.22
2% fat	0.98	-0.21	0.45	-2.47	1.93	-0.22	-0.04	-0.19
Whole	0.66	-0.27	-0.70	2.23	-1.21	-0.06	-0.08	0.13
Soy LF	0.91	4.60	-2.40	-2.01	-0.45	-1.41	1.29	0.50
F-F orgnc	0.86	0.21	1.21	-3.53	-6.10	11.63	-4.08	-2.67
1% orgnc	1.02	-18.53	17.73	-30.03	17.47	8.39	-4.97	-7.34
2% orgnc	0.99	2.35	9.62	-1.76	-3.22	-4.41	-0.24	0.93
Whole orgnc	0.53	1.24	-13.90	19.34	-9.79	5.67	1.27	1.03
Soy LF orgnc	1.00	-0.24	2.54	-2.73	0.14	-0.92	-0.75	-0.48
F-F flavor	1.00	8.28	0.46	4.94	-8.05	-3.74	1.22	1.26
1% fla	-0.11	-1.63	3.46	-2.57	0.08	2.54	3.46	0.57
2% fla	0.97	-1.96	-1.83	3.14	-0.31	0.91	-0.03	-0.70
Whole flavor	1.31	1.71	-4.09	4.66	-2.68	0.45	0.47	1.35
Soy LF flv	0.38	-1.85	4.35	0.13	-2.35	1.10	0.06	0.40
Soy LF org fl	0.69	-4.46	0.13	0.14	5.33	-0.94	-0.20	0.22

2% orgnc	Whole orgnc	Soy LF orgnc	F-F flavor	1% flavor	2% flavor	Whole flavor	Soy LF flavor	Soy LF org fl
0.03	0.01	-0.01	0.15	-0.02	-0.09	0.14	-0.06	-0.34
0.19	-0.27	0.25	0.01	0.05	-0.13	-0.54	0.23	0.02
-0.02	0.19	-0.14	0.07	-0.02	0.12	0.32	0.00	0.01
-0.04	-0.11	0.01	-0.14	0.00	-0.01	-0.21	-0.08	0.39
-0.41	0.52	-0.44	-0.52	0.19	0.32	0.29	0.28	-0.55
-0.20	1.05	-3.21	1.52	2.32	-0.09	2.66	0.13	-1.05
1.46	1.58	-3.85	2.91	0.72	-4.03	14.36	1.73	2.18
-1.00	0.67	4.08	-1.16	-1.23	0.83	-4.42	-1.87	0.60
0.69	-1.91	-0.25	-1.50	0.93	-0.42	0.74	-0.29	-2.97
0.80	-0.05	-1.10	1.09	0.38	-0.12	0.65	0.54	0.03
-0.79	-0.99	3.75	-3.26	-0.50	0.36	-1.21	-1.78	-0.18
-1.54	1.13	2.41	-0.93	-1.38	0.78	-4.74	-0.07	-1.54
0.23	-0.11	-0.16	0.15	0.17	-0.99	1.62	-0.21	-0.13
-0.65	0.11	0.48	-0.26	-0.56	0.88	-2.51	0.43	-0.09
-0.68	-0.10	0.99	-0.95	-0.02	-0.28	1.06	-1.78	-0.18
0.09	-0.46	0.02	-0.04	-0.20	-0.07	-0.09	-0.08	0.44

<Table 8> Unconditional Elasticities at the Brand Level

	Income	1_A	1_B	1_C	2_A	2_B	2_C	3_A	3_B	3_D	3_C	3_E
1_A	0.94	-2.02	0.92	-0.14	0.09	1.44	0.03	-0.01	-0.21	0.00	-0.01	0.00
1_B	0.76	0.66	-1.86	0.21	0.07	1.16	0.03	-0.01	-0.17	0.00	-0.01	0.00
1_C	0.99	-0.07	-0.16	-1.07	0.09	1.52	0.04	-0.01	-0.23	0.00	-0.01	0.00
2_A	2.02	0.40	4.23	0.18	-1.24	-3.65	-0.09	0.09	1.82	0.04	0.08	0.02
2_B	0.84	0.17	1.75	0.07	-0.06	-2.13	0.13	0.04	0.75	0.02	0.03	0.01
2_C	0.87	0.17	1.81	0.08	-0.10	-0.92	-1.12	0.04	0.78	0.02	0.03	0.01
3_A	0.98	-0.01	-0.20	-0.01	0.03	0.41	0.01	-1.74	-0.57	-0.03	-0.10	-0.05
3_B	0.98	-0.01	-0.20	-0.01	0.03	0.41	0.01	0.78	-3.98	0.31	0.27	0.13
3_D	1.38	-0.02	-0.28	-0.01	0.04	0.58	0.01	-0.12	-1.84	-1.41	-0.22	0.07
3_C	1.01	-0.01	-0.20	-0.01	0.03	0.43	0.01	0.00	-1.98	0.14	-0.82	-0.94
3_E	0.97	-0.01	-0.19	-0.01	0.03	0.41	0.01	-0.08	-1.27	-0.01	-0.07	-1.05

	Income	4_A	2_B	4_F	4_D	4_G	4_C	4_E	5_B	5_H	5_I	5_J	5_K
4_A	0.64	-1.40	0.44	0.04	0.01	-0.14	-0.12	-0.05	-0.02	-0.04	-0.01	-0.01	-0.01
2_B	0.70	0.37	-2.12	-0.05	0.18	0.01	0.28	-0.03	-0.02	-0.05	-0.01	-0.01	-0.01
4_F	0.66	-0.04	-0.15	-0.68	-0.14	-0.13	-0.07	-0.06	-0.02	-0.04	-0.01	-0.01	-0.01
4_D	0.68	-0.02	-0.56	-0.13	-0.78	0.14	0.05	-0.01	-0.02	-0.04	-0.01	-0.01	-0.01
4_G	0.71	0.03	-2.11	-0.13	0.08	-1.15	-0.18	-0.10	-0.02	-0.05	-0.01	-0.01	-0.01
4_C	0.69	-0.05	-0.09	0.02	-0.04	-0.02	-1.16	-0.02	-0.02	-0.04	-0.01	-0.01	-0.01
4_E	0.66	-0.02	-0.24	0.01	0.00	0.01	-0.03	-1.00	-0.02	-0.04	-0.01	-0.01	-0.01
5_B	2.44	-0.04	-1.04	-0.01	-0.03	-0.05	-0.09	-0.02	-2.52	-2.50	-0.47	-0.94	-0.82
5_H	1.29	-0.02	-0.55	-0.01	-0.01	-0.03	-0.05	-0.01	-0.48	-2.26	-0.36	-0.45	-0.28
5_I	2.45	-0.04	-1.05	-0.01	-0.03	-0.05	-0.09	-0.02	-1.53	-2.51	-1.48	-0.94	-0.82
5_J	2.46	-0.04	-1.05	-0.01	-0.03	-0.05	-0.09	-0.02	-1.54	-2.53	-0.48	-1.95	-1.82
5_K	2.42	-0.04	-1.04	-0.01	-0.03	-0.05	-0.09	-0.02	-1.51	-2.48	-0.47	-0.93	-1.81

*** Numbers represent groups and Alphabets represent brands; Alphabet B represents supermarket labels.

(continue Table 8)

	Income	6_B	6_L	6_M	7_L	7_M	8_B	8_L	8_M	9_B	9_L	9_N	9_M	10_B	10_O	10_M
6_B	0.81	-1.39	-4.11	-0.51	-1.74	-0.71	-0.03	-0.10	-0.07	0.14	0.77	0.10	0.07	-0.17	-2.68	-0.42
6_L	1.61	-3.78	-5.42	-2.83	-3.47	-1.41	-0.06	-0.20	-0.14	0.29	1.55	0.20	0.15	-0.34	-5.35	-0.84
6_M	0.99	-0.56	-4.71	-2.13	-2.14	-0.87	-0.03	-0.12	-0.08	0.18	0.95	0.12	0.09	-0.21	-3.30	-0.52
7_L	1.00	-0.96	-5.92	-0.79	-5.17	-1.85	0.21	0.76	0.53	0.23	1.22	0.16	0.12	-0.21	-3.35	-0.52
7_M	0.99	-0.95	-5.90	-0.78	-4.17	-2.82	0.21	0.75	0.52	0.23	1.22	0.16	0.12	-0.21	-3.34	-0.52
8_B	0.98	-0.05	-0.29	-0.04	0.64	0.26	-0.96	-0.23	0.16	0.10	0.53	0.07	0.05	0.23	3.60	0.56
8_L	1.01	-0.05	-0.29	-0.04	0.66	0.27	0.07	-1.05	-0.08	0.10	0.54	0.07	0.05	0.24	3.70	0.58
8_M	1.10	-0.05	-0.32	-0.04	0.72	0.29	0.14	0.04	-1.33	0.11	0.59	0.08	0.06	0.26	4.04	0.63
9_B	0.61	0.29	1.78	0.24	0.82	0.33	0.12	0.42	0.29	-3.23	-1.28	2.68	2.78	-0.02	-0.26	-0.04
9_L	0.55	0.26	1.60	0.21	0.74	0.30	0.11	0.38	0.26	-0.13	-1.72	-0.15	-0.19	-0.01	-0.23	-0.04
9_N	1.70	0.80	4.97	0.66	2.30	0.93	0.33	1.17	0.81	-0.70	-4.05	-1.63	-0.45	-0.05	-0.71	-0.11
9_M	0.55	0.26	1.62	0.21	0.75	0.30	0.11	0.38	0.26	-0.06	-1.01	0.16	-1.31	-0.01	-0.23	-0.04
10_B	1.27	-0.19	-1.16	-0.15	-0.42	-0.17	0.15	0.54	0.37	-0.01	-0.05	-0.01	0.00	-0.69	-1.01	0.19
10_O	1.06	-0.16	-0.96	-0.13	-0.35	-0.14	0.13	0.45	0.31	-0.01	-0.04	-0.01	0.00	0.05	-1.37	0.05
10_M	1.21	-0.18	-1.10	-0.15	-0.40	-0.16	0.14	0.51	0.36	-0.01	-0.05	-0.01	0.00	-0.80	2.44	-2.50

	Income	11_P	11_Q	12_B	12_D	13_B	13_P	13_R	13_Q	14_B	14_C	14_E	14_S	14_T
11_P	0.11	-0.61	0.37	-0.03	-0.01	0.00	0.01	0.00	0.03	-0.07	-0.03	-0.01	-0.01	-0.01
11_Q	1.01	0.21	-2.49	-0.25	-0.14	0.04	0.05	0.03	0.25	-0.62	-0.28	-0.05	-0.13	-0.07
12_B	-0.07	-0.02	-0.40	-2.47	1.78	0.06	0.07	0.04	0.35	-1.56	-0.70	-0.12	-0.34	-0.19
12_D	-0.13	-0.04	-0.71	0.69	-1.92	0.10	0.12	0.07	0.61	-2.77	-1.24	-0.22	-0.60	-0.33
13_B	0.93	0.00	0.09	0.08	0.05	-0.99	0.14	-0.02	-0.01	0.79	0.35	0.06	0.17	0.09
13_P	0.91	0.00	0.09	0.08	0.04	-0.13	-1.44	0.46	0.17	0.77	0.34	0.06	0.17	0.09
13_R	1.02	0.00	0.10	0.09	0.05	0.01	0.16	-1.04	-0.18	0.86	0.39	0.07	0.19	0.10
13_Q	0.99	0.00	0.10	0.08	0.05	-0.04	-0.04	0.14	-1.07	0.83	0.37	0.07	0.18	0.10
14_B	1.17	-0.01	-0.15	-0.25	-0.14	0.09	0.10	0.06	0.53	-1.82	-0.07	0.06	-0.13	-0.15
14_C	1.30	-0.01	-0.17	-0.27	-0.15	0.10	0.11	0.06	0.59	-0.65	-1.38	-0.07	-0.15	-0.08
14_E	1.30	-0.01	-0.17	-0.27	-0.15	0.10	0.11	0.06	0.59	-0.66	-0.36	-1.07	-0.17	-0.09
14_S	1.45	-0.01	-0.19	-0.31	-0.17	0.11	0.13	0.07	0.66	-0.83	-0.33	-0.07	-1.26	-1.14
14_T	1.32	-0.01	-0.17	-0.28	-0.16	0.10	0.12	0.06	0.60	-0.72	-0.33	-0.06	-0.19	-1.09