Milk Marketing Order Winners and Losers

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Abstract

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ABSTRACT

Do milk marketing orders affect various demographic groups differently? To answer this question, we use supermarket scanner data to estimate an incomplete demand system for dairy products. We use these estimates to simulate substitution among dairy products and the welfare impacts of price changes resulting from changes in milk marketing orders for various consumer groups. While we find little difference in own- and cross-price substitution elasticities of demand, the welfare effects of price changes vary substantially across demographic groups, with some losing and others winning from this government program.

Milk Marketing Order Winners and Losers

Milk marketing orders raise the price of fresh milk and lower the price of processed milk from the single-price, competitive level. Some cynics have suggested that by so doing, these laws harm orphans who consume fresh milk while benefiting yuppies who consume brie and premium ice creams. To determine who benefits and who loses from the price changes due to marketing orders, we estimate an incomplete system of demands for dairy products and calculate the welfare effects of marketing orders.

The U.S. dairy industry has been regulated for nearly 70 years. These regulations affect the price and consumption of dairy products. During our sample period, 1997-1999, milk marketing orders were the most important direct regulations of the price of dairy products.[1] During the 1990s, production was affected by 31 federal marketing orders and 4 state orders, of which only the Virginia and California orders replaced the federal orders.

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[1] Two other programs that affect milk markets are price supports and trade restrictions. Price supports in the dairy sector provide a floor for wholesale milk product prices. The Commodity Credit Corporation is the government agent that purchases the excess supply of dairy products from manufacturers resulting from artificially high support prices. In our sample period – the late 1990's – price supports had no direct effect on market prices because support prices were below the price levels that cleared the open market. Trade restrictions also affect the price of dairy products in the U.S. During the 1990's, import restrictions on dairy products involved a two-tier tariff. With trade liberalization, the level of imports of dairy products has increased and the dairy industry continues to move towards free trade. Sumner describes how marketing orders also may stimulate net exports.

Milk marketing orders affect prices for various classes of fluid milk by setting minimum farm-level prices for milk.[2] Federal marketing orders establish four classes of fluid milk. Class I is the milk used for fluid consumption.[3] Class II milk is used to produce soft dairy products such as ice cream, cottage cheese, and yogurt. Class III milk goes into hard dairy products such as butter and cheese. Class III-A milk is used to manufacture nonfat dry milk. The California state marketing order includes five classes of milk, creating separate classes for ice cream and other frozen products and for butter and dry milk.

By studying a system of demands for dairy products, we can determine how changes in prices that would result from a change in marketing orders affect the short-run consumption of various dairy products by consumers and the associated welfare impacts. We examine the effects of marketing orders on the dairy product purchase decisions and the welfare impacts by estimating an incomplete demand system for dairy products that incorporates several demographic variables. We calculate the own- and cross-elasticities of demand for dairy products for different consumer groups and the equivalent variation from eliminating the marketing orders. We also examine the regressive nature of the regulation burden as those with lower incomes pay relatively more for marketing orders than those with higher income levels. We next discuss previous dairy demand studies. Then, we present the model and discuss our estimation technique. After describing the data, we discuss our estimation results. Finally, we use our estimates to calculate elasticities and simulate the welfare effects.

[2] Berck and Perloff (1985) present a theory of how marketing order prices are set and how they affect milk prices.

[3] Only grade A milk may be used for the Class I market. When milk marketing orders were introduced in the 1930s, one of the justifications was to reduce the variability in the availability of Grade A milk. However, today nearly all of the milk produced in the United States meets the Grade A standards, so this rationale is outdated.

Literature

Previous studies examined the demand for dairy products and the purchasing decisions of various demographic groups using different estimation models than we use. None of these studies examined the welfare implications of marketing orders on these groups.

Jensen; Haines, Guilkey, and Popkin; and Blaylock and Smallwood examined which consumer characteristics affect the expenditure on dairy products. Using data from the U.S. National Food Consumption Survey and limited dependent variable models, each of these studies found that dairy product demands vary with regions of the country, the presence of children, ethnicity, income level, and education level.

Demand elasticity estimates for broad categories of dairy products and the effect of demographic characteristics have been performed using the U.S. National Food Consumption Survey in several articles. Heien and Wessells (1988) find the own-price elasticity of demand for milk to be -0.63 and for cheese to be -0.52. They suggest that age, gender, ethnicity, location, season and other demographic variables impact the price elasticities of demand. Park, Holcomb, Raper and Capps estimate the own-price elasticity of demand for milk to be -0.47 and for cheese to be -0.24 for non-poverty status households, and -0.53 and -0.01, respectively, for poverty status households. Huang and Lin estimate the own-price elasticity of demand for dairy products to be -0.8, while households with relatively high and low income levels exhibit slightly smaller demand elasticities, -0.78 and -0.77, respectively. Gould, Cox and Perali use aggregate per capita sales data and find the own-price elasticity of demand for whole milk to be approximately equal to -0.32 and for low fat milk to be equal to -0.43, while age, ethnicity, and education appear to have small effects on the price elasticities of demand for dairy products. These studies suggest that demographic variables influence the demand for dairy products, but the effects on price elasticities appear to be small.

Bergtold, Akobundu and Peterson use scanner data in a multistage, weakly separable, translog demand system to estimate demand elasticities for disaggregate dairy products. They report uncompensated expenditure elasticities for several dairy products including: cheese -0.17, shredded cheese 0.47, imitation cheese -0.39, whole milk -0.28, low-fat milk 0.01, and ice cream 0.04. This study did not include demographic variables in the empirical model, which could create biased estimates due to omitted variables. Including expenditure on a subset of goods (such as food) as a regressor also can cause endogeneity bias (Deaton; Attfield 1985, 1991; LaFrance 1991b).

Estimates of the income elasticity of demand for dairy products vary widely in the previous literature. Some other authors found positive elasticities. Park, Holcomb, and Capp estimated income elasticities for non-poverty consumers of 0.22 for cheese and 0.27 for milk. Huang and Lin estimated total food expenditure elasticities for all dairy products of 0.67. Heien and Wessells estimated food expenditure elasticities of 0.77 for milk, 1.01 for cheese, and 1.06 for butter. Other studies found slightly negative or essentially zero income or expenditure elasticities. Gould, Cox, and Perali estimated food expenditure elasticities that are very slightly negative: -0.017 for whole milk and -0.010 for low fat milk. Bergtold, Akobudu, and Petersen estimated expenditure elasticities of -0.17 cheese, 0.47 shredded cheese, -0.28 whole milk, 0.01 low-fat milk, and 0.04 ice cream.

Other studies have examined the effects on consumers of eliminating or changing milk marketing orders. Some estimate that eliminating the New England Dairy Compact, which acted much like a marketing order, would result in a 4% - 70% decrease in fresh milk prices (Cotterill). LaFrance and de Gorter and Dardis and Bedore estimated that consumer surplus losses due to marketing orders averaged nearly $700 million dollars annually during the 1970s and the mid-1980s. Dardis and Bedore pointed out that the consumers with the lowest incomes are the hardest hit by this type of price discrimination policy.

This study departs from the existing literature in two important ways. First, we obtain more accurate elasticity estimates than in previous studies by using individual scanner data, controlling for the impacts of retail sales taxes in calculating real, after-tax prices facing consumers, and modeling the demands for dairy products as an incomplete system of demand equations. Second, we measure household-level welfare effects of changes in milk marketing orders by including demographic factors specific to individual households. The next section describes the incomplete demand system and its main properties.

Incomplete Demand System

We use a generalized Almost Ideal Demand System (AIDS) that is linear and quadratic in prices and linear in income (hereafter, the LQ-IDS). The structure of this model was first discovered in LaFrance (1990) and recently has been shown to be a special case of a very general extension of the AIDS model to incomplete systems (LaFrance 2004). This model is flexible with respect to both price and income effects. The theoretical subsystem of demand equations for the LQ-IDS model can be written as

$$\boldsymbol{q} = \alpha + \boldsymbol{A}\boldsymbol{s} + \boldsymbol{B}\boldsymbol{p} + \gamma\left(m - \alpha^{\top}\boldsymbol{p} - \boldsymbol{p}^{\top}\boldsymbol{A}\boldsymbol{s} - \tfrac{1}{2}\boldsymbol{p}^{\top}\boldsymbol{B}\boldsymbol{p}\right), \tag{1}$$

where $\boldsymbol{q}$ is the vector of quantities demanded, α and γ are vectors of parameters, $\boldsymbol{A}$ is a matrix of parameters, $\boldsymbol{B} = \boldsymbol{B}^{\top}$ (a superscript $^{\top}$ denotes the transpose of a matrix or vector) is a symmetric matrix of parameters, $\boldsymbol{p}$ is the vector of normalized final consumer prices for dairy products, m is normalized income, and $\boldsymbol{s}$ is a vector of demographic variables. All prices and income have been normalized by a linear homogeneous function of the prices of other goods, $\pi(\tilde{\boldsymbol{p}})$, where $\tilde{\boldsymbol{p}}$ is a vector of market prices other than those for dairy products. The class of normalized expenditure functions that generates this demand model is

$$e(\boldsymbol{p},\tilde{\boldsymbol{p}},\boldsymbol{s},u)=\alpha^{\top}\boldsymbol{p}+\boldsymbol{p}^{\top}\boldsymbol{A}\boldsymbol{s}+\tfrac{1}{2}\boldsymbol{p}^{\top}\boldsymbol{B}\boldsymbol{p}+\theta(\tilde{\boldsymbol{p}},\boldsymbol{s},u)e^{\gamma^{\top}\boldsymbol{p}}\,, \tag{2}$$

where $\theta(\tilde{\boldsymbol{p}},\boldsymbol{s},u)$ is increasing in u but otherwise cannot be identified (LaFrance 1985; LaFrance and Hanemann). Equivalently, the class of indirect utility functions theoretically consistent with this demand model is

$$v(\boldsymbol{p},\tilde{\boldsymbol{p}},m,\boldsymbol{s})=\upsilon\left[\left(m-\alpha^{\top}\boldsymbol{p}-\boldsymbol{p}^{\top}\boldsymbol{A}\boldsymbol{s}-\tfrac{1}{2}\boldsymbol{p}^{\top}\boldsymbol{B}\boldsymbol{p}\right)e^{-\gamma^{\top}\boldsymbol{p}},\tilde{\boldsymbol{p}},\boldsymbol{s}\right]. \tag{3}$$

Either of these claims can be verified by applying Hotelling's lemma to (2) or Roy's identity to (3) to produce the incomplete demand system in (1).

Price and Income Elasticities

The matrix of derivatives of the demands with respect to the deflated prices is

$$\frac{\partial \boldsymbol{q}}{\partial \boldsymbol{p}^{\top}}=\boldsymbol{B}-\gamma\left(\alpha^{\top}+\boldsymbol{s}^{\top}\boldsymbol{A}^{\top}+\boldsymbol{p}^{\top}\boldsymbol{B}\right), \tag{4}$$

with typical element,

$$\frac{\partial q_i}{\partial p_j}=\beta_{ij}-\gamma_i\left(\alpha_j+\sum\nolimits_{k=1}^{K}a_{jk}s_k+\sum\nolimits_{k=1}^{n}\beta_{jk}p_k\right). \tag{5}$$

The own- and cross-price elasticities of demand are therefore defined by

$$\varepsilon_{q_i}^{p_j}=\frac{p_j}{q_i}\frac{\partial q_i}{\partial p_j}=\frac{p_j}{q_i}\left[\beta_{ij}-\gamma_i\left(\alpha_j+\sum\nolimits_{k=1}^{K}a_{jk}s_k+\sum\nolimits_{k=1}^{n}\beta_{jk}p_k\right)\right]\quad\forall\ i,j=1,\ldots,n\,. \tag{6}$$

In matrix notation, if we let $\boldsymbol{P}=\mathbf{diag}[p_i]$, $\boldsymbol{Q}=\mathbf{diag}[q_i]$, and $\boldsymbol{E}_{\boldsymbol{q}}^{\boldsymbol{p}}=[\varepsilon_{q_i}^{p_j}]$ then we can write (6) in the form

$$\boldsymbol{E}_{\boldsymbol{q}}^{\boldsymbol{p}}=\boldsymbol{Q}^{-1}\frac{\partial \boldsymbol{q}}{\partial \boldsymbol{p}^{\top}}\boldsymbol{P}=\boldsymbol{Q}^{-1}\left[\boldsymbol{B}-\gamma\left(\alpha^{\top}+\boldsymbol{s}^{\top}\boldsymbol{A}^{\top}+\boldsymbol{p}^{\top}\boldsymbol{B}\right)\right]\boldsymbol{P}\,. \tag{7}$$

Similarly, the derivatives of the demands with respect to deflated income are $\partial \boldsymbol{q}/\partial m = \boldsymbol{\gamma}$, so that the income elasticities of demand are

$$\varepsilon_{q_i}^{m} = \frac{m}{q_i}\frac{\partial q_i}{\partial m} = \frac{\gamma_i m}{q_i} \quad \forall\ i = 1,\ldots,n\,. \tag{8}$$

If we define the vector $\boldsymbol{\varepsilon}_{\boldsymbol{q}}^{m} = [\varepsilon_{q_1}^{m} \cdots e_{q_n}^{m}]^{\top}$, then we can rewrite (8) in matrix notation as

$$\boldsymbol{\varepsilon}_{\boldsymbol{q}}^{m} = m\boldsymbol{Q}^{-1}\boldsymbol{\gamma}\,. \tag{9}$$

Welfare Measurement

To determine the impact of a change in the prices of dairy products on consumer welfare, we need to compare the scalar quasi-utility level at the initial prices, $\theta_0 \equiv \theta(\tilde{\boldsymbol{p}}, \boldsymbol{s}, u_0)$, where

$$\theta(\tilde{\boldsymbol{p}}, \boldsymbol{s}, u_0) \equiv \left[m - \left(\boldsymbol{\alpha}_0^{\top}\boldsymbol{s} + \boldsymbol{\alpha}^{\top}\boldsymbol{p}_0 + \boldsymbol{s}^{\top}\boldsymbol{A}^{\top}\boldsymbol{p}_0 + \tfrac{1}{2}\boldsymbol{p}_0^{\top}\boldsymbol{B}\boldsymbol{p}_0\right)\right]e^{-\boldsymbol{\gamma}^{\top}\boldsymbol{p}_0}\,, \tag{10}$$

with initial prices for dairy products equal to $\boldsymbol{p}_0$, to the scalar quasi-utility level at the final prices, $\theta_1 \equiv \theta(\tilde{\boldsymbol{p}}, \boldsymbol{s}, u_1)$, where

$$\theta(\tilde{\boldsymbol{p}}, \boldsymbol{s}, u_1) \equiv \left[m - \left(\boldsymbol{\alpha}_0^{\top}\boldsymbol{s} + \boldsymbol{\alpha}^{\top}\boldsymbol{p}_1 + \boldsymbol{s}^{\top}\boldsymbol{A}^{\top}\boldsymbol{p}_1 + \tfrac{1}{2}\boldsymbol{p}_1^{\top}\boldsymbol{B}\boldsymbol{p}_1\right)\right]e^{-\boldsymbol{\gamma}^{\top}\boldsymbol{p}_1}\,, \tag{11}$$

with final prices for dairy products equal to $\boldsymbol{p}_1$. Given that consumer prices for dairy products change from $\boldsymbol{p}_0$ to $\boldsymbol{p}_1$, the equivalent variation, *ev*, is the change in income at the original price vector, $\boldsymbol{p}_0$, that is just necessary to bring the consumer to the new quasi-utility level at the final price vector, $\boldsymbol{p}_1$,

$$\theta_1 = \left(m - \boldsymbol{\alpha}^{\top}\boldsymbol{p}_1 - \boldsymbol{p}_1^{\top}\boldsymbol{A}\boldsymbol{s} - \tfrac{1}{2}\boldsymbol{p}_1^{\top}\boldsymbol{B}\boldsymbol{p}_1\right)e^{-\boldsymbol{\gamma}^{\top}\boldsymbol{p}_1} = \left(m + ev - \boldsymbol{\alpha}^{\top}\boldsymbol{p}_0 - \boldsymbol{p}_0^{\top}\boldsymbol{A}\boldsymbol{s} - \tfrac{1}{2}\boldsymbol{p}_0^{\top}\boldsymbol{B}\boldsymbol{p}_0\right)e^{-\boldsymbol{\gamma}^{\top}\boldsymbol{p}_0}\,. \tag{12}$$

Solving for *ev* then gives

$$ev = \left(m - \boldsymbol{\alpha}^{\top}\boldsymbol{p}_1 - \boldsymbol{p}_1^{\top}\boldsymbol{A}\boldsymbol{s} - \tfrac{1}{2}\boldsymbol{p}_1^{\top}\boldsymbol{B}\boldsymbol{p}_1\right)e^{\boldsymbol{\gamma}^{\top}(\boldsymbol{p}_0 - \boldsymbol{p}_1)} - \left(m - \boldsymbol{\alpha}^{\top}\boldsymbol{p}_0 - \boldsymbol{p}_0^{\top}\boldsymbol{A}\boldsymbol{s} - \tfrac{1}{2}\boldsymbol{p}_0^{\top}\boldsymbol{B}\boldsymbol{p}_0\right). \tag{13}$$

The compensating variation for this model can be shown to satisfy $cv = ev \times e^{\gamma^{\top}(\boldsymbol{p}_1 - \boldsymbol{p}_0)}$. As a result, we focus here on the equivalent variation measure of consumer welfare.

Effects of Demographics on Elasticities and Welfare

To evaluate the impacts of a marginal change in a demographic variable on the price elasticities of demand for dairy products, we must take two separate forces into account. The reason is that any change in a demographic variable both shifts and rotates the demand function for each dairy product when it is depicted in the usual way with price on the vertical axis and quantity on the horizontal axis. To see this, first note that the rate of change in the demand for the i^{th} good with respect to the i^{th} price is

$$\frac{\partial q_i}{\partial p_i} = \beta_{ii} - \gamma_i \left(\alpha_i + \sum_{k=1}^{K} a_{ik} s_k + \sum_{j=1}^{n} \beta_{ij} p_j \right). \tag{14}$$

Using (14) and the elasticity definition from Equation (6), the own-price elasticity of demand is

$$\varepsilon_{p_i}^{q_i} = \frac{p_i}{q_i} \frac{\partial q_i}{\partial p_i} = \frac{p_i}{q_i} \left[\beta_{ii} - \gamma_i \left(\alpha_i + \sum_{k=1}^{K} a_{ik} s_k + \sum_{j=1}^{n} \beta_{ij} p_j \right) \right]. \tag{15}$$

The *shift* in the demand curve is the rate of change in the demand for the i^{th} good with respect to the k^{th} demographic variable,

$$\frac{\partial q_i}{\partial s_k} = a_{ik} - \gamma_i \sum_{j=1}^{n} a_{jk} p_j \; . \tag{16}$$

Depending on the relative sign and size of the elements of the matrix $\boldsymbol{A}$, the relative levels of the dairy product prices $\boldsymbol{p}$, and the sign and size of the income coefficients $\boldsymbol{\gamma}$, an individual demand function's shift can be positive, negative, or zero at any given data point.

We also need to examine how the demand curve rotates. The second-order cross effect of the i^{th} price and the k^{th} demographic variable on the i^{th} good is

$$\frac{\partial^2 q_i}{\partial p_i \partial s_k} = -\gamma_i a_{ik} . \tag{17}$$

This term shows the *rotation* in the demand curve. The sign of this term depends on the sign of the i^{th} income coefficient and the coefficient for the k^{th} demographic variable in the demand equation for the i^{th} good. For example, if the good is normal and $a_{ik} > 0$, then $\partial^2 q_i/\partial p_i \partial s_k < 0$. In general the shift and rotation effects could (but need not) work in opposite directions and offset each other at a given point in ($\boldsymbol{q}$, $\boldsymbol{p}$, m, $\boldsymbol{s}$) space.

The net impact of a marginal change in the demographic variable s_k on the i^{th} own-price elasticity of demand, $\varepsilon_{p_i}^{q_i}$, can be expressed simply in terms of the percentage change in the own-price elasticity with respect to a percentage change in the demographic variable,

$$\begin{aligned} \frac{s_k}{\varepsilon_i^i} \frac{\partial \varepsilon_{p_i}^{q_i}}{\partial s_k} &= \frac{s_k}{\varepsilon_i^i} \left[\frac{p_i}{q_i} \left(\frac{\partial^2 q_i}{\partial p_i \partial s_k} \right) - \frac{p_i}{q_i^2} \left(\frac{\partial q_i}{\partial p_i} \right) \left(\frac{\partial q_i}{\partial s_k} \right) \right] \\ &= \underbrace{s_k \cdot \left(\frac{\partial^2 q_i / \partial p_i \partial s_k}{\partial q_i / \partial p_i} \right)}_{\text{\% rotation}} - \underbrace{\frac{s_k}{q_i} \cdot \left(\frac{\partial q_i}{\partial s_k} \right)}_{\text{\% shift}} . \end{aligned} \tag{18}$$

Thus, the sign and size of the percentage change in the own-price elasticity of demand due to a change in a demographic variable depends on the net difference between the *percentage rotation* and the *percentage shift*. In general, this difference can be positive, negative, or zero for a given dairy product at any given point in ($\boldsymbol{q}$, $\boldsymbol{p}$, m, $\boldsymbol{s}$) space.

On the other hand, the marginal effect of a change in the k^{th} demographic variable on the equivalent variation for the change in dairy product prices from $\boldsymbol{p}_0$ to $\boldsymbol{p}_1$ is

$$\frac{\partial ev}{\partial s_k} = \sum_{j=1}^{n} a_{jk} \left[p_{j0} - p_{j1} e^{\gamma^{\top} (\boldsymbol{p}_0 - \boldsymbol{p}_1)} \right] . \tag{19}$$

This marginal effect depends on all of the coefficients on s_k in the subsystem of demands for dairy products, the relative prices changes, and the vector of income coefficients. Because equations (16)–(19) are functions of the demographic variables, we expect that the elasticities of demand will vary differently than the welfare effects as the prices consumers pay for dairy products change. That is what we find in our empirical work.

Data and Variables

We use weekly Information Resources Incorporated's (IRI) Infoscan™ scanner data from January 1, 1997 through December 30, 1999 for 23 U.S. cities.[4] The city populations range from 50,000 to several million. Each region of the country is represented with several cities. IRI records purchase price and quantity information at the Universal Product Code (UPC) level for a panel of customers for a number of grocery stores in each city. We aggregate this household data to city-level weekly average household expenditures.

The dependent variable in the incomplete demand system is the average expenditure of the sample of households in each city for each dairy product in each week, deflated by a regional consumer price index for non-food items. We also aggregated the thousands of individual dairy UPC codes into 14 product categories: non-fat milk, 1% milk, 2% milk, whole milk, dairy cream including half and half, coffee creamers, butter and margarine, ice cream including frozen yogurt and ice milk, cooking yogurt (plain and vanilla yogurt), flavored yogurt (all other yogurt that is not categorized as cooking yogurt), cream cheese, shredded and grated cheese, American and other processed cheese, and natural cheese. The average household expenditure for each category is the sum of the expenditures for each UPC code within that category divided by the number of

[4] Atlanta, Boston, Cedar Rapids (IA), Chicago, Denver, Detroit, Eau Claire (WI), Grand Junction (CO), Houston, Kansas City, Los Angeles, Memphis, Midland (TX), Minneapolis/St. Paul, New York, Philadelphia, Pittsburgh, Pittsfield (MA), San Francisco/Oakland, Seattle/Tacoma, St. Louis, Tampa/St. Petersburg, and Visalia (CA).

households that purchased any product in the category.

For each of the dairy product categories in each city and for each week, we calculated a fixed quantity-weighted average price to represent the average weekly price for each product category. For a generic city, the formula for the j^{th} product category in the t^{th} week is

$$p_{jt} = \sum_{i_j=1}^{n_j} \left(\frac{\overline{q}_{i_j}}{\Sigma_{k_j=1}^{n_j} \overline{q}_{k_j}} \right) p_{i_j t}, \; j = 1,...,14, \tag{20}$$

where, p_{jt} is the average price for dairy product category j in week t, n_j is the number of unique UPC codes for that product category, $\overline{q}_{i_j}$, $i_j = 1,...,n_j$, is the average quantity purchased in the given city of UPC code i_j in product category j throughout all of the weeks in the sample period, and $p_{i_j t}$ is the retail price of good i_j in week t. Each of these average prices is then multiplied by one plus the respective state's retail sales tax on food items to adjust the price for these tax effects. These price indices are then deflated by the regional after-tax consumer price index for all items less food for all urban consumers, not seasonally adjusted (hereafter, nonfood CPI).[5] Because we are estimating a demand system with weekly average deflated expenditures on these dairy product categories as left-hand side dependent variables, it is appropriate to select a price deflator that does not include any of the prices of the goods whose specific UPC codes are included as part of these dependent variables. We also assume that individual households are price takers, so that the aggregate prices for dairy product categories and the nonfood CPI can be taken to be exogenous.

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[5] If the general ad valorem retail sales tax rate in the state is α, then the after-tax nonfood CPI is $(1 + \alpha)$CPI. Retail sales tax rates are taken from the Council of State Governments and the regional nonfood CPI's are from the Bureau of Labor Statistics. We linearly interpolate monthly nonfood CPI data to obtain weekly series. We matched each of our IRI cities to one of four CPI regions: Northeast, South, Midwest, and West.

Our data set also includes each household's income bracket. There are eight income brackets with midpoints ranging from $7,500 to $200,000.[6] We constructed a weekly estimate of the city-level average household income by taking the sum of the products of the proportion of households in each income bracket times the midpoint of that income bracket. In each city and week in the sample, the population proportions that were used to calculate the city-level income distribution were calculated as the fractions of households who had purchased at least one dairy product in that city during that week. We deflated the city-level average household income with the after-tax nonfood CPI. Finally, we divided these measures of deflated average annual household income associated with each week by 52 to construct estimates of the deflated average weekly income per household for each city and week in our sample.

The data set also includes several demographic characteristics for each household. We constructed city-level aggregate measures of these demographic variables similar to the weekly average income per household variable. That is, if a household purchased any dairy product in a given week, we included that household's demographic characteristics to calculate city-level aggregates, so that the demographic variables vary week-to-week and city-by-city as averages of dairy-product purchasing households' demographic characteristics.

Table 1 shows the sample means and standard errors of the continuous variables and the proportions of households with the discrete characteristics that are included in the demand system. Not shown in the table, but also included in the empirical model, are dummy variables to incorporate city-level fixed effects. Demographic variables included in the model include the

[6] The last category is top coded as income at or above $100,000 per year. We arbitrarily set $200,000 as the conditional mean of the top income category. This amount is roughly the mean income level of all U.S. households that earned at least $100,000 per year in the years 1997-1999. We calculated this national average conditional mean income using the full household income samples in the March supplement of the Continuing Population Survey for each of these three years.

proportions of households by ethnic group, home ownership, employment status, occupation, and educational attainment, households with children under 18, with young children (ages 0-5.9), medium aged children (ages 6-11.9), or older children (ages 12-17.9), and city-level weekly averages of the number of young, medium and older children for all households, the number of children in each of the three age groups, years of education, household weekly income, number of members in each household, and the ages of the heads of household.

Demand System Estimates

Table 2 presents summary statistics for each of the 14 dependent variables and the individual equations' regression error variances and goodness of fit measures. Because the empirical model is nonlinear in the parameters and the right-hand-side explanatory variables, the R^2 measure that we report is the squared correlation between the observed and predicted dependent variables. The R^2 indicated that this demand model fits the data reasonably well.

Coefficients

We estimated the LQ-IDS demand model for the 14 dairy product categories using a large number of demographic variables. It is not practical to report all of the coefficient estimates in a table.[7] Thus in Table 3, we report a subset of the demographic coefficients for each equation: the ethnicity variables, the average age of male heads of household (these results are similar to those for the average age of female heads of household), the share of home ownership, and the share of households with children under 6 years of age.

We can reject the null-hypothesis that the coefficients are zero at the 0.05 level for all coefficients for 1% milk, and all but two for 2% milk. Families with young children demand less low-fat milks: The fraction of households with young children has statistically significant

[7] A complete set of empirical results is available from the authors upon request.

negative effects on demand for 1%, 2%, and no-fat milk, but has statistically insignificant effects on other dairy products.

Ethnicity also affects a few of the non-milk dairy products (particularly some of the cheeses and ice cream). For most dairy products, we cannot reject (at the 5% significance level) the hypothesis that the coefficient on the age of the male household head is positive. The exceptions are ice cream and yogurt, where the demand decreases with the age of a male head of household, and cream, butter, and cooking yogurt where the effect is not statistically significant. Home ownership has statistically significant effects on 1% milk, cream, and processed cheese.

Collectively, the demographic variables are statistically quite important. For example, a χ^2 test that the coefficients for all of the ethnicity share variables in all of the demand equations are collectively zero is $\chi^2(56) = 410.41$ with a *p*-value of 0.00000. An analogous test on the employment variables is $\chi^2(112) = 557.67$ (0.00000), and on all of the children variables is $\chi^2(98) = 432.10$ (0.00000).

Similar patterns hold for other demographic variables: They are statistically significant in some but not all equations and collectively strongly statistically significant. Rather than try to describe the effects of all of the demographic variables on the quantities demanded variable by variable, we turn to their effects on price elasticities of demand and the equivalent variation measure of the welfare effects of marketing orders.

Price Elasticities

As the prices of dairy products change due to milk marketing orders, consumers alter the mix of dairy products that they demand. Table 4 shows the own- and cross-price elasticities for various categories of dairy products calculated at the mean of the variables (from Table 1). Each cell shows the price elasticity for a change in the product listed at the top of the column.

All of the own-price elasticities are negative, statistically significant, and inelastic. This result is consistent with the previous literature. The magnitudes of our point estimates are similar to those in the previous literature. The own-price elasticities of demand for the four types of fresh milk (1%, 2%, no-fat, and whole) range from –0.622 for no-fat milk to -0.882 for 1% milk. The other dairy products are generally even less elastic, down to cream cheese, which has an elasticity of -0.185. There are roughly equal numbers of positive and negative cross-price elasticities of demand, but all of these elasticities are very close to zero—mostly below 0.05 in absolute value, and none larger than 0.3 in absolute value. Indeed, most of the cross-price elasticities are not statistically different from zero at a 5% level of significance.

Even though many of the demographic variables are statistically significant, the own-price elasticities of demand do not vary much across demographic groups. As we discussed in the theory section, a change in a demographic variable may cause a demand curve to shift and rotate in such a way that the elasticities do not vary substantially, which is what appears to happen here.

Table 5 reports the income elasticities evaluated at the mean. All of the income elasticities are negative and nine (including all of the milk products) are statistically different from zero at the 5% significance level. The income elasticities also vary only slightly across demographic characteristics. Our income elasticity estimates fall generally in the range of other estimated income elasticities for dairy products. But, as one would expect, they tend to differ from the previous estimates of food expenditure elasticities for dairy product demands in a conditional (that is, in a weakly separable) system of demand equations.

Welfare Effects from Eliminating Marketing Orders

Even though elasticities do not vary substantially across demographic groups, the welfare effects of price changes do vary substantially across these groups. Indeed, if we were to eliminate the marketing order so that fresh milk prices fell while processed prices rose, consumers in some demographic groups would gain while others would lose.

We illustrate how eliminating a milk marketing order differentially affects the equivalent variation, *ev*, for various consumer groups. We report the equivalent variation as the weekly change in income that a consumer is willing to accept in lieu of experiencing the price changes. When the equivalent variation is positive, consumers benefit from the price changes.

When the New England Dairy Compact ended in 2001, fresh milk prices fell by about a fifth. To illustrate the effects of eliminating the federal marketing order, we examine cases where retail fluid milk prices drop by 20%.[8] This change in fluid milk prices is consistent with the farm-level price effects due to milk marketing orders estimated by LaFrance and deGorter and the pass through effects on retail prices estimated by LaFrance (1991a, 1993).

A drop in the price of fresh milk would be offset by a rise in the prices of processed milk products as raw milk shifts from processed dairy products to fresh milk use. In Tables 6 and 7, we consider five scenarios ranging from the prices of manufactured products remaining constant to rising up to 20% (the same absolute percentage value as the decrease in the fluid milk prices). One might argue that a relatively small change is more plausible, given that the retail prices of manufactured dairy products remained nearly constant when the New England Dairy Compact was terminated in 2001. Almost certainly, therefore, the relatively large (15% and 20%) price increases for manufactured dairy products that we consider in the table are unlikely to occur.

[8] Our simulation experiments show that smaller or larger cuts have proportional effects. For example, a 10% cut in fluid milk prices has almost exactly half as large an *ev* effect as a 20% decrease.

Table 6 shows how the quantities demanded (evaluated at the mean of the explanatory variables) would vary for each of the scenarios. As expected, the demand for fresh milk products rise and those for processed dairy products fall. In all of the scenarios, the quantity demanded of 1% and 2% milk increase substantially, by nearly 8.9% to 10.4%. The demands for the other milk products increase by less, but still substantially. In the scenarios when processed prices rise, the demands for these products drop by relatively modest amounts except for cottage cheese (where the decrease is between 3.1% and 13.6% depending on the scenario), cooking yogurt (fell by between 3.3% and 10.1%), and flavored yogurt (dropped by between 1.7% and 8.3%).

Given these increases in milk demands and drops in processed product demands in the scenarios with large processed price increases, it is not surprising that some consumers benefit and others lose. Table 7 shows how welfare changes across demographic groups by holding all demographic characteristics but one at their means and then changing one characteristic at a time. The larger the percentage increase in the prices of manufactured products, the worse off is each demographic group.

The first row of Table 7 shows the equivalent variation for the "average" consumer group in the sense that we evaluate each demographic variable at its mean level. For this average group, given that the price of fresh milk falls 20%, each household's equivalent variation is \$1.38 if the prices of processed goods do not change, 57¢ if the processed prices rise by 5%, -22¢ if they rise by 10%, -\$1.01 if they rise by 15%, and -\$1.78 if they rise by 20%. Of course, if the retails prices of processed milk products remain unchanged, then all consumer groups benefit from a drop in the price of fresh milk. On the other hand, if the prices of processed dairy products were to rise sufficiently, then all consumers would be harmed.

The third row of Table 7 shows the equivalent variation for a comparable black family. To do these calculations, we set the variable for "black" equal to one, the variables for the other race and ethnic groups equal to zero, and the values of all other demographic variables (age, income, and so forth) equal to the average value for the entire sample. The corresponding equivalent variations are 18¢ for 0% change in processed goods, -90¢ for a 10% change, and -$1.93 for a 20% change. The corresponding equivalent variations for a white family (second row) are $1.39, -21¢, and -$1.77. Thus, black families benefit less or are harmed more (depending on the change in processed goods prices) than are white families.

That the welfare response to price changes varies with race could be due to varying incidences of lactose intolerance, though the pattern is not clear.[9] Whites are less likely to be lactose intolerant than Asians and hence it is not surprising that they benefit more from eliminating marketing orders than do Asians as long as the processed product prices do not increase or do so only modestly. However, blacks are less likely to be lactose intolerant than Asians, yet Asians gain more than black consumers from eliminating the marketing order.

In addition to race, the table also shows the welfare effects for various demographic groups where we vary one variable at a time for income, education, head of household's age, presence of children, and age of children (whether you have a child in each age group). Where the processed prices do not change much (5% or less), lower income families benefit more than wealthier families from eliminating the marketing order. Similarly, less educated families do better than more educated ones (though the differences are very small). Families with young

[9] In the United States, the prevalence of lactose intolerance varies substantially by race: 5% for Caucasians of Northern European and Scandinavian decent, 45% for African American children and 79% for African American adults, 55% for Mexican American males, 70% for North American Jews, to 90% for Asian Americans, and 98% for Southeast Asians (**nutrigenomics.ucdavis.edu/lactoseintolerance.htm**).

children (under six years of age) benefit more than others from eliminating marketing orders.

Perhaps the most interesting experiments are those in the last two rows of Table 7, where we compare the equivalent variations of two types of families by varying several characteristics at once. In the next to last row, we examine a "young family." The heads of household are 25 years old, they have a deflated income of $10,000, the wife is not employed, the husband works in a non-professional occupation, they have two children under six years of age, and they rent their dwelling. In contrast, in the last row, is the "childless couple." This pair has a higher income of $30,000, they are a decade older (35 years old), are working professionals, and own their dwelling.

The young family gains more from the elimination of the marketing order than the average family or virtually any other group, presumably because their children consume relatively large amounts of fresh milk. Even if the price of processed milk increases as much as 15%, they benefit from eliminating the marketing order (reducing the price of fresh milk by 20%). In contrast, the childless, older, wealthier family only benefits if the increase in processed milk prices is less than 10%. Moreover, even if there is no increase in the processed milk price, the benefit to the young family is 86% greater than that for the childless couple.

In general, if the 20% drop in the fresh milk price is offset by a 0% or 5% increase in the processed products prices, virtually all consumer groups benefit. With an implausible 15% or 20% increase, virtually all groups lose. If the fall in the fresh milk price is offset by a moderate (10%) rise in the processed prices, there are winners and losers. The average family loses, as do whites, blacks, families with incomes of $10,000 or $30,000, families with heads who have college educations, and families with children over the age of six. In contrast, Asian and

Hispanic families benefit, as do those with heads who have less than a college education and those with young children.

How large are the welfare effects? At first glance, an equivalent variation of less than a couple of dollars per week per household seems small. However, there are 111 million U.S. households. If eliminating marketing orders for milk caused fresh milk prices to fall by 20% and processed prices to rise by 5%, then the average household would have an equivalent variation of 57¢ per week. The economic welfare of all households would increase by about $63 million per week or almost $3.3 billion per year. If the price of processed dairy products do not rise, while the retail prices for fluid milk fall by 20%, then the total welfare gain is approximately $153 million per week, and nearly $7 billion per year.

Finally, our simulations show that the milk marketing order regulations are regressive. We define the "regulatory burden" as the annual equivalent variations associated with a 20% decrease in fluid milk prices and a 5% increase in manufacturing prices divided by a household's annual income. In Figure 1, we show how the regulatory burden for the average family falls with income. The burden is 0.49% at an income of $7,500. It falls 0.36% at $10,000, 0.16% at $20,000, 0.09% at $30,000, 0.014% at $70,000. Indeed, the burden is slightly negative, -0.023%, at $200,000 (not shown in the figure).

The curve for white families is virtually the same as for the average. The curves for Asian and Hispanic families lie strictly above those for white families, but all curves fall with income. Black families actually benefit slightly from the policy (with the benefit falling with higher incomes).

Summary and Conclusions

Using supermarket scanner data, we estimate an incomplete demand system to determine the effects of changing the milk marketing order regulations on various demographic groups. We calculate the price elasticities and the equivalent variations associated with price changes. The price elasticities describe the substitutability between dairy products as prices change. The equivalent variation measures the changes in welfare associated with the price changes.

There is very little variation in price elasticities across demographic groups. Nonetheless, there are substantial welfare differences across demographic groups from eliminating the market orders.

When the New England Dairy Compact ended in 2001, fresh milk prices fell by about a fifth and other milk product prices were virtually unchanged (though we would have expected at least a small increase). Under those conditions, all consumers benefit from eliminating marketing orders. In particular, poorer, less educated, families with young children tend to gain more than richer, better-educated families with no children or older children.

If eliminating the market order results in a drop in fresh milk prices that is offset by half as large an increase in processed product prices, households that consume relatively more fresh milk gain, and those that consume relatively more processed products lose. Families with young children, Asians, and Hispanics would gain, while older childless couples would lose. That is, as predicted, orphans suffer from marketing orders while yuppies benefit. Finally, marketing orders are regressive: Households with lower income levels pay a larger percentage of their income due to the regulations than do those with higher income levels.

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Table 1. Summary Statistics of the Variables

	mean	*standard error*
Household (HH) Size	2.82	0.003
Weekly Income	471.76	0.023
Own House	0.83	
Race/Ethnicity		
Share White	0.880	
Share Black	0.054	
Share Hispanic	0.045	
Share Asian	0.014	
Male Head of household		
Age	54.20	0.035
Years of Education	12.90	0.008
Share Unemployed	0.030	
Share Employed Part Time	0.037	
Share Employed Full Time	0.65	
Share Nonprofessional Occupation	0.36	
Technical Education	0.11	
Female Head of household		
Age	53.55	0.035
Years of Education	13.37	0.007
Share Unemployed	0.23	
Share Employed Part Time	0.17	
Share Employed Full Time	0.37	
Share Nonprofessional Occupation	0.43	
Share Technical Education	0.068	
Children		
Children present in HH	0.35	
Average Number of Young Children Ages 0-5.9	0.13	0.0007
Average Number of Middle Children Ages 6-11.9	0.25	0.0008
Average Number of Older Children Ages 12-18	0.31	0.001
Share of HH with children with Young Children	0.31	
Share of HH with children with Middle Children	0.52	
Share of HH with children with Older Children	0.56	

Table 2. Equation Summary Statistics

	Dependent Variable		*Regression Equation*	
	Mean	*S.E.*	^{2}	R^2
1% Milk	1.671	.303	.038	.59
2% Milk	1.684	.266	.015	.78
Nonfat Milk	1.579	.274	.015	.80
Whole Milk	1.545	.335	.025	.78
Cream	1.016	.204	.019	.56
Coffee	1.100	.174	.017	.44
Natural Cheese	1.963	.356	.044	.65
Processed Cheese	1.884	.272	.028	.62
Shredded Cheese	1.996	.259	.036	.47
Cream Cheese	1.178	.204	.023	.46
Butter	1.711	.445	.111	.44
Ice Cream	2.662	.465	.100	.54
Cooking Yogurt	.958	.243	.046	.22
Other Yogurt	1.534	.213	.020	.57

Notes: “Cooking yogurt” is defined as plain and vanilla yogurt. “Other yogurt” is yogurt of all other flavors.

Table 3. Coefficients on Selected Demographic Variables

	White	*Black*	*Hispanic*	*Asian*	*Male Age*	*Own House*	*Young Children*
1% Milk	**-345.84**	**-498.84**	**-215.14**	**-288.51**	**5.76**	**-44.36**	**-96.45**
2% Milk	**165.74**	29.93	**295.10**	**159.79**	**2.72**	14.14	**-57.25**
Nonfat Milk	24.63	-72.91	82.79	-76.88	**3.24**	-5.10	**-42.47**
Whole Milk	-23.23	**-125.43**	73.97	-11.68	**1.40**	-4.15	-8.96
Cream	-20.00	-12.44	-1.03	-19.48	-.06	**11.73**	-1.74
Coffee Creamer	-8.33	-5.57	7.70	**-69.20**	**.71**	-6.23	-4.57
Natural Cheese	-12.75	**-20.15**	-9.76	**-22.94**	**.25**	-.23	-.61
Processed Cheese	**-26.80**	**-27.23**	**-23.43**	**-28.10**	**.22**	**-4.15**	2.81
Shredded Cheese	3.65	-2.83	5.19	2.66	**.24**	-1.10	2.85
Cream Cheese	-14.74	-15.24	-12.70	-19.74	**.28**	3.24	-1.91
Butter	-24.83	-16.11	-37.23	-10.45	-.19	1.11	-5.79
Ice Cream	**-108.48**	**-169.27**	-71.53	**-137.57**	**-2.43**	7.40	-15.99
Cooking Yogurt	-16.87	-43.21	-2.34	-59.23	-.34	-11.09	-9.17
Yogurt	-31.32	**-54.36**	-24.78	-20.59	**-.41**	4.48	6.93

Notes: Male Age is the average; other variables are proportions. The coefficient is boldfaced if we can reject the null hypothesis that it is zero at the 0.05 significance level.

Table 4. Price Elasticities of Demand for Dairy Products Calculated at the Mean of the Explanatory Variables

	Milk 1%	*Milk 2%*	*Milk No-Fat*	*Milk Whole*	*Fresh Cream*	*Coffee Additives*	*Natural Cheese*	*Processed Cheese*	*Shredded Cheese*	*Cream Cheese*	*Butter*	*Ice Cream*	*Yogurt Cooking*	*Yogurt Flavored*
1% Milk	**-0.882**	**0.091**	**0.122**	**0.135**	0.014	0.001	**0.073**	**0.045**	-0.012	-0.023	-0.009	**-0.055**	**-0.083**	-0.027
	(0.026)	(0.014)	(0.014)	(0.015)	(0.015)	(0.013)	(0.021)	(0.017)	(0.014)	(0.016)	(0.012)	(0.026)	(0.028)	(0.016)
2% Milk	**0.089**	**-0.788**	**0.078**	**0.097**	-0.016	**-0.066**	**0.095**	0.007	0.012	-0.014	0.012	-0.027	0.019	-0.020
	(0.014)	(0.027)	(0.022)	(0.023)	(0.018)	(0.019)	(0.032)	(0.027)	(0.009)	(0.015)	(0.009)	(0.024)	(0.026)	(0.017)
Milk No-Fat	**0.128**	**0.083**	**-0.622**	0.010	0.030	**0.059**	-0.037	**-0.089**	-0.003	0.008	**-0.032**	0.005	**0.121**	0.019
	(0.015)	(0.023)	(0.034)	(0.026)	(0.021)	(0.022)	(0.029)	(0.032)	(0.014)	(0.020)	(0.010)	(0.024)	(0.028)	(0.019)
Milk Whole	**0.146**	**0.107**	0.011	**-0.742**	-0.028	**-0.054**	**-0.177**	-0.019	-0.021	0.021	0.010	-0.010	-0.025	0.010
	(0.016)	(0.025)	(0.026)	(0.041)	(0.021)	(0.021)	(0.035)	(0.032)	(0.015)	(0.017)	(0.012)	(0.030)	(0.031)	(0.022)
Fresh Cream	0.022	-0.026	0.047	-0.044	**-0.421**	0.033	**0.108**	**0.196**	0.039	0.015	0.004	0.066	**-0.123**	0.037
	(0.024)	(0.030)	(0.032)	(0.032)	(0.052)	(0.035)	(0.053)	(0.048)	(0.037)	(0.051)	(0.023)	(0.052)	(0.056)	(0.035)
Coffee Additives	0.001	**-0.102**	**0.085**	**-0.077**	0.031	**-0.477**	-0.006	-0.006	-0.034	**-0.098**	-0.009	**0.126**	-0.021	**0.102**
	(0.020)	(0.029)	(0.031)	(0.030)	(0.032)	(0.049)	(0.044)	(0.046)	(0.031)	(0.033)	(0.017)	(0.048)	(0.057)	(0.032)
Natural Cheese	**0.061**	**0.081**	-0.029	**-0.139**	**0.056**	-0.003	**-0.721**	**0.208**	0.015	**-0.109**	0.022	**0.126**	-0.021	**0.057**
	(0.018)	(0.027)	(0.023)	(0.028)	(0.028)	(0.025)	(0.050)	(0.036)	(0.015)	(0.028)	(0.013)	(0.042)	(0.036)	(0.024)
Processed Cheese	**0.038**	0.006	**-0.075**	-0.016	**0.105**	**-0.003**	**0.216**	**-0.773**	0.006	**-0.084**	-0.006	**0.161**	0.066	-0.010
	(0.015)	(0.025)	(0.027)	(0.026)	(0.026)	(0.027)	(0.037)	(0.053)	(0.022)	(0.020)	(0.013)	(0.036)	(0.036)	(0.026)
Shredded Cheese	-0.012	0.010	-0.003	-0.017	0.020	-0.019	0.014	0.006	**-0.253**	-0.034	-0.001	-0.008	0.026	0.005
	(0.012)	(0.007)	(0.011)	(0.012)	(0.019)	(0.017)	(0.015)	(0.021)	(0.082)	(0.020)	(0.013)	(0.025)	(0.016)	(0.014)
Cream Cheese	-0.034	-0.020	0.010	0.027	0.013	**-0.092**	**-0.183**	**-0.134**	-0.059	**-0.185**	-0.007	0.080	**-0.158**	0.024
	(0.023)	(0.021)	(0.026)	(0.023)	(0.044)	(0.031)	(0.047)	(0.032)	(0.033)	(0.0003)	(0.017)	(0.082)	(0.047)	(0.034)
Butter	-0.008	0.013	**-0.028**	0.009	0.003	-0.005	0.026	-0.005	-0.000	-0.004	**-0.410**	**0.187**	**0.034**	-0.012
	(0.012)	(0.009)	(0.009)	(0.011)	(0.014)	(0.011)	(0.014)	(0.014)	(0.015)	(0.012)	(0.023)	(0.023)	(0.016)	(0.012)
Ice Cream	**-0.035**	-0.016	0.004	-0.006	0.025	**0.053**	**0.093**	**0.115**	-0.005	0.036	**0.120**	**-0.803**	**0.097**	**0.059**
	(0.016)	(0.015)	(0.014)	(0.018)	(0.020)	(0.020)	(0.031)	(0.025)	(0.019)	(0.036)	(0.015)	(0.049)	(0.030)	(0.020)
Yogurt Cooking	**-0.145**	0.0340	**0.201**	-0.040	**-0.130**	-0.023	-0.042	0.132	0.0556	**-0.193**	**0.060**	**0.270**	**-0.683**	0.095
	(0.049)	(0.046)	(0.045)	(0.050)	(0.059)	(0.065)	(0.075)	(0.071)	(0.034)	(0.058)	(0.029)	(0.082)	(0.155)	(0.057)
Yogurt Flavored	-0.031	-0.022	0.0196	0.009	0.024	**0.073**	**0.072**	-0.012	0.007	0.019	-0.014	**0.102**	0.059	**-0.773**
	(0.018)	(0.019)	(0.019)	(0.009)	(0.023)	(0.023)	(0.030)	(0.032)	(0.018)	(0.026)	(0.013)	(0.035)	(0.036)	(0.034)

Notes: The table shows the price elasticity given that the price of the good shown in the column changes. The elasticity is boldfaced if we can reject the null hypothesis that it is zero at the 0.05 significance level.

Table 5. Income Elasticities for Dairy Products

	Income Elasticity	*Standard Error*
1% *Milk*	**-0.511**	0.071
2% *Milk*	**-0.162**	0.054
Milk No-Fat	**-0.168**	0.052
Milk Whole	**-0.333**	0.066
Fresh Cream	**-0.228**	0.102
Coffee Additives	-0.090	0.090
Natural Cheese	**-0.242**	0.075
Processed Cheese	-0.056	0.063
Shredded Cheese	-0.141	0.073
Cream Cheese	-0.065	0.110
Butter	**-0.523**	0.138
Ice Cream	**-0.294**	0.075
Yogurt Cooking	**-0.445**	0.183
Yogurt Flavored	-0.113	0.068

Note: The elasticity is boldfaced if we can reject the null hypothesis that it is zero at the 0.05 significance level.

Table 6. Percent Change in Quantity Given Fresh Milk Prices Fall 20% and Processed Product Prices Increase by Various Amounts
(Evaluated at the Mean of the Explanatory Variables)

	Processed Product Prices Increase				
Product	*0%*	*5%*	*10%*	*15%*	*20%*
1% Milk	10.366	9.997	9.627	9.256	8.884
2 % Milk	10.381	10.388	10.394	10.400	10.405
Milk No-Fat	7.929	8.335	8.741	9.147	9.552
Milk Whole	9.517	8.056	6.594	5.131	3.667
Fresh Cream	0.002	-0.218	-0.440	-0.662	-0.884
Coffee Additives	1.852	-0.089	-2.031	-3.973	-5.915
Natural Cheese	0.516	-1.328	-3.173	-5.019	-6.866
Processed Cheese	0.938	-0.648	-2.234	-3.820	-5.406
Shredded Cheese	0.424	-0.783	-1.990	-3.198	-4.406
Cream Cheese	0.337	-3.149	-6.635	-10.121	-13.608
Butter	0.269	-0.641	-1.554	-2.467	-3.382
Ice Cream	1.069	0.021	-1.028	-2.078	-3.128
Yogurt Cooking	-1.000	-3.266	-5.533	-7.801	-10.070
Yogurt Flavored	0.473	-1.729	-3.932	-6.135	-8.338

Table 7. Equivalent Variation ($/week) by Demographic Groups Given Fresh Milk Prices Fall 20% and Processed Product Prices Increase by Various Amounts

	Processed Product Prices Increase				
Demographic Group	*0%*	*5%*	*10%*	*15%*	*20%*
Mean	1.38	0.57	-0.22	-1.01	-1.78
White	1.39	0.59	-0.21	-0.99	-1.77
Black	0.18	-0.37	-0.90	-1.42	-1.93
Asian	1.28	0.75	0.24	-0.26	-0.75
Hispanic	2.43	1.40	0.39	-0.61	-1.59
Income=$10,000	1.60	0.69	-0.21	-1.10	-1.97
Income=$30,000	1.29	0.52	-0.23	-0.97	-1.70
Education=10 Years	1.44	0.75	0.07	-0.59	-1.24
Education=16 Years	1.27	0.38	-0.50	-1.37	-2.22
HH Head 25 Years Old	0.17	-0.27	-0.69	-1.10	-1.49
HH Head 35 Years Old	0.70	0.10	-0.49	-1.07	-1.63
HH Head 60 Years Old	1.58	0.71	-0.16	-1.01	-1.85
Young Child (0-5.9)	1.93	1.05	0.19	-0.65	-1.49
Middle Child (6-11.9)	1.31	0.61	-0.07	-0.74	-1.39
Older Child (12-18)	1.50	0.69	-0.10	-0.88	-1.65
No Children	1.50	0.63	-0.24	-1.09	-1.92
Young Family[a]	1.88	1.36	0.85	0.36	-0.12
Childless Couple[b]	1.01	0.11	-0.77	-1.64	-2.50

[a] Heads of household are 25 years old, they have a real income of $10,000, the wife is not employed, the husband works in a non-professional occupation, they have two children under 6 years of age, and they rent their dwelling.

[b] Heads of household are 35 years old, they have a real income of $30,000, both are working professionals, and they own their dwelling.

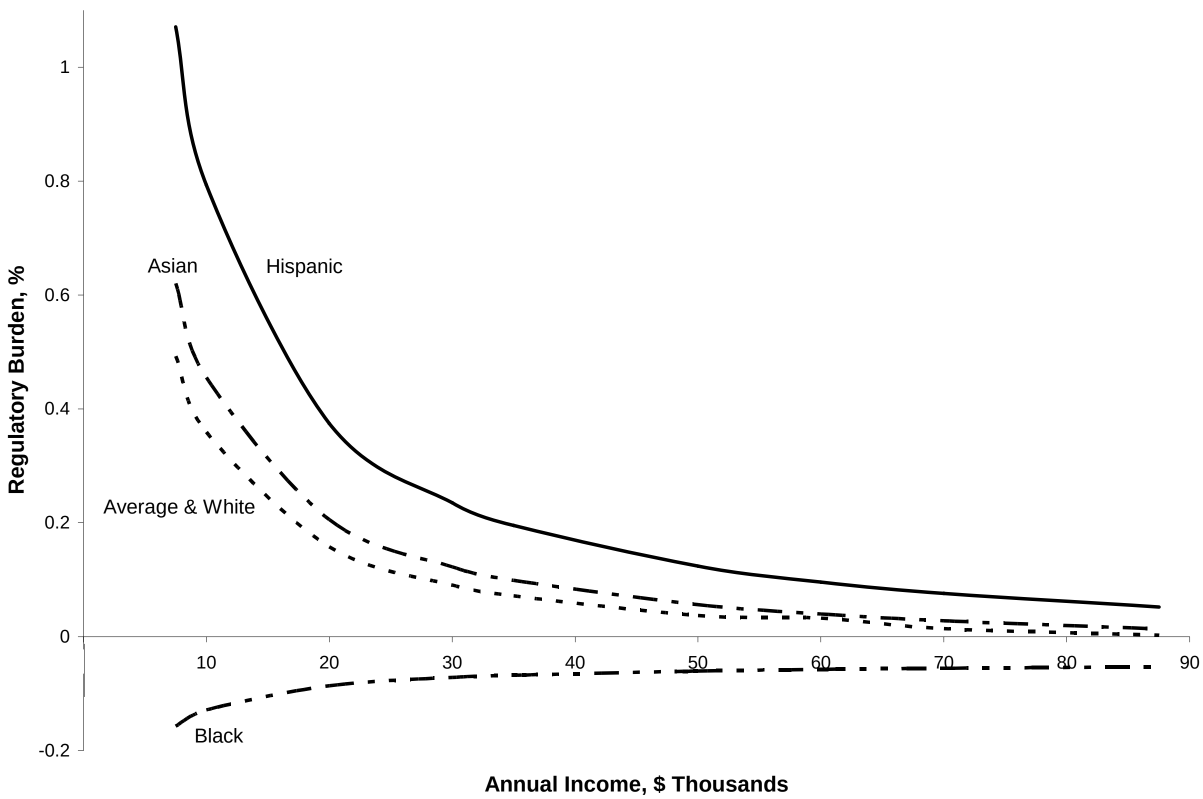

Figure 1. Percent of the Regulation Burden on Income for Various Income Levels