The direct economic effects of a policy to provide government subsidized price discounts for the purchase of fruit and vegetable by food stamp recipients.

by

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INTRODUCTION

This study will evaluate the direct benefits and costs to consumers and producers from changes in prices, consumption and production, of a policy to offer government price discounts on fresh fruit and vegetable to food stamp recipients. The suggestion for a price discount on fruit and vegetable for food stamps recipients is contained in the 2004 Farm Bill, section 4116 that provides for research on "encouraging consumption of fruit and vegetables by developing a cost-effective system for providing discounts for purchases of fruit and vegetables made through use of electronic benefit transfer (EBT) cards". In California, legislation has been proposed (AB 2384) to complete a pilot study of providing a price discount of 20% to 40% to food stamp recipients for every dollar spent on fruit and vegetable purchases. To date no studies have been completed to determine if, or under what circumstances, this is an economically viable option.

The price discount for the purchase of fruit and vegetables would take place at the cash register when food stamp users swipe their EBT cards. The technology to provide the discount is the same as the technology used by supermarkets that offer discounts to shoppers who use their in-store "club" card and is administratively feasible (personal communication, Don Harris, Vice President, Produce Department, Safeway, Inc., 1999). The question remains whether it is economically feasible.

Increased consumption of fruit and vegetable has been linked to a decrease in dietary related chronic diseases such as heart disease, diabetes and some cancers (Hung et al., 2004). Low socioeconomic status (SES) is strongly associated with higher rates of obesity and high rates of the leading causes of illness and death. For instance, results from the National Health Interview Survey show that low SES adults are more likely to have diabetes, cancer, heart disease, and hypertension compared to those with higher SES (Mokdad et al. 2001; Paeratakul et

al. 2002). They are also more likely to be diagnosed in the later stages of chronic diseases such as cancer and, consequently, have higher mortality rates than their higher income counterparts (Bradley et al. 2005). Diet may play an important mediating role in explaining socioeconomic disparities in health status. Analyses of data from the Continuing Survey of Food Intakes of Individuals (CSFII) indicate that wealthier respondents eat more fruit and vegetable, and eat a greater variety of foods, than their lower-income counterparts (Haan et al. 2001).

About half of all food stamp recipients are persistently on food stamps. Even though 70% of all recipients leave within two years, more than half of those who leave the program will return within two years (Gleason et al. 1998). Consequently, developing cost effective policies that lead to a higher consumption of fruit and vegetable may have a significant impact on the incidence of chronic disease among persistent food stamp recipients.

Improving diet quality by eating according to the newly revised food pyramid guidelines (www.mypyramid.com) may strain low-income household budgets. Current recommendations for healthy eating include eating whole grain products and very lean meat. However, the additional cost eating whole grains and lower fat meat is about 17% more than the level of food stamp benefits based on the Thrifty Food Plan (Jetter and Cassady 2006) as the Thrifty Food Plan does not include whole grains or very lean ground beef (USDA 1999). The availability of healthier foods may also be a problem. To economize low-income consumers often buy bulk items that have a lower per unit cost (Kaufman et al. 1997). When it comes to the purchase of healthier foods however this may not be a feasible strategy as whole grains, very lean meat and skinless poultry are rarely sold in the large “family” packs in which white flour or rice, white breads, and higher fat ground meat and poultry are often sold (Jetter and Cassady 2006).

Therefore, a policy that eases budgetary constraints of low-income consumers may promote healthier eating habits among that group.

To assist food stamp recipients in meeting the revised guidelines, a general increase in assistance can be provided, or a policy that targets the healthier food items can be adopted. With respect to general assistance, Blisard et al. (2004) estimated that an additional dollar of income in a low-income household (less than 130 percent of the poverty line) will probably be allocated to food groups other than fruit and vegetable, or to other items that are deemed more important by the household. Conversely, in a review of environmental interventions, Seymour et al (2004) determined that targeted assistance may be more efficient at effectuating dietary changes than more general assistance programs. As reported in the review, interventions that offered discounts of 25% to 50% resulted in a significant change in consumption to healthier foods. Price discounts of 10% did not have a significant effect. In a study on the effect of labeling and price discounts on snack items in vending machines French et al. (2001) estimated that price discounts of 25% and 50% lead to an increase in the purchase of healthier snacks by 39% and 93% respectively. Labeling alone or in combination with price discounts did not have a significant effect.

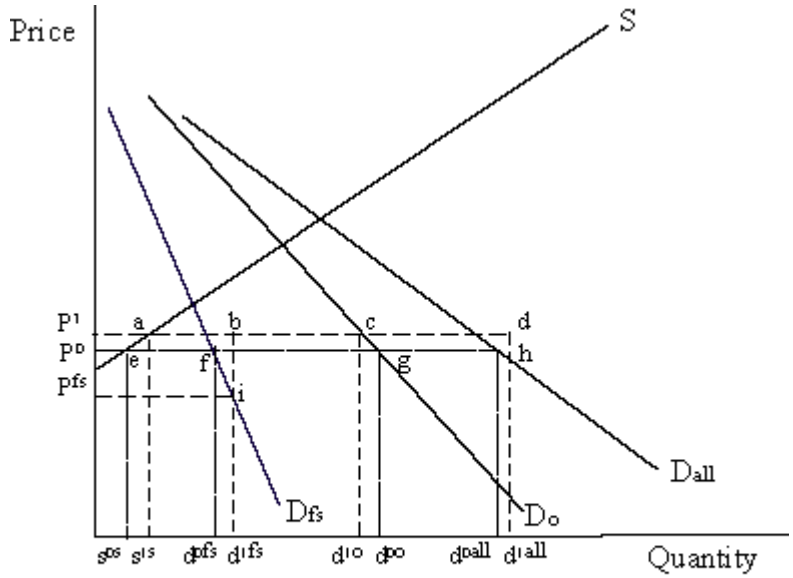
The potential to improve the health status of food stamp consumers is the impetus behind a government subsidized price discount policy. Providing price discounts also directly benefits food stamp consumers through lowering the prices that they pay for fruit and vegetables. However, a price discount may cause equilibrium market prices to rise for fruit and vegetables as the discount would cause the quantity demanded of fruit and vegetables to increase. This would benefit growers of fruit and vegetable as they are now receiving higher prices for their products, but make non-food stamp consumers potentially worse off. Tax payers would also bear the

burden of paying stores for the difference between market prices and the price discounts. Including these effects on all groups is essential when calculating the total costs and benefits of a policy change.

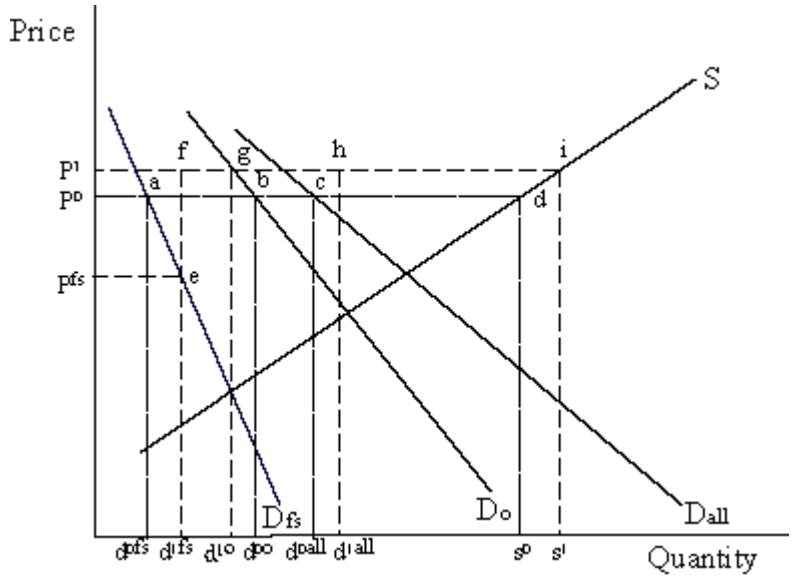
Graphical analysis of the costs and benefits to consumers and producers of a food stamp bonus value coupon.

The graphical analysis of the market for a commodity is for the case of a large country and is either a net importer or a net exporter of a commodity. The case of a net importer is presented first, then the case of the net exporter will be presented.

If the U.S. domestic market is a net importer of a commodity, insufficient quantity is produced within the country, so the country has an excess demand for the commodity that is satisfied by imports. The initial equilibrium price is P^o. At the market price of P^o the initial quantity demanded by food stamp recipients is d^{ofs}, the quantity demanded by other consumers is d^{oo}, and total quantity demanded is d^{oall}.



The bonus value coupon causes the quantity demanded to increase to d^{1fs}. The greater demand from commodity i causes an increase in the market price to P^1. At P^1 quantity demanded by other consumers falls to d^1o but quantity demanded by both food stamp and non food stamp recipients increases to d^{1all}.



Given the relatively small share of food stamp users in the general population (only four percent of respondents in the NHANES 2001-2002 & 2003-2004 surveys), the change in market price is anticipated to be minimal, causing minimal changes in consumption by non-food stamp consumers, and only a slight increase in output by growers. However, given the size of the U.S. agricultural sector, even a slight change in output may have large benefits to growers. For example, increasing the consumption of fruit and vegetable by Californians from about 4 servings a day to 5 a day benefits all growers in the U.S. by approximately $460 million a year (Jetter et al 2004).

Food stamp recipients stand to benefit substantially depending on the level of price discount and their responsiveness to price changes. An additional indirect benefit would be a

reduction in chronic diseases, such as cancer, among the low-income population that is the focus of the price discount policy. The benefits may include both a reduction in mortality and a reduction in public expenditures such as Medicaid. While very important benefits, undertaking an epidemiology study of the potential change in incidence of chronic diseases in beyond the scope of this small grant proposal.

Hypotheses to be evaluated

1. Offering price discounts of 25% or 40% to food stamp recipients for the purchase of fruit and vegetables will substantially increase consumption of fruits and vegetables.
2. Even though non-food stamp recipients may be worse off, the total direct benefits to consumers and producers would provide economic justification for a policy of price discounts to food stamp recipients for fruits and vegetables.

METHODOLOGY

Data analysis strategy.

The analysis involves using a model of the U.S. fruit and vegetable industry that captures the effects of price discounts on market prices and supply, quantity demanded, trade and production. The model is solved for the new equilibrium price and quantity for a given price discount. The basic model sets out supply and demand conditions in log-differential form such that $dlnX = (X_1 - X_0)/X_0$, where the subscript 1 indexes the new price or quantity level and the subscript 0 indexes the original level of variable X. The model is used to show how the equilibrium quantities, prices and other variables respond to shocks to the system, such as a price discount. The supply side of the model contains equations for net U.S. trade (U.S. imports minus U.S. exports), market quantity supplied from the agricultural marketing sector (processors and handlers), and production supplied to the marketing sector from growers in California and the

rest of the U.S. The result is a model that links supply and demand in the final market to supply and demand in the marketing sector, and ultimately, to growers' production decisions. The solution to the system of equations is the percentage change in retail and grower prices, final quantity demanded by each consumer group in the study, imports and exports, and production by growers in each region.

The advantage of simulating a linear market model is that it does not require estimating the underlying supply and demand curves. The supply and demand functions are log-linear approximations to the underlying curves. For small changes in demand they provide estimates of surplus changes that are a close approximation to the actual values (Alston, Norton, and Pardey 1995). Another advantage is that the system can be simulated with readily available information (Alston, Norton, and Pardey 1995). The main disadvantage is that the larger the shock to the system, the more biased is the estimate of surplus changes. However, this is true for any model where the demand curve is an approximation.

Similar market models have been widely used to estimate the benefits of agricultural research (e.g., Alston, Norton, and Pardey 1995), agricultural policies (e.g., Sumner and Lee 1997) and changes in consumption following nutrition education to school age children (Alston, Chalfant, and James 1999). They do not predict what the actual market quantity and prices will be, because many other factors influence actual production (such as temperature, rainfall, etc.), market price, and market quantity each year. Instead, this model allows the economic effects of increased consumption to be modeled separately from all other market influences, treating the other market conditions and production costs as remaining constant when the change occurs. This is, in fact, the preferred measure of the effects of an isolated incident, even if interest is in a real-world demand shift, not a hypothetical one. Simply looking at the market before and after

the change, and attributing the entire change to the demand shift, runs the risk of interpreting the effects of weather or other changes on production as the effects of the demand shift alone.

Final market demand equations

The quantity demanded, Y, for fruit or vegetable commodity j by income group k, depends upon its own-price P_j, the price of other commodities, P_{-j}, and an exogenous demand shifter ϕ that represents the price discount for fruits and vegetables (eq. (1))

(1) $$Y_{jk} = d_{jk}\left(P_1,...,P_j;\phi_{jk}\right).$$

Total demand for commodity j is the sum of demand for each income group k (eq. (2))

(2) $$Y_j^D = \sum_k Y_{jk}\ .$$

Final Market Supply Equations

The U.S. market supply, Y^S, of commodity j comes from production, Q, by the marketing sector in region i, where i is California or the rest of the U.S., and from net trade, T, with other countries (eq. (3)). Net trade is equal to total imports less total exports. If T is positive, the U.S. imported more than it exported. If T is negative, the U.S. exported more than it imported.

(3) $$Y_j^S = \sum_i Q_{ji} + T_j\ .$$

In equilibrium total quantity demanded has to equal total quantity supplied (eq. (4)).

(4) $$Y_j^D = Y_j^S$$

Trade in commodity j depends on its U.S. market price (eq. (5)). As U.S. prices increase, the amount of commodity j that goes to the U.S. market also increases.

(5) $$T_j = t_j\left(P_j\right)$$

Marketing Sector

The marketing sector takes the farm product and either packs it fresh for delivery to markets, or processes it to sell as juiced, canned, frozen or dried products. Non-farm inputs such as labor, transportation, packing materials, machinery in processing plants, etc., are used to bring fresh and processed fruits and vegetables to market. The total cost of the non-farm inputs is w_m. The price received by growers of fruits and vegetables, w_g, will change as the quantity demanded for fruits and vegetables changes in response to the price discount for food stamp recipients. The retail price depends upon the cost of the farm and non-farm inputs in each region i (eq. (6)).

(6) $$P_j = C_{ji}\left(w_{jgi}, w_{jmi}\right)$$

The marketing sector receives the farm commodity from growers and the non-farm inputs from other suppliers. As demand for the final output changes, demand for the farm commodity and non-farm inputs changes. Using Shepard's Lemma, the derived demand for the farm commodity, x_{jgi}, (eq. (7)) by the marketing sector in each region is

(7) $$x_{jgi} = \partial C_{ji}\left(w_{jgi}, w_{jm}; Q_{ji}\right) / \partial w_{jgi}.$$

Again using Shepard's Lemma, the derived demand for the marketing input, x_{jmi}, (eq. (8)) in each region is

(8) $$x_{jmi} = \partial C_{ji}\left(w_{jgi}, w_{jm}; Q_{ji}\right) / \partial w_{jm}.$$

The supply for the marketing input and grower inputs depends on the price for the inputs so that

(9) $$x_{jgi} = x_{jgi}(w_{jgi}) \text{ and}$$

(10) $$x_{jmi} = x_{jmi}(w_{jmi}).$$

Total quantity demanded for the marketing input by each region is the sum of quantity demanded by each region (eq. (11)).

(11) $X_{jm} = \sum_i x_{jmi}$

Model in Log-linear Specification

The log-differential is taken of the system of equations specified above, and parameters converted into elasticities, and demand, supply and cost shares. The final simulation model, expanded for each equation, is:

(1) $d\ln Y_j^{fsh} = \eta_{jj}^L d\ln P_j + \sum_{-j} \eta_{j-j}^L d\ln P_{-j} + \eta_{jj}^L d\ln \phi_j$

(2) $d\ln Y_j^{fsa} = \eta_{jj}^L d\ln P_j + \sum_{-j} \eta_{j-j}^L d\ln P_{-j}$

(3) $d\ln Y_j^{lt1.3} = \eta_{jj}^L d\ln P_j + \sum_{-j} \eta_{j-j}^L d\ln P_{-j}$

(4) $d\ln Y_j^{gt1.3} = \eta_{jj}^H d\ln P_j + \sum_{-j} \eta_{j-j}^H d\ln P_{-j}$

(5) $d\ln Y_j = \sum_k \gamma_k d\ln Y_{jk}$

(6) $d\ln Y_j = \lambda_{jC} d\ln Q_{jC} + \lambda_{jR} d\ln Q_{jR} + \lambda_{jT} d\ln T_j$

(7) $d\ln T_j = \varepsilon_{jT} d\ln P_j$

(8) $d\ln P_j = \alpha_{jgC} d\ln w_{jgC} + \alpha_{jmC} d\ln w_{jmC}$.

(9) $d\ln P_j = \alpha_{jgR} d\ln w_{jgR} + \alpha_{jmR} d\ln w_{jmR}$.

(10) $d\ln x_{jgC} = -\alpha_{jmC}\sigma_{jgmC} d\ln w_{jgC} + \alpha_{jmC}\sigma_{jgmC} d\ln w_{jm} + d\ln Q_{jC}$

(11) $d\ln x_{jgR} = -\alpha_{jmR}\sigma_{jgmR} d\ln w_{jgR} + \alpha_{jmR}\sigma_{jgmR} d\ln w_{jm} + d\ln Q_j$

(12) $d\ln x_{jmC} = \alpha_{jgC}\sigma_{jgmC} d\ln w_{jgC} - \alpha_{jgC}\sigma_{jgmC} d\ln w_{jm} + d\ln Q_{jC}$

(13) $d\ln x_{jmR} = \alpha_{jgR}\sigma_{jgmR} d\ln w_{jgR} - \alpha_{jgR}\sigma_{jgmR} d\ln w_{jm} + d\ln Q_{jR}$

(14) $$d\ln x_{jgC} = \varepsilon_{jj} d\ln w_{jgC} + \sum_{-j} \varepsilon_{j-j} d\ln w_{-jgC}$$

(15) $$d\ln x_{jgR} = \varepsilon_{jj} d\ln w_{jgR} + \sum_{-j} \varepsilon_{j-j} d\ln w_{-jgR}$$

(16) $$d\ln x_{jmc} = \varepsilon_{x_{jm}} d\ln w_{jmc}$$

(17) $$d\ln x_{jmr} = \varepsilon_{x_{jm}} d\ln w_{jmr}$$

(18) $$d\ln X_{jm} = \beta_{jmC} d\ln x_{jmC} + \beta_{jmR} d\ln x_{jmR}$$

where the variables and parameters used in the analysis are defined below (Table 1).

Table 1. Variable and parameter definitions for market model.

Variable	Name
Y_j^k	Quantity demanded by income group k.
Y_j^D	Total quantity demanded in the retail market.
Y_j^S	Total quantity supplied to the retail market.
Q_{ji}	Quantity supplied to the retail market by region i.
T_j	Net imports.
x_{jgi}	Quantity produced of the farm commodity in region i.
x_{jmi}	Quantity supplied of the marketing input in region i.
P_j	Retail price.
w_{jgi}	Input price for the farm input.
w_{jmi}	Input price for the marketing input.
ϕ_j	Shift parameter for the price discount.
Elasticity	

η_{jj}^{k}	Own price elasticity of demand by income group k
η_{j-j}^{k}	Cross price elasticity of demand by income group k
ε_{jj}	Own price elasticity of supply for the farm commodity
ε_{j-j}	Cross price elasticity of supply for the farm commodity
$\varepsilon_{x_{jm}}$	Elasticity of supply for the marketing input
σ_{gm}	Elasticity of substitution between the farm and non-farm input.
Shares	
λ_{ji}	Market supply share for region i
γ_{k}	Demand share for income group k
α_{vi}	Cost share of input v for region i.
β_{jmi}	Marketing input share

The change in consumer surplus (ΔCS) for home consumption by food stamp recipients is equal to

(19) $\Delta CS_{jfsh} = d\ln P_{jfsh} * OP_{j} * OY_{jfsh} * (1 + 0.5 * d\ln Y_{jfsh})$ where $d\ln P_{jfsh}$ is the proportional change in the market price paid by food stamp recipients for food consumed at home and reflects the price discount. The change in consumer surplus for food purchased away from home by food stamp recipients, consumers who live in households below 1.3 the poverty ratio but not on food stamps, and consumers above the poverty ratio of 1.3, is

(20) $\Delta CS_{jk} = d\ln P_{j} * OP_{j} * OY_{jk} * (1 + 0.5 * d\ln Y_{jk})$ for k equal to the three consumption groups not subject to the price discount.

The change in producer surplus (ΔPS) for growers in both California and the rest of the U.S. is

(21) $\Delta PS_{jgi} = d\ln w_{jgi} * Ow_{jgi} * Ox_{jgi} * (1 + 0.5 * d\ln x_{jgi})$

where $d\ln w_{gji}$ is the percentage change in the grower price per ton received for commodity j in region i, is the percentage change in the grower cost per ton to produce commodity j in region i, Ow_{gji} is the original price of commodity j paid to growers in region i, Ox_{jgi} is the original level

of production of commodity j in region i, and $d\ln x_{jgi}$ is the percentage change in production of commodity j in region i. The total change in producer surplus for fruit and vegetable growers is

(22) $\Delta PS_{gj} = \sum_i \Delta PS_{gji}$.

The change in producer surplus for the marketing sector is

(23) $\Delta PS_{jmi} = d\ln w_{jm} * Ow_{jm} * OX_{jmi} * (1 + 0.5 * d\ln X_{jmi})$.

In addition to the changes in consumer and producer surplus, tax payers will bear the cost of the price discount. The tax payer cost is calculated as

(24) Tax payer costs = $.25 * (1 + d\ln P_j) * OP_j * (1 + d\ln OY_{jfsh}) * OY_{jfsh}$. This equation is equal to .25 for the 25% price discount multiplied by the new market price multiplied by the new quantity of food consumed at home by food stamp recipients.

Data

Thirty-eight commodities are included in this analysis (Table 2). The final fruits and vegetables that were selected were those for which a complete demand and supply data set was available.

Table 2. Commodities included in the analysis by USDA commodity group.

Commodity Group	Commodities
Fruit	apple, apricots, avocados, bananas, cantaloupe, cherries, grapes, grapefruit, honeydew melon, oranges, peaches and nectarines, pears, pineapples, plums and prunes, strawberries, tangerines and other citrus, watermelon.
Dark Green Vegetable	spinach, broccoli, leaf lettuce
Deep Yellow Vegetable	carrots, sweet potatoes
Potatoes	white potatoes

Other Starchy Vegetables	corn, peas
Other Vegetables	artichokes, asparagus, snap beans, celery, cucumbers, eggplant, head lettuce, onions, bell peppers, fresh market tomatoes, processing tomatoes, cabbage, cauliflower

To complete the analysis data are needed on the consumption of different food items by income, current level of retail prices, U.S. and California crop production and value, imports, exports, and demand and supply elasticities (used to measure the responsiveness of growers and consumers to price changes).

Consumption

The consumption data for fruits and vegetables were obtained from the NHANES 2001-2002 survey. This survey was used because it had the SAS routines available that would map the NHANES 24-hour food recall surveys to the USDA pyramid servings. The limitation of using this data set is that it does not control for the place of purchase. It only distinguishes whether food was consumed within the food versus food consumed away from home. The NHANES 2003-2004 survey controls for place of purchase, but did not have the SAS routines available at the time the analysis was completed. These are 24-hour recall surveys and administered during person-to-person interviews. The data were downloaded from the NHANES website (http://www.cdc.gov/nchs/about/major/nhanes/nhanes01-02.htm).

Production and Trade

U.S. and California production and farm value data are available from the USDA's Fruit and Nut Yearbook and Outlook reports, the Vegetable and Melon Yearbook and Outlook reports, and Agricultural Statistics. The USDA data has California statistics for most, but not all crops.

Additional data for California are available from the California Agricultural Statistics Service (2003-2005). The crop figures for grapes exclude production that is used in wine production. Important parameters needed for this study are the elasticities of demand and supply.

The only available data on elasticities of demand were taken from Huang, and Huang and Lin. Huang estimated the own price, cross price and income elasticities of demand for a variety of foods including beef, chicken, apples, oranges, lettuce, fresh and processed tomatoes, etc. Huang and Lin estimated own price, cross price and income elasticities of demand for low, medium and high-income households, but used a general fruit and general vegetable category. The elasticities of demand by household income type in Huang and Lin were used to weight the elasticities for individual commodities in Huang. For items included in this study that were not included in the Huang study such as eggplant, peaches, etc., average elasticity values for the own price and income elasticity were used. Cross prices elasticities were calculated using the homogeneity conditions for demand functions.

There is no study that has estimated supply elasticities in a system that includes individual crops, though the fruit and vegetable sectors are included in studies that have estimated input and output elasticities of supply for U.S. agriculture (Chavas and Cox 1995; Shumway and Lim 1993; and Shumway and Alexander 1988). The supply elasticities for individual fruits and vegetables are extrapolated from this literature. The supply elasticities are determined for two different production groups perennial and annual. Supply elasticities are more elastic for annual crops than the perennial crops. The own price elasticity of supply is 1.0 for annual crops and 0.8 for perennial crops. When the U.S. is a net importer of commodity, the elasticity of supply for trade, 2.0 is positive, and when the U.S. is a net exporter it is negative at -

2.0. The positive value indicates that as the U.S. price increases, imports increase. The negative value indicates that as the U.S. price increases, exports decrease.

The elasticity of substitution between the farm and non-farm input in the marketing sector depends upon the share of the commodity that is marketed as a fresh commodity. For commodities with a high share of production entering the fresh market, such as artichokes and asparagus, few non-farm inputs can be substituted for the farm product, and the elasticity of substitution is .05. For commodities with a low share of production entering the fresh market (such as grapes/raisins, potatoes, and processed tomatoes), a high share is processed, and more non-farm inputs can be substituted for the farm product in production, and the elasticity of substitution is higher at 0.1. Only one value is used for the elasticity of substitution. A sensitivity analysis was completed for other reasonable values and found to have no effect on the final results.

RESULTS

Current consumption of fruit and vegetables.

The pyramid guidelines recommend different quantities of fruits and vegetables for males and females, and by level of activity. The recommendations are greater for men than for women, and the recommendations increase as the level of physical activity increases. The minimum recommendations in this study are for a female who gets less than 30 minutes of exercise daily, net of the recommendations for dry beans and legumes. The minimum recommendations are 10.5 cups a week for fruit and 14 cups of vegetables for a total recommendation of 24.5 cups of fruits and vegetables a week (Table 3). Within the vegetable category, specific

recommendations were made for dark green (3 cups a week), deep orange (2.5 cups a week), and starchy vegetables (3 cups a week).

Table 3: Average weekly cup equivalents consumed

Commodity Group	Recommended Minimum	Currently on food stamps	Not on food stamps, below 1.3 of the poverty ratio	Not on food stamps, above 1.3 of the poverty ratio
Fruit	10.5	8.0	6.8	7.7
Vegetable	14	10.1	9.4	10.8
Dark Green	3	0.36	0.47	0.72
Deep Orange	2.5	0.32	0.50	0.54
Starchy	3	3.6	3.26	3.25
no Potato		0.5	0.60	0.55
Potato		3.1	2.65	2.70
Other	6	3.4	2.9	3.8
Total	24.5	18.1	16.2	18.5

Source: NHANES 2001-2002

All consumers are eating fewer than the recommended amount of fruits and vegetables. Food stamp recipients consume the greatest amount of fruit; however, of the three socio-economic groups included in this study (Table 3). Food stamp recipients consume an average of eight cups of fruit a week compared to 6.8 cups for those people below the poverty ratio of 1.3, but not on food stamps, and the 7.7 cups for people with higher incomes.

For vegetable consumers above the 1.3 poverty ratio, people with the highest incomes have the greatest consumption at 10.8 cups, followed closely by those on food stamps with 10.1 cups. People who are below the 1.3 poverty ratio only consume 9.4 cups of vegetables a week. Even though people below the 1.3 poverty ratio have the lowest consumption of vegetables, they eat more dark green and deep yellow vegetables than food stamp recipients. On the other hand, food stamp recipients have the lowest consumption of dark green and deep yellow vegetables, but the highest consumption of potatoes among all the consumption groups. For total fruit and vegetable consumption, people above the 1.3 poverty ratio has the greatest consumption at 18.5

cups, food stamp recipients consume 18.1 cups, and people below the 1.3 poverty ratiolevel lag behind at 16.2 cups.

Changes in consumption.

The price discount will cause consumption of the commodities included in this study to increase by 5.18%. The percentage change in consumption is less than the percentage price discount because the own price elasticities of demand are less than -1.0, and generally less than -0.5 (see Appendix), and the increase in market prices for food consumed away from home – i.e. food not eligible for the discount – which puts downward pressure on consumption. The greatest gains are in fruit, dark green and other starchy vegetables (Table 4).

An expected, there is only a slight decrease in quantity consumed by people who do not receive food stamps. Total consumption decreases by 0.04% for both groups (Table 4). The very low change in consumption by consumers who do not receive a price discount is due to the small percentage change in market prices, and elasticities of demand. The percentage changes in market prices were less than 0.01%. This, combined with elasticities of demand less than -0.5, resulted small changes in consumption.

Table 4. Summary of the original weekly cups consumed and final cups consumed after price discount for each consumption group for 36 commodities.

Commodity Group	Currently on food stamps	Not on food stamps, below the 1.3 the poverty ratio	Not on food stamps, above the 1.3 poverty ratio
		Current Cups Consumed	
Fruit	5.767	5.655	6.360
Vegetable	7.946	7.679	8.851
Dark Green	0.134	0.320	0.638
Deep Orange	0.200	0.406	0.447
Starchy			
no Potato	0.201	0.406	0.404
Potato	3.079	2.654	2.695

Other	4.262	3.868	4.668
Total	13.713	13.334	15.211
		Cups Consumed After Price Discount	
Fruit	6.241	5.650	6.355
Vegetable	8.183	7.678	8.850
Dark Green	0.141	0.320	0.638
Deep Orange	0.225	0.406	0.446
Starchy			
no Potato	0.285	0.431	0.404
Potato	3.120	2.654	2.695
Other	4.411	3.867	4.667
Total	14.424	13.328	15.205
Percentage change in consumption	5.18%	-0.04%	-0.04%

Benefits and costs of a price discount policy.

The total annual benefits to food stamp recipients are $653.23 million (Table 5). The benefits due to lower market prices and greater consumption of fruit are $278.06 million and the benefits for vegetables are $375.17 million. These benefits are net of the losses experienced by food stamp recipients due to higher prices for food consumed away from home. Offsetting the benefits to food stamp recipients are losses to other consumers. The total losses to non-food stamp recipients are $56.13 million. These losses are distributed as $37.26 million for fruit and $18.87 million for vegetables.

Table 5. Total benefits and losses from a price discount for food stamp recipients (*in millions*)

	Food stamp	Non-food stamp	Farm Sector	Marketing Sector	Tax payer cost	Total costs and benefits
Fruit	278.06	-37.26	41.02	6.57	295.91	-7.52
Vegetable	375.17	-18.87	20.80	5.67	385.59	-2.81
Dark Green	14.51	-1.03	1.22	0.20	14.91	-0.01
Deep Yello	22.51	-2.96	3.75	0.71	23.83	0.17

Other Starchy	18.59	-0.82	1.58	0.38	19.17	0.56
Potatoes	81.33	-1.86	2.40	0.70	82.46	0.10
Other Vegetable	238.25	-12.20	11.85	3.69	245.22	-3.63
Total	653.23	-56.13	61.82	12.24	681.50	-10.33

Growers and the suppliers of marketing inputs also gain from a price discount policy. The total gains are $61.82 million for growers and $12.24 million for marketing inputs. The total gains are $74.06 million. The total costs and benefits to producers and consumers are $671.16 million. This amount is less than the total taxpayer cost of $681.50, and the total costs of the program are greater than the benefits by $10.33.

Even though the total costs are greater, select commodities have total benefits that are greater than the costs. These commodities are potatoes, cauliflower, spinach, peas, celery, head and leaf lettuce, sweet potatoes, corn, plums and prunes, grapes, cherries, apricots, avocados, oranges, strawberries, and grapefruit.

CONCLUSION

Consuming more fruit and vegetables would have a positive impact on the incidence of chronic diseases such as diabetes, heart disease, and dietary related cancers. Getting consumers to change their consumption in order to improve dietary related public health indicators is the challenge facing public health professionals and educators. Providing a price discount will encourage greater consumption of fruit and vegetables by food stamp recipients and bring them closer to the recommended levels. Growers in the U.S. also benefit from the price discount because they receive higher prices and increase production.

Offsetting the gains to food stamp recipients are the losses to non-food stamp recipients and the cost of the program born by taxpayers. Even though the percentage changes in market prices and quantities are small, due to the size of the fruit and vegetable industries included in

this analysis (almost 1/3 of the commodities gross over $1.0 billion in farm gate value), even small change can result in millions of dollars worth of loses to consumers. The net gains to producers and consumers are less than the cost to tax payers. Consequently, the total direct costs are greater than the direct benefits.

Absent from this analysis are the savings due to reductions in health care costs. If significant, this may raise the benefits above the costs of the program. Also not included in the analysis are impacts from changes in participation rates due to greater food stamp benefits. People below the 1.3 poverty ratio have significantly less consumption of fruit and vegetables, and also greater food insecurity than people who receive food stamps or have a higher income. Consequently, policies that increase participation rates may also be a way to improve the health status of low-income people.

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