

The economic impact on fruit and vegetable industries in the U.S. from an increase in consumption to levels recommended in the Dietary Guidelines for Americans 2015-2020

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Background

Increased consumption of fruits and vegetables has been linked to a decrease in dietary related chronic diseases such as obesity, heart disease, diabetes, and some types of cancer. This study estimates the economic impact on fruit and vegetable industries in the U.S. from an increase in consumption to levels recommended in the Dietary Guidelines for Americans (DGA) 2015-2020.

Each subgroup of vegetables and fruit has a different combinations of nutrients, so the DGA provides recommendations for the *composition* of fruit and vegetable consumption, as well as the total level.

Despite the known health benefits, many people do not eat the amounts recommended in the dietary guidelines (Figure 1). People in households that earn less than 130 percent of the poverty line average even fewer servings per day than do people in higher income households. Figure 1 shows that a substantial shift in consumption is needed for the households to achieve the recommended consumption level of fruit and vegetables at a sedentary and moderate activity level.

A shift in demand toward more fruits and vegetables would be met through increased production from within the U.S., and a reduction in exports to or increased imports from other regions. Agricultural industries stand to benefit significantly, should consumers achieve the recommended levels of fruit and vegetable consumption.

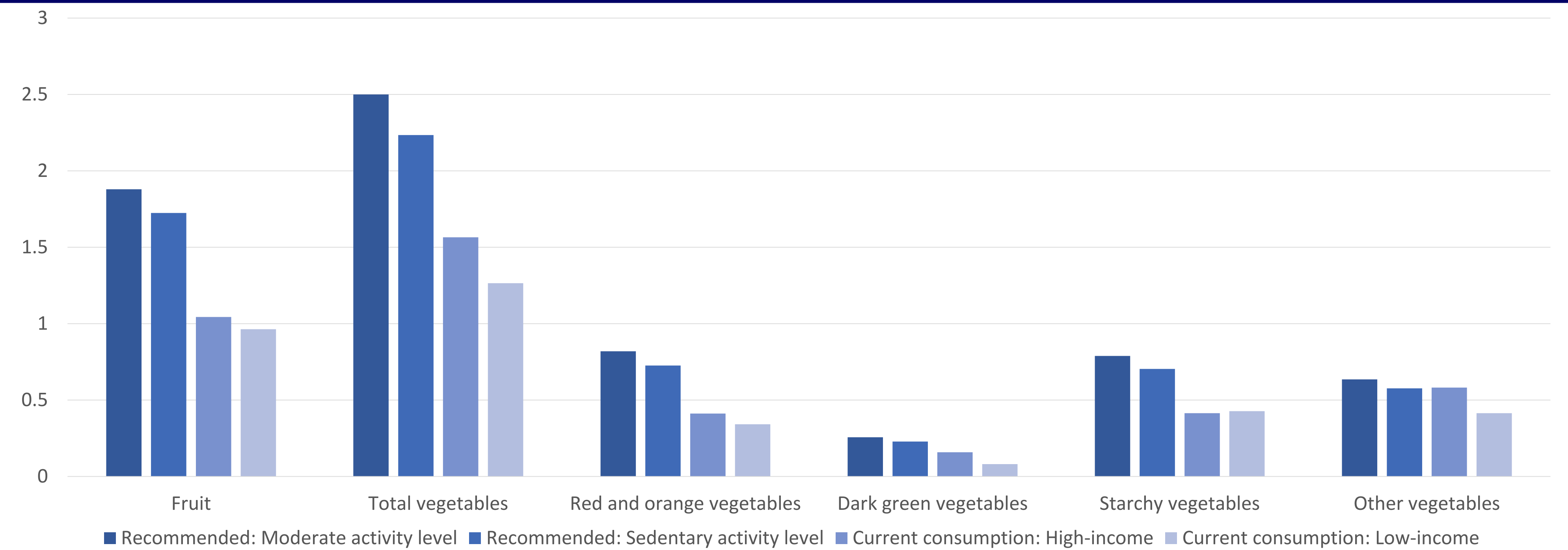


Figure 1. Recommended amounts of cups equivalent servings per day of fruit and vegetables at different calorie levels. As the recommended servings depend on the age and the sex of the individuals, a weighted average of the recommended servings given by the DGA 2015 are calculated using population data on age, sex, and income level from the 2012 US census. Similarly, average current consumption by income level is calculated using consumption data from NHANES.

Methodology

The effects on consumers and growers from an increase in the demand for fruits and vegetables are determined by converting changes in prices and quantities into changes in measures of economic welfare, known as consumer surplus and producer surplus, respectively. These measures of welfare change can be understood most easily by reference to Figure 2a. The consumer is said to earn a *surplus*, if he or she assigns a high value to the good, but is required to pay only P_1 to acquire it. Summing over all consumers, the value of consumer surplus corresponds to the area of the triangle formed by aP_1b , the cross-hatched area labeled CS.

Similarly, producer surplus is the difference between what a grower is paid for the sale of a crop and the lowest amount the producer is willing to accept to sell the crop. It is the area above the supply curve and below the price line. As was the case with the consumer surplus calculations, because the model has linear supply curves, producer surplus is the area of triangle aP_1c (the shaded area labeled PS in Figure 2a).

The benefits to consumers and growers are calculated as the changes in surplus for each group. The increase in demand causes the demand curve to shift right, raising both prices and quantity marketed. Consumers benefit from the increase in quantity, but must also incur higher prices. Area $bedf$ is the gain to consumers from the shift in demand and area P_1afP_2 is the loss to consumers from higher prices in Figure 2b. The net gain to consumers is the difference between the two areas.

Higher prices cause farmers to grow more, imports to increase and exports to decrease. Growers in both California and the rest of the U.S. benefit from the increase in production and the increase in market prices. The increase in producer surplus is area P_1adP_2 and is calculated as the difference between the size of the triangle using the new market price and quantity, area dP_2c , and the size of the triangle under the original price and quantity, area aP_1c .

To simulate the effect of the shift in consumption on the included commodities in the study, a market model was developed to calculate the changes in prices, market supply, trade and production for forty-one different fruits and vegetables for each scenario.

The changes in consumer and producer surplus and then calculated from the market changes in prices and supply.

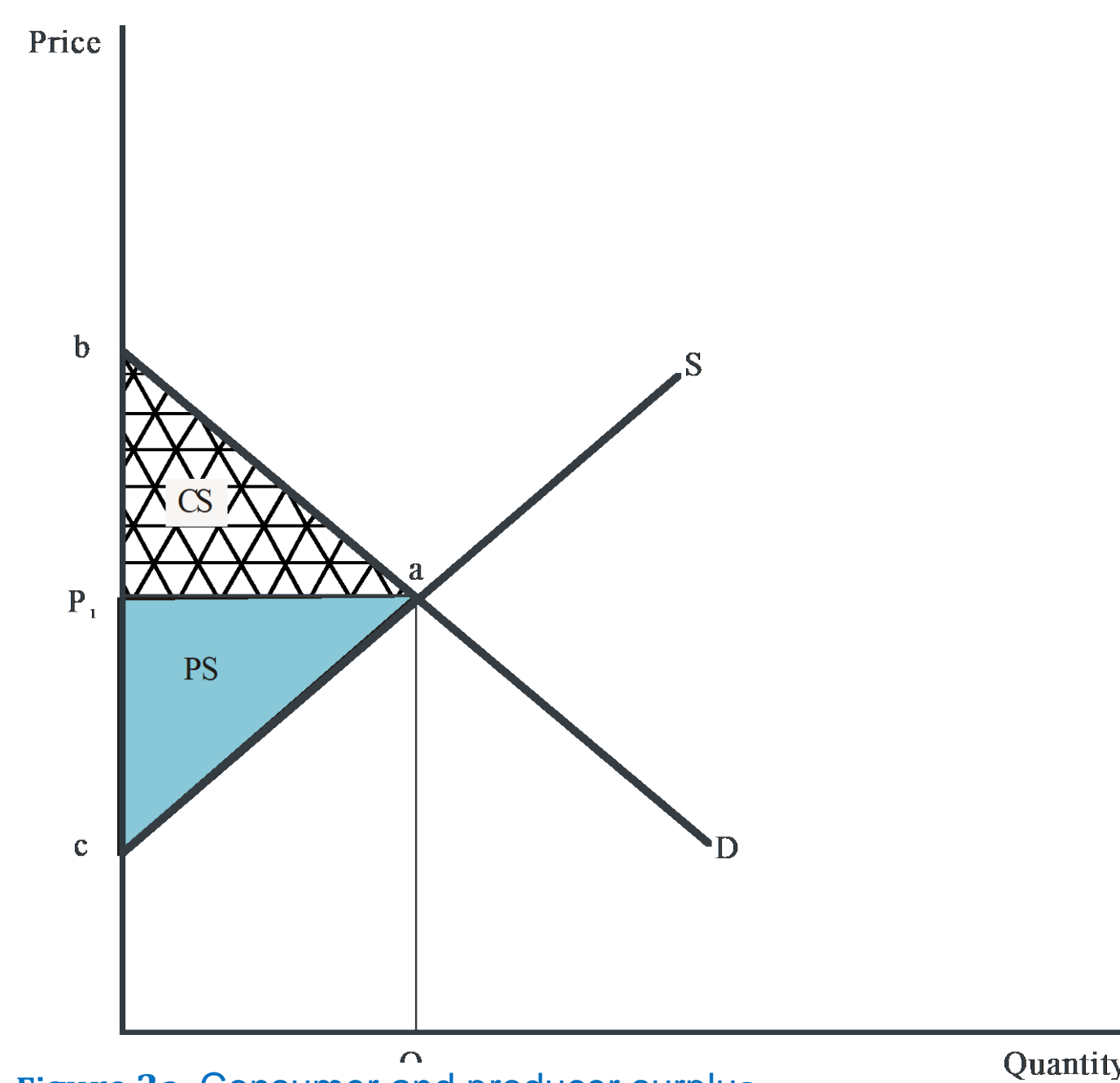


Figure 2a: Consumer and producer surplus.

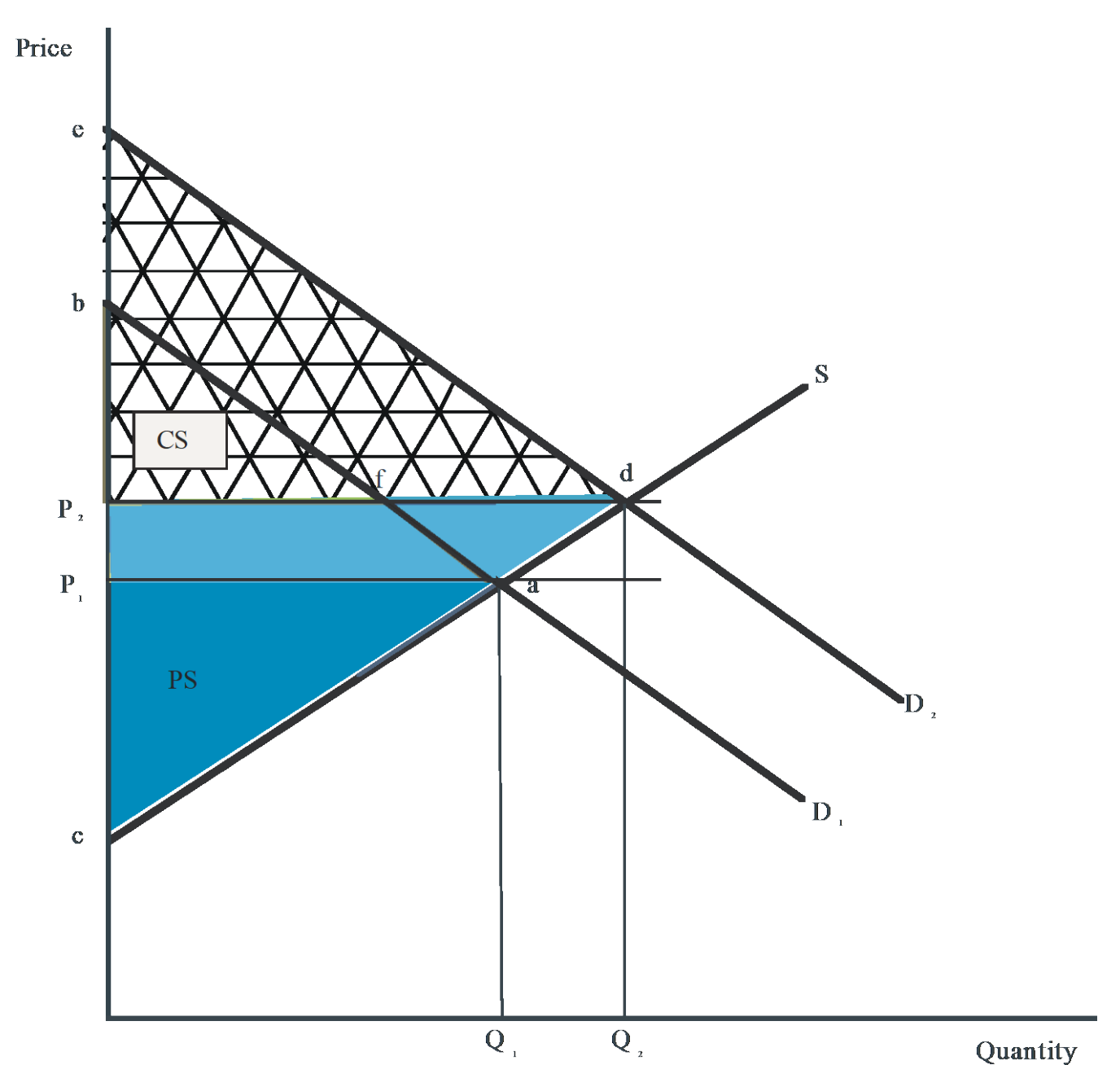


Figure 2b: Changes in consumer and producer surplus.

Table 1. The commodities by the USDA sub-group

USDA subgroup	Commodity
Fruit	Apple, apricots, avocados, bananas, berries, blueberry, cantaloupe, cherries, dates, grapes, grapefruit, honeydew melon, lemons, kiwis, oranges, peaches and nectarines, pears, plums and prunes, strawberries, tangerines, watermelons.
Dark green vegetables	Spinach, broccoli, lettuce (leaf).
Red and orange vegetables	Carrots, sweet potatoes, tomatoes (fresh), tomatoes (processed).
Starchy vegetables	Corn (fresh market sweet), peas, potatoes.
Other vegetables	Lettuces (head, romaine, endive, etc.), artichokes, asparagus, beans (snap), celery, cucumbers, onions, bell peppers, cabbage, cauliflower.

The scenarios considered are:

1. A 10% increase in demand for each commodity
2. A 25% increase in demand for each commodity
3. An increase in demand corresponding to a shift required to reach the consumption level in the 2015 DGA corresponding to a sedentary activity level
4. An increase in demand corresponding to a shift required to reach the consumption level in the Dietary Guidelines corresponding to a moderate activity level

We also consider two different levels of grower responsiveness to price: less and more. More responsive means that as prices change, output increases more than if growers were less responsive to changes in prices.

Results

Table 2. Total change in consumer and producer surplus in billions of dollars.

	10%		25%		Sedentary activity level		Moderate activity level	
	Less	More	Less	More	Less	More	Less	More
Producer surplus	\$4	\$3	\$11	\$9	\$28	\$24	\$38	\$32
Consumer Surplus	\$25	\$26	\$67	\$69	\$220	\$227	\$301	\$310
- for low-income	\$6	\$6	\$15	\$15	\$56	\$57	\$76	\$78
- for high-income	\$19	\$20	\$52	\$54	\$164	\$170	\$224	\$232
Total change in surplus	\$29	\$29	\$78	\$78	\$249	\$251	\$339	\$342

As would be expected, as the percentage increase in demand increases, the benefits to agricultural industries increases. When demand increases by 25 percent, the increase in producer surplus for growers is \$11.10 billion in the less responsive scenario and \$9.22 billion in the more responsive scenario. As the annual 2012 farm-gate value of U.S. production of fruit and vegetables was \$43 billion (USDA, 2014), this result shows that for even relatively small changes in demand, the total benefits to the agricultural sector can be substantial.

Table 2 shows that the potential benefits to an increase in consumption of fruit and vegetables are significant, with an increase of around \$250 billion in shifting the demand to reach the goal in DGA for a sedentary activity level. This change in surplus is driven by changes in the consumer surplus, with around 85-90 percent of the change in total surpluses are due to changes in consumer surplus. Although the final shifts in consumptions are higher in the low-income categories, the total changes in consumer surplus are higher for high-income consumers than for low-income consumers. This is due to a larger share of the population live in high-income households.

Summary

- 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.
- The results of this study show that fruit and vegetable industries would also substantially benefit by investing in promotions to increase the awareness of the improved health benefits of eating the recommended amounts of fruit and vegetables.
- Even small changes of, say, 25 percent, result in large changes in producer surplus and consumer surplus.



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