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Marketing Effects of U.S. Fresh Produce Imports

Sophia Wu Huang and Kuo S. Huang

The rapid growth of U.S. fresh produce imports has significant implications for many facets of the U.S. fresh produce industry and consumers as well. Fresh produce imports generally complement domestic production, because of seasonal differences in availability. Since supplies of most U.S.-produced fruits and vegetables are highest in summer and lowest in winter, increased fresh produce imports in the off-seasons make it possible to meet seasonal shortages in U.S. production. In addition, imports can reduce supply volatility even in normal U.S. producing seasons. We measure significant effects of imports, especially for fruits, in reducing domestic price levels and smoothing price fluctuations.

Key words: coefficient of variation, fresh produce imports, monthly shipments and prices

The United States, the world's leading fresh fruit and vegetable importer, has substantially increased its imports, particularly since the 1990s. Annual average fresh fruit and vegetable imports excluding melons surged from $2.6 billion (nominal dollars) in 1990-92 to $10.4 billion in 2008-10. The upward trend in U.S. fresh produce imports has significant implications not only for the produce industry but for domestic consumers as well.

For producers, because imports increasingly outpace exports in the trade of fresh produce, the U.S. produce industry requested inclusion or expansion of various policy tools in the *Food, Conservation, and Energy Act of 2008* (*Farm Bill*). These tools included, among others, the *Market Access* (formerly the *Market Promotion*), the *Technical Assistance for Specialty Crops*, and the *Emerging Markets* programs. Although specialty crops, which include produce, have historically received few benefits from Federal farm programs, the *2008 Farm Bill* allocated $3 billion over 2008-12 to address issues facing the industry.

The fast growth of fresh produce imports also has significant implications for consumers in the United States. While consumer demand is continual, fruit and vegetable production is largely seasonal and fresh-market commodities are highly perishable and

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costly to store and transport. With improved production, transportation, and other technological developments in recent decades, fresh produce, even exotic ones, are now grown and delivered to consumers across national and geographical boundaries. As a result, U.S. retailers now routinely augment domestic supplies with imports, satisfying consumer demand for an extensive array of fresh produce year round.

Since the 1990s, economic research on fresh produce has been increasing, reflecting increased interest in fresh produce from both the supply and demand side. You, Epperson, and Huang (1998) estimated a demand system for 21 items of fresh produce. Carman (2006) documented the efforts of fresh producers to capture the benefits of targeting sales from the growing public concerns about preventive health maintenance. Bond, Thilmany, and Bond (2006) focused on consumer purchasing decisions on direct marketing of fresh produce. Nzaku and Houston (2009) estimated the demand for selected fresh vegetable imports. Nzaku, Houston, and Fonsah (2011) further estimated the demand for selected fresh fruit and vegetable imports. Mekonnen, Huang, and Fonsah (2012) analyzed the composite demand for fresh fruits, fruit juice, and processed fruits. Thus far, research on the market effects of fresh produce imports on domestic price variations has been relatively sparse.

In this study, we investigate the role of fruit and vegetable imports in shaping U.S. fresh produce prices and marketing. In particular, since most fresh produce is highly seasonal, this study focuses on the seasonal nature of fresh produce marketing. Some questions addressed include the following: What are the seasonal relationships between imported fresh produce and domestically produced products? What are the effects of imports on domestic produce price variations? Will fresh produce prices be changed under various scenarios of imported quantities? How much will these price changes vary?

To understand the dynamics inherent in the seasonal nature of fresh produce marketing, we use the monthly imports of fresh produce and the corresponding shipments of those domestically produced to establish the seasonal relationships between imports and domestic production. To provide some insight about the effects of fresh produce imports on domestic price fluctuations, we estimate a set of price-dependent demand equations for fresh produce. Based on these estimated demand equations, we further simulate the effects of price changes in response to various scenarios by assigning different import levels of fresh produce imports.

Imports Affect Domestic Fresh Produce Marketing

Although the category "fresh fruits and vegetables" encompasses a great variety of products, one common characteristic in this category is that climate causes produce production to be seasonal or even precludes production (Huang, 2004). For fresh fruits,

the largest harvests occur during the summer and fall, and the United States generally does not produce significant quantities of tropical fruits. U.S. fresh fruit imports, which peak in winter, are led by tropical fruits (typically bananas) and counter-seasonal temperate fruits (typically grapes), with bananas and grapes together accounting for 46% of total U.S. fresh fruit imports by value in 2008-10. For fresh vegetables, U.S. imports also peak in winter, and tender warm-season vegetables—notably tomatoes, bell peppers, and cucumbers—are import mainstays because field-based vegetable production in the States during the cold season is restricted to Southern and Southwestern areas. In terms of value, these three vegetables together accounted for 55% of total U.S. fresh vegetable imports excluding melons in 2008-10.

In addition, although fruits and vegetables are similar in production, marketing, and distribution, there are important differences between these two segments of fresh produce. For example, fruits, unlike vegetables, are usually perennial crops that mature and are harvested over a two to three-month period, and are easier to store. Furthermore, fruits are generally eaten as an appetizer, dessert, or out of hand, while vegetables are commonly used as part of the main course. Thus, in satisfying consumer demand for year-round fresh produce, U.S. fresh fruits are more diverse than vegetables in terms of foreign suppliers. Also, the patterns are more dynamic and complicated in terms of marketing structure for fruits than those for vegetables. Thus, in the following, fruits and vegetables are discussed separately.

Data Sources

The basic sources of data for this section come from (1) Fresh Fruit and Vegetable Shipments, issued by the Agricultural Marketing Service (AMS) of the U.S. Department of Agriculture (USDA) and (2) the Global Trade Atlas from Global Trade Information Services, Inc. (GTIS), an online data base that provides trade data issued by the Bureau of Census of the U.S. Department of Commerce.

The AMS data are the only available source that depicts the monthly interstate movement of U.S. domestically-produced fresh fruits and vegetables from major shipping-points. This data set includes the domestic rail and piggyback shipments, available truck, boat, and air shipments to major cities across the United States. Although these shipments do not represent complete movements of a commodity, some indicators still can be derived from this data set to illustrate the relative monthly availabilities of domestic fresh produce in the wholesale market.

We also employ the trade values and trade flows from the GTIS data set to supplement the AMS data in the analysis of trade patterns in U.S. fresh fruit and vegetable imports. By doing so, we are able to identify the relationships between the

monthly imports and their corresponding domestic shipments to get a picture of how, when, and where the imports meet seasonal shortfalls in domestic fresh fruit and vegetable production.

Effects on Fresh Fruit Marketing

Among the three general categories of fresh fruits—tropical fruits, citrus, and noncitrus—the United States has little production of tropical fruits, but harvests citrus virtually year round, with peak output from November through May for navel oranges and other early citrus varieties and April to October for Valencia oranges and California grapefruit. Meanwhile, the noncitrus fruit harvest begins in December with strawberries and progresses through the spring, summer, and fall of the succeeding year, ending with apples and pears (Lucier et al. 2006). To satisfy consumer demand for various fresh fruits year round, the United States heavily depends on imports to supplement domestic production. According to AMS data, imports accounted for 56.7% of the total volume of fresh fruit shipments during 2008-10 (Table 1).

Table 1—Monthly Shipments of Fresh Fruits, 2008-2010 Average

Month	Aggregate Fruits			Tropical Fruits[a]			Citrus[b]			Grapes		
	Imported	Domestic	Import Share[c]	Imported	Domestic	Import Share	Imported	Domestic	Import Share	Imported	Domestic	Import Share
	- million pounds		percent	- million pounds		percent	- million pounds		percent	- million pounds		percent
January	1,612	1,085	59.8	1,046	5	99.6	108	323	25.0	287	7	97.7
February	1,635	946	63.3	1,058	5	99.5	74	296	20.1	325	-	100.0
March	1,930	1,077	64.2	1,223	11	99.1	70	286	19.7	456	-	100.0
April	1,723	929	65.0	1,164	22	98.2	69	183	27.4	333	-	100.0
May	1,618	1,133	58.8	1,256	39	97.0	81	89	47.6	115	26	81.5
June	1,725	1,156	59.9	1,292	35	97.4	104	49	68.2	181	76	70.4
July	1,383	1,333	50.9	1,063	48	95.7	156	19	89.4	15	187	7.3
August	1,224	1,249	49.5	936	42	95.7	171	16	91.3	1	300	0.2
September	1,216	1,209	50.1	995	29	97.2	143	26	84.4	6	318	1.9
October	1,348	1,383	49.3	1,082	24	97.8	113	162	41.2	28	274	9.3
November	1,315	1,275	50.8	1,066	12	98.9	123	269	31.4	29	231	11.2
December	1,446	1,085	57.1	1,064	4	99.6	129	332	27.9	121	118	50.7
Total	18,176	13,861	56.7	13,244	275	98.0	1,342	2,050	39.6	1,897	1,537	55.2

a/ Tropical fruits include mainly bananas, pineapples, mangoes, plantains, avocados, and papaya.
b/ Citrus include mainly limes, clementines, oranges, lemons, grapefruits, tangelos, and tangerines.
c/ Import share is calculated as the percentage of imported divided by the sum of imported and domestic shipments.
Source: USDA, Economic Research Service analysis of USDA, Agricultural Marketing Service data.

Table 1 also shows the monthly relationships between imported and domestic shipments for aggregate fresh fruits as well as three major categories of fresh fruit imports—tropical fruits, citrus, and grapes. Among these three categories of fresh fruits, the seasonal traffic for tropical fruits is unique and straightforward—stable seasonal variation in imports from equatorial countries for a consistent supply throughout the year because of little domestic production.

Since tropical fruits account for more than half of the value of U.S. fresh fruit imports, the seasonal patterns for fresh fruits as a whole are deeply affected by those of tropical fruits. Thus, the degree of seasonal variations for the aggregate fresh fruit imports is also relatively stable. Still, as shown in the table, the strongest import seasons for fresh fruits as a whole occur in winter and spring, while the largest domestic shipments occur during summer and fall.

As for citrus fruits, imports accounted for nearly 40% of total citrus shipments during 2008-10. Among the many citrus fruits, orange and tangerine imports are the most dynamic in term of marketing. For other kinds of citrus fruits, U.S. imports are either negligible, such as grapefruit, or almost totally dependent on imports for consumption, such as limes. Orange imports have grown rapidly in recent years, although the United States is the second largest orange producer in the world. In particular, the counter-seasonal production from Southern Hemisphere countries makes varieties available to the northern markets that would otherwise not be available. For example, the United States imports navel oranges during summer from several Southern Hemisphere countries—notably South Africa, Australia, and Chile. As for tangerines, the rising popularity of the small, easy-peeling, and seedless clementine (the most popular variety of tangerine) from Spain, Chile, Morocco, and other countries has led to their increased presence in the U. S. market since the late 1990s. Spain's clementine arrive primarily in the fall months while other countries pick up the slack in U.S. production, which runs mostly from November to April, with a possible overlap into May.

The complementary relationships between imported and domestic shipments are quite apparent for individual products. For example, imported and domestic shipments of grapes appear to blend well in terms of timing. In fact, more than 90% of U.S. fresh grape imports enter the United States during winter and spring. Imported grapes, mainly from Chile—and to a much smaller degree from Mexico—have been filling a gap in California's off-season—winter and spring. In general, fresh grapes from Mexico supply the U.S. market during the period when Chilean grape shipments drop off and before the largest volume of U.S.-produced grapes, from California's San Joaquin Valley, enter the market (Huang and Huang, 2007). California supplies approximately 99% of all of the country's domestically-grown fresh-market grapes. On average, AMS data show that 55% of total fresh grape shipments came from imports during 2008-10.

Effects on Fresh Vegetable Marketing

Most fresh vegetables consumed by Americans are still domestically produced, despite increased imports. Table 2 shows that the import share of total shipments for

aggregate fresh vegetables was 30% in 2008-10. This import share, however, is likely overstated due to the undercounting of domestic volume in the AMS shipments data set.

Table 2—Monthly Shipments of Fresh Vegetables, 2008-2010 Average

Month	*Aggregate Vegetables*[a]			*Tomatoes*			*Bell Peppers*			*Cucumbers*		
	Imported	Domestic	Import Share[b]	Imported	Domestic	Import Share	Imported	Domestic	Import Share	Imported	Domestic	Import Share
	- million pounds -		percent	- million pounds -		percent	- million pounds -		percent	- million pounds -		percent
January	1,093	1,728	38.7	315	229	57.9	120	46	72.4	148	8	94.9
February	1,064	1,519	41.2	319	162	66.3	103	38	72.9	140	1	99.0
March	1,149	1,716	40.1	340	186	64.6	106	51	67.4	143	14	91.2
April	921	1,909	32.5	301	232	56.5	82	66	55.4	118	54	68.5
May	727	2,216	24.7	241	294	45.0	67	85	44.1	81	59	57.9
June	556	2,012	21.6	182	255	41.8	36	105	25.4	51	60	45.8
July	496	1,801	21.6	147	260	36.0	32	100	24.2	42	56	42.7
August	473	1,831	20.5	115	276	29.5	32	94	25.7	35	82	29.9
September	530	1,758	23.2	111	260	30.0	38	88	30.2	34	49	40.9
October	638	1,852	25.6	136	252	34.9	38	90	29.4	58	45	56.1
November	730	1,837	28.4	153	255	37.6	49	90	35.2	103	33	76.0
December	881	1,847	32.3	194	287	40.3	91	47	65.9	132	13	91.0
Total	9,257	22,026	29.6	2,554	2,948	46.4	795	901	46.9	1,084	473	69.6

a/ Quantities exclude melons, potatoes, and sweet potatoes.

b/ Import share is calculated as the percentage of imported divided by the sum of imported and domestic shipments.

Source: USDA, Economic Research Service analysis of USDA, Agricultural Marketing Service data.

For decades, the mainstay of U.S. fresh vegetable imports has been tender warm-season vegetables like tomatoes, cucumbers, peppers, squash, and snap beans. In particular during the winter and early spring, these vegetables require warmer temperatures for growth than those that prevail in most parts of the United States (Lucier et al. 2006). The neighboring partners of the North American Free Trade Agreement (NAFTA) account for nearly 90% of total U.S. fresh vegetable imports by value, with Mexico the dominant supplier and Canada (largely hothouse except potatoes) as the distant second supplier (Huang and Huang, 2007).

Table 2 also includes monthly imported and domestic shipments for aggregate fresh vegetables as well as for those of the top three fresh vegetable imports. Understandably, the complementary relationships between imported and domestic produce shipments are less clear in the aggregated product than those of individual crops. Still, because U.S. imports are dominated by a few vegetables during cool seasons, as Table 2 shows, aggregate fresh vegetable imports have a definite seasonal pattern—with imported shipments in winter more than doubling those in summer. However, while summer is the lightest season of the year for fresh vegetable imports, the complementary relationships between imported and domestic shipments of aggregate fresh vegetables are not obvious. Because of plentiful supplies of locally grown, commercial and noncommercial vegetables during summer not captured by the AMS data set, domestic shipments for

aggregate fresh vegetables do not appear in the data to be as strong as they actually are during this season.

In comparison, the complementary relationships between imports and domestic production are more pronounced for individual imported fresh vegetables, with winter the largest season for imports and summer the strongest season for domestic production. For tomatoes and bell peppers, as illustrated by Table 2, the strongest imports occur in winter and to a lesser degree, spring, while the highest cucumber imports occur in winter followed by fall. For domestic production, summer followed by spring are the largest seasons for bell peppers and cucumbers, while summer followed by fall and spring are the seasons for domestic tomato shipments.

Also similar to fresh fruits, imports largely supplement domestic supply to make various fresh vegetables available year-round for consumption. Take tomatoes as an example: domestic fresh-market tomato shipments start to pick up in spring when Florida's volume is highest and California and various southeastern States begin to ship tomatoes. Fresh tomato imports, primarily from Mexico and, to a much lesser degree, Canada (largely hothouse), boost total supply during the first several months of the year. In particular, strong imports occur during winter, almost totally from Mexico, when southern Florida is the predominant U.S. producer. Florida tomatoes then dominate the market during the spring as imports decline. Imported tomatoes are at a seasonal low in summer as a large volume of tomatoes produced in California and many other states is available in the market.

Imports Affect Domestic Fresh Produce Prices

The marketing effects of U.S. produce imports not only make year-round supply of various fresh fruits and vegetables possible as discussed earlier but also affect domestic fresh produce prices. To analyze these price effects, we first estimate a set of monthly price-dependent demand equations for fresh fruit and vegetable groups. By using these estimated demand equations, we are able to quantify the effects of imports at various levels on fresh produce prices and their variations. Following is a discussion on model specification, estimation, and simulation for assessing the price effects of changes in fresh produce imports.

Specification of Price-dependent Demand Equations

A price-dependent demand system can be derived within the context of Marshallian demand relationships. Let q be a vector of n quantities for a representative consumer, p a vector of the corresponding n prices, $m = p'q$ the consumer's income (or expenditure),

and $u(q)$ the utility function, assumed non-decreasing and quasi-concave in q. The primal function for maximizing consumer utility with respect to q, and a multiplier π is the following Lagrangean function:

$$(1) \quad L = u(q) - \pi (p' q - m)$$

By solving the necessary conditions for an optimum, we can derive the Wold identity (1944) as

$$(2) \qquad r_i = u_i(q) / \Sigma_j \; q_j \, u_j(q)$$

where $r_i = p_i / m$ is the normalized price, and $u_i(q)$ is the marginal utility of the ith commodity. This is a price-dependent demand system, in which the normalized prices are functions of quantities demanded.

Based on this conceptual demand relationship and with the consideration of the seasonal nature of fresh produce marketing, we can approximate a monthly price-dependent demand system for fruits, vegetables, and other foods, including a set of monthly dummy variables, as follows:

$$(3) \qquad log\,(r_{it}) = \Sigma_j f_{ij}\, log\,(q_{jt}) + \Sigma_k \alpha_k \, d_{kt}$$

where variables r_{it} and q_{it} are respectively the monthly normalized retail price and monthly per capita consumption at time t, and the parameter f_{ij} is price flexibility. The variable d_{kt} is a monthly dummy variable with its parameter α_k.

Estimation of Price-dependent Demand Equations

Ideally, it would be better for us to have a complete monthly price-dependent demand system for fruits, vegetables, and other foods. But the data shortage of monthly prices for many fresh produce products and monthly quantities for foods other than fresh produce prevents us from estimating a complete monthly demand system. Therefore, we specify the monthly price equations for fruit and vegetable groups only.

We use the monthly total shipments (including domestic and imported) from AMS data as a proxy to represent U.S. consumption. To validate the representation of the shipment data for consumption, we compare the yearly total amount of shipments from AMS data with the commonly used annual consumption data published by the Economic Research Service (ERS) of USDA during the period 1999-2008. For fresh fruits, the calculated yearly average ratio of AMS shipments to the ERS data is 93.7% or a 6.3-percent difference. For fresh vegetables, the yearly average ratio of total shipments to the

ERS data is 87.8%, or a 12.3% difference. We therefore conclude that the monthly AMS shipment data can represent the monthly U.S. consumption of fresh produce.

In addition to the monthly AMS shipment data of fruits and vegetables, the corresponding monthly prices are obtained from the *Consumer Price Indexes* issued by the Bureau of Labor Statistics of the U.S. Department of Labor. The monthly per capita income is derived through an extrapolation of available annual data by assuming the same rate of monthly increment between any two consecutive years. The normalized retail price used in the price-dependent demand equation is then obtained as the monthly retail prices deflated by monthly per capita income.

The estimated price equations for fruits and vegetables are presented in Table 3. All estimated own and cross-price flexibilities are statistically significant at either the 1-percent or 5-percent probability level. The estimates of price equation for fresh fruits are shown in the column under "Fruits." The price flexibilities of fruits in response to quantity changes of fruits and vegetables are -0.2297 and -0.5976, respectively, meaning that a marginal 10-percent increase in the quantities of fruits and vegetables would reduce the prices of fruits by 2.30 and 5.98%, respectively. Similar explanation can be applied to the estimates of price equation for fresh vegetables in the column under "Vegetables." The price flexibilities of vegetables in response to quantity changes of fruits and vegetables are -0.0918 and -0.1530, respectively.

It is worth noting that the set of price-dependent equations for aggregate fruits and vegetables is not a complete demand system, and the estimates of price flexibilities are not constrained by the restrictions derived from classical demand theory. Consequently, the estimated cross-quantity effects between fruits and vegetables may not reflect closely their interdependent demand relationships as perceived in individual commodities. Thus, we cannot ensure that the magnitude of cross-quantity effects should be less than own-quantity effects, as in the case of vegetables in this study. In addition, we do not compare our estimated price flexibilities with others; partly because none of our reviewed articles is related to the price-dependent demand equations for fruits and vegetables, and partly because sizable measurement errors may be committed by inverting elasticities for representing flexibilities, or vice versa.

Table 3 also includes the estimates of monthly dummy variables, which show the shifts of price variations over months. In this study, the estimates of monthly dummy variables for March, April, and May are positive for fresh fruits, implying an upward trend in fruit prices during these months. The findings likely indicate that the amount of domestic fruit production, such as grapes, is relatively low, resulting in higher fruit prices in these months. The prices of both fruits and vegetables, however, have significant downward trends with negative estimates from July to November, likely because of high domestic production in these months. The estimates of monthly dummy variables for

Table 3—A Price Forecasting Model for Fresh Produce, 1999-2010

Explanatory Variables:	*Dependent Variables: Normalized Retail Prices of*			
	Fruits		Vegetables	
Quantity of	Coefficient	Standard Error	Coefficient	Standard Error
Fruits	-0.2297 ***	0.0689	-0.0918 **	0.0451
Vegetables	-0.5976 ***	0.0793	-0.1530 ***	0.0520
Month of				
January	0.0425 **	0.0192	0.0322 **	0.0126
February	-0.0533 ***	0.0194	-0.0060	0.0127
March	0.0598 ***	0.0221	0.0242 *	0.0144
April	0.0380 *	0.0200	0.0015	0.0131
May	0.0896 ***	0.0217	-0.0054	0.0142
June	-0.0163	0.0223	-0.0361 **	0.0146
July	-0.1254 ***	0.0261	-0.0653 ***	0.0171
August	-0.1388 ***	0.0251	-0.0786 ***	0.0164
September	-0.1652 ***	0.0269	-0.0815 ***	0.0176
October	-0.0883 ***	0.0221	-0.0471 ***	0.0145
November	-0.0437 **	0.0193	-0.0272 **	0.0127
Constant	7.1966 ***	0.2183	5.8584 ***	0.1430
R-square	0.39		0.44	

*Note: The coefficients are the estimated price flexibilities for normalized retail price equations. Asterisks (***,**,*) denote statistical significance at the 1%, 5%, and 10 % levels, respectively.*

May are negative for vegetables, in contrast to the positive value for fruits, mainly because domestic shipments in May are high for vegetables. In addition, with the volatile variations in monthly data, it is not surprising that the goodness of fit in the estimated price equations is relatively low with the estimated R-squares at 0.39 for fruits and 0.44 for vegetables.

Simulation of Price Variations in Response to Imports

The estimated price-dependent demand equations for fruits and vegetables provide an instrument for the analyses of price effects in response to changes in fresh produce imports. Since the shipments available for consumption are defined as the sum of imports and domestic shipments excluding exports, we assume that domestic production and exports are maintained at the same actual levels in past years and focus on simulating the effects of changes in imports over the sample period in 1999-2010. Three scenarios of imports are considered: Case 1 with imports maintained at the same actual past levels,

Case 2 with imports reduced by one-half from the actual past levels, and Case 3 without imports.

Accordingly, we first calculate the amount of shipments available for fresh produce consumption under the three scenarios of imports and then plug in these shipments to the estimated monthly price equations for simulating the price variations. To compare the degree of price variations under various scenarios involving different quantity levels of fresh produce imports, we calculate the coefficient of variation (*CV*) in percent as an indicator for the volatility of price changes:

$$(4) \qquad CV = [\ \Sigma_t (y_t - y^*)^2 / (n - 1)\ ]^{1/2} / y^* \bullet 100$$

where y_t is the simulated price at time t with a total of n observations, and y^* is the yearly average of simulated prices. A higher value of *CV* indicates greater price variation. Similarly, the coefficient of variation can be applied to measure the variations of monthly shipments.

Simulation Results

Table 4 is a summary of the simulated results over the sample period, with the upper part of the table referring to those of fruits and the lower part referring to those of vegetables. For fresh fruits, Table 4 indicates that the average monthly fruit quantity per person with imports available for domestic consumption is 7.79 pounds, and its measured *CV* is 8.48%. If the amount of imports is reduced by one-half each year, the average quantity is reduced to 5.52 pounds, and the measured *CV* is increased to 9.32%. In eliminating all imports, the average quantity is reduced to 3.26 pounds, and the measured *CV* is increased substantially to 17.48%.

As for the simulated price variations for fresh fruits, we find that the simulated average real retail price index with imports is 153.4% (using prices indexed to 1982-84 levels), and its measured *CV* is 3.86%. By reducing the imports of fruits by one-half each year, we find that the average price of fruits increases about 18% to a price index of 180.1%, and the measured *CV* of the simulated price variations increases to 6.18%. Furthermore, under an extreme scenario of eliminating all imports, the average price index increases to 225.4%, and the measured *CV* increases substantially to 12.02%.

The monthly real retail price variations of fresh fruits are depicted in Figure 1. Obviously, without any substantial imports of fruits, the nature of seasonal variations in the domestic shipments would result in much higher price levels and cause volatile price

Table 4–Monthly Variations of Produce Shipments and Prices, 1999-2010

	Average (1)	*Standard Deviation (2)*	*Coefficient of Variation (2)/(1)*
Fruits:			
Monthly Shipment Per Person	Pound	Pound	Percent
With Imports	7.79	0.66	8.48
Imports Reduced by Half	5.52	0.51	9.32
Without Imports	3.26	0.57	17.48
Real Retail Price Index (1982-84=100)		-- Percent --	
With Imports	153.4	5.92	3.86
Imports Reduced by Half	180.1	11.14	6.18
Without Imports	225.4	27.08	12.02
Vegetables:			
Monthly Shipment Per Person[a]	Pound	Pound	Percent
With Imports	8.16	1.00	12.31
Imports Reduced by Half	7.12	0.78	10.91
Without Imports	6.08	0.71	11.74
Real Retail Price Index (1982-84=100)		-- Percent --	
With Imports	136.6	6.50	4.76
Imports Reduced by Half	144.0	8.00	5.56
Without Imports	155.2	11.16	7.19

a/ Quantities exclude melons, potatoes, and sweet potatoes.

variations for fruits. From these simulated shipments and prices, we find that import of fresh fruits effectively lowers domestic prices and smooths out their price fluctuations.

For fresh vegetables, Table 4 indicates that the average monthly quantity of vegetable shipments per person with imports is 8.16 pounds, and its measured *CV* is 12.31% (using prices indexed to 1982-84 levels). With the imports reduced by one-half, its average quantity is 7.12 pounds, and the measured *CV* is 10.91%. If the import of vegetables is eliminated, its average quantity is reduced to 6.08 pounds, and the measured *CV* is 11.74%.

At varied levels of imports, the simulated price levels for fresh vegetables are 136.6% with imports, 144% with imports reduced by one-half, and 155.2% without imports. The measured *CV* of simulated price variations increases from 4.76% with imports to 7.19% without imports. The monthly real retail price variations for fresh vegetables are depicted in Figure 2. Since imports contribute a much smaller share of consumption for fresh vegetables than fresh fruits, the impacts of imports on price and consumption for fresh vegetables are smaller relative to those for fresh fruits.

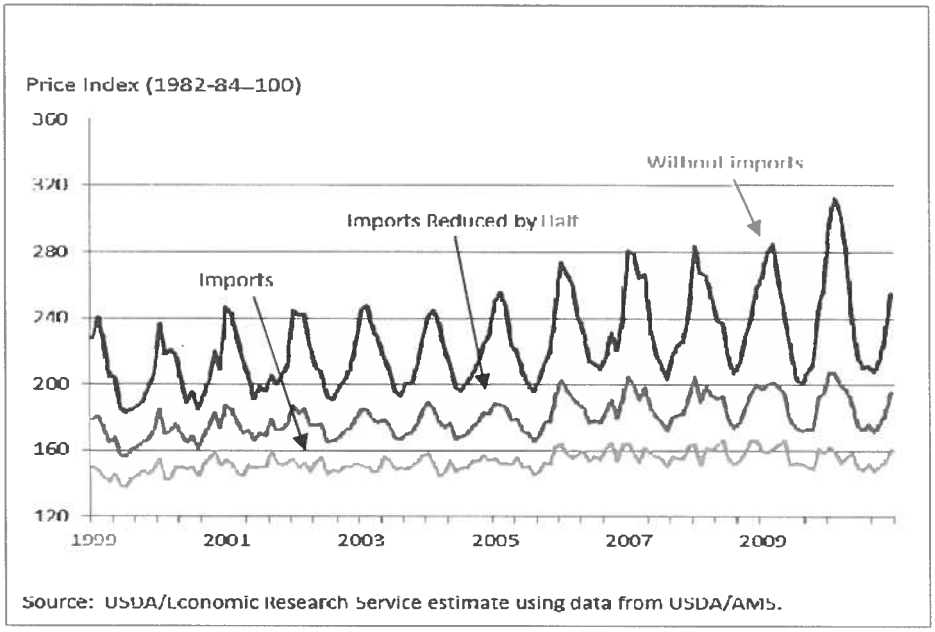

Figure 1-Monthly Real Price Variations of Fresh Fruits

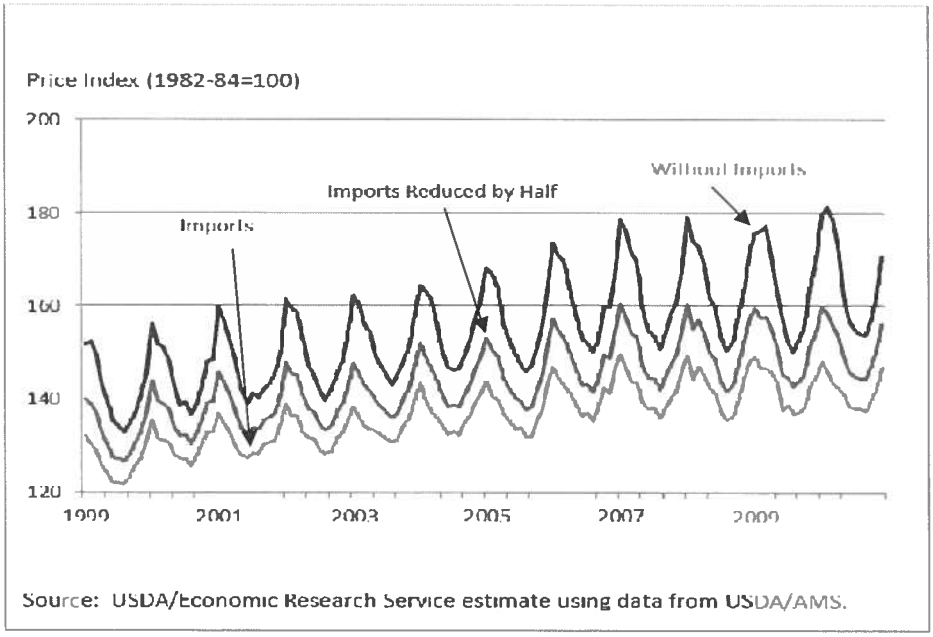

Figure 2-Monthly Real Price Variations of Fresh Vegetables

Conclusions

U.S. produce imports have played an important role in the marketing of fresh produce, particularly since the 1990s. According to the AMS shipment data, more than one-half of fresh fruits and about 30% of fresh vegetables in the U.S. produce market came from imports in 2008-10. Because of climate, the United States does not produce tropical fruits commercially, and the U.S. domestic production of other fresh produce is seasonal—usually at a low in winter but peaking in summer. Thus, aside from steady imports of tropical fruits, the U.S. imports of fresh produce are, in general, complementary in seasonal nature with domestic production. For fresh fruits, the import share of the U.S. market peaks in winter and, to a lesser degree, in spring. Similarly, imported shipments for fresh vegetables in winter are more than double those in summer.

In addition, expanded fresh produce imports, especially fruits, have helped to lower domestic produce price levels and reduce price fluctuations. Since many domestically-produced fruits and vegetables peak in summer and are scarce during winter, this production cycle could cause volatile fluctuations in retail prices. Without fruit imports, the average real retail price index for fresh fruits would increase from 153.4% to 225.4% (using prices indexed to 1982-84 levels) and cause volatile price variations, with the measured coefficient of variations (*CV*) increasing from 3.86% to 12.02%. The market effects of fresh vegetable imports, however, are much smaller than for fruits, largely because most fresh vegetables consumed by Americans are still domestically produced. Without fresh vegetable imports, the average real retail price index for fresh vegetables would increase from 136.6% to 155.2%, and the estimated *CV* would increase from 4.76% to 7.19%.

American consumers have benefited from the fast growth of fresh produce imports. With increasing national concern about diet and obesity, public and private sector nutritionists have emphasized the need for Americans to increase fruit and vegetable consumption. Increased imports make year-round supplies of various fresh produce possible in the U.S. retail market by filling the gap for off-season demand in the market, supplying consumer demand for tropical fruits that are commercially unviable in the States, and making available varieties that are different from those currently produced domestically. In addition, a rapid increase of fresh produce imports would reduce retail price variations and make produce more affordable for consumers—potentially leading to increased fresh produce consumption. Thus, fresh produce imports have narrowed the gap in meeting produce consumption levels as recommended in the *2010 Dietary Guidelines for Americans*. This is an important step in the right direction because diets rich in fruit and vegetables—good sources of vitamins, minerals, and fiber—are associated with reducing some chronic diseases and, of more recent concern, lessening the problem of obesity.

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