# Potential Impacts of Avocado Imports from Mexico on the Florida Avocado Industry

**Sikavas Nalampang**
Agricultural Economics Extension
Tropical Research and Education Center
University of Florida
Email: nalampan@ufl.edu

**Wirusana Tantiwongampai**
Agricultural Economics Extension
Tropical Research and Education Center
University of Florida
Email: wtantiw@yahoo.com

**Edward A. Evans**
Agricultural Economics Extension
Tropical Research and Education Center
University of Florida
Email: eaevans@ufl.edu

***Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Long Beach, California, July 23-26, 2006***

**Potential Impacts of Avocado Imports from Mexico**

**on the Florida Avocado Industry**

The United States is the third largest avocado producer behind Mexico and Indonesia. U.S. avocado production occurs in three regions: California, Florida, and Hawaii. California is by far the largest producer, accounting for 90% of production, on average, followed by Florida with about 9% and Hawaii with less than 1%. Although producing only 9% of the USA total, the avocado industry is of great importance to the many small- and medium-size farmers in Florida. Moreover, since the bulk (80%) of the avocados produced in Florida is sold outside the state, the industry is considered to be an important revenue generator for Florida. In 2005, Florida growers produced about 28 thousand short tons valued at US$14.45 million.

Florida produces “green skin” varieties of avocados that are easily distinguished from the more popular “purplish-black skin” Hass varieties produced in California. There is growing concern among Florida growers and industry representatives that a recent USDA policy decision could have dire consequences for the Florida avocado industry. Specifically, the decision to reverse a 93-year ban and allow U.S. imports of avocados grown in Mexico could flood the domestic market and cause a substantial lowering of the prices received by Florida avocado growers (Florida avocados already are sold at a discount to the more popular Hass varieties).

While earlier studies have considered the issue of the likely impacts of increased market access for avocados shipped from Mexico, the main concern has largely been on the potential effects on the California avocado industry (USDA, APHIS 2004; Carman and Rodriquez 2004). For example, a partial equilibrium and economic assessment by the

Animal and Plant Health Inspection Service of the rule allowing Mexican avocados to be imported year-round to all states of the United States in 2007 looked at the implications for prices California growers would receive. Among other things, the findings suggested that under the proposed rule change, imports of Mexican avocados would increase by 267.2% (from 38.45 million pounds to 141.17 million pounds). In contrast, production of California avocados would decrease by 9.5%, and imports of avocados from Chile would decrease by 8.9%. Wholesale prices of avocados supplied by California and Chile are expected to decrease by 15.4% (from US$1.49 per pound to US$1.26 per pound) and 6.5% (from US$1.24 per pound to US$1.16 per pound), respectively. Likewise, a study by Carman and Rodriguez (2004) estimated the U.S. avocado demand function by using avocado data from the marketing years 1961-1962 to 2001-2002. Their results suggested a -0.43 price elasticity of demand for avocado from all sources (California, Florida, and all imports) at average prices and quantities, with a 1.47 income elasticity of demand and a 0.21 advertising elasticity of demand at mean values.

Unlike past studies, this article examines demand equation estimates for each category of avocados by incorporating avocado data from California, Chile, Mexico, and Florida into the Rotterdam inverse demand system to analyze the relationships among avocados from each category and assess potential impacts on the price of avocados, especially Florida green skin avocados, when Hass avocados from Mexico are allowed to enter all U.S. states in 2007.

The specific approach taken is to first develop quantitative estimates of the demand for California Hass avocados, Chile Hass avocados, Mexico Hass avocados, and Florida green skin avocados in the United States using the Rotterdam inverse demand system. Following this, an assessment is made regarding the extent to which the normalized price of avocados will change in response to a proportional increase in the total quantity of all selected avocado varieties through the scale effect, and the extent to which the price of avocados must change for consumers to absorb more of the cost through the quantity effect.

**Background**

Recently there has been a surge in the demand for ethnic foods in the United States. Between 2002 and 2004, the ethnic food market in the United States increased from US$53 billion to US$75 billion, an average annual rate of growth of about 20%. The growing demand for ethnic food is fueled largely by changes in the ethnic makeup of the U.S. population. Currently more than 30% of the people living in the United States are regarded as ethnic. Hispanics are the largest and fastest growing segment, accounting for about 13% of the U.S. population in 2004 (Miller 2005). Avocados are one of the most popular ingredients used in Hispanic cuisine.

Other factors responsible for the increase in avocado consumption in the United States (from a per capita level of 1.53 pounds in 1996 to 3.00 pounds in 2005) include year-round availability of fresh avocados due to imports, lower avocado prices, the promotion of the health benefits of avocado, and increased disposable income. With consumers more health conscious, the demand for healthier food items has increased. Avocados have been promoted as a healthy fruit providing necessary vitamins and minerals.

Noticeable with regards to the rise in avocado consumption is the increased share being satisfied by imports. Since the late 1980s, the United States has shifted from being a net exporter of avocados to becoming a net importer. For example, in 2002, the United States overtook France as the world's number one importer of avocados. Figure 1 shows the trend in U.S. imports of avocados over the period 1996 to 2005. The graph indicates a steep rise in the volume of avocado imports in 2005. For the first time, imports outnumbered domestic production. Between 1996 and 2005, imports increased from 28 thousand short tons to about 291 thousand short tons, an average annual growth rate of approximately 30%. The largest (by volume) single-year increase occurred in 2005, with imports increasing by 131 thousand short tons (from 160 to 291 thousand short tons). This was due to sizeable increases in the volume of avocados imported from Mexico and Chile (discussed below). The 2005 avocado imports were valued at US$337.16 million.

The main sources of U.S. imports of avocados are Mexico, Chile, Dominican Republic, and New Zealand (figure 2). Most of these imports are the Hass variety from Mexico, Chile, and New Zealand. Dominican Republic exports are mainly of the green skin type similar to those produced in Florida. Mexico and Chile, with shares of 50.87% and 43.50%, respectively, dominate the U.S. avocado import market, accounting for 94.37% of total imports in 2005. As illustrated in figure 2, up until 2004, Chile was the main supplier of avocados to the United States, followed by Mexico. However, the situation now has been reversed. In 2005, Mexico more than tripled the amount of avocados it ships to the United States (from 42 thousand short tons in 2004 to 148 thousand short tons in 2005). This represents an increase of 106 thousand short tons (247.37%) over the previous year. In comparison, imports from Chile increased by 23 thousand short tons (22.70%) to reach 127 thousand short tons for the same period.

Imports of Dominican Republic avocados in the United States doubled between 1996 and 2005 from 7.7 thousand short tons to 16 thousand short tons.

The main driving force behind the sharp increase in avocado imports entering the United States is the elimination of trade restrictions on avocado imports from Mexico. While Mexico is the world's largest producer of avocados, for a long time it was shut out of the U.S. market and banned for phytosanitary reasons. In 1993, the ban was partially lifted, allowing entry of Mexican avocados into the state of Alaska. Then, in November 1997, more restrictions were lifted, allowing Mexico to ship fresh avocados to 19 northeastern states and the District of Columbia during a four-month period from November through February. In November 2001, the number of states allowed to import Mexican avocados was increased to 31, and the length of the shipping period was extended from October to April. Since January 2005, Mexico has been allowed to ship year-round to 47 states (excluding California, Florida, and Hawaii). Full market access to all 50 states will be permitted beginning January 2007. Although there were no restrictions on avocados exported from Chile and Dominican Republic, the recent signing of bilateral trade agreements between these countries and the United States should make it easier for these countries to ship avocados to U.S. markets.

The upward trend in avocado imports is expected to continue due to strong U.S. domestic demand and increased supplies in the exporting countries. Mexico is expected to increase both its production and exports to U.S. markets due to increased acreages, good agricultural practices that have successfully controlled pests, and the elimination of restricted harvesting. Under the restricted harvesting program, producers agreed to restrict the amount of avocados they harvested per acre so as not to saturate the export market and cause prices to fall. In the case of Chile, both production and exports are expected to continue to increase in the coming years as a result of new bearing acreages and the need to increase export volume to compensate for falling prices and lost market shares to Mexico. Finally, industry experts have indicated that production of green skin avocados in Dominican Republic will increase considerably in the coming years due to the expansion of their avocado acreages by about 25 thousand acres. Many of those trees are still immature.

**The Florida Avocado Industry**

As mentioned earlier, avocados are of great significance to the economy of Florida. Grown mainly in Dade County, avocados are one of the top crops grown statewide and rank fifth among all crops nationwide (USDA, NASS 2004). Bearing acreage for avocados in Florida totaled 5.9 thousand acres in 2002/03, 6.1 thousand acres in 2003/04, and 6.4 thousand acres in 2004/05 (USDA, NASS 2005). The 2002 Census of Agriculture shows that there are 839 avocado farms in Florida, with a total of 7.255 thousand acres (table 1). Approximately 89.15% of avocado farms in Florida are less than 15 acres, and about 10.85% are larger than 15 acres.

Florida's avocado yields totaled 5.25 tons per acre in 2002/03, 2.79 tons per acre in 2003/04, and 4.38 tons per acre in 2004/05. Total production of avocados in Florida reached 28 thousand short tons in 2004/05, with total production value of US$14.45 million (USDA, NASS 2005).

Figure 3 shows the actual and inflation-adjusted trends of the prices Florida avocado growers received over the period 1996/97 to 2004/05. Between 1996/97 and 1999/00, prices increased from US$528 to US$748 per short ton, or 41.67%. However, with the exception of a slight recovery in 2001/02 and a spike in 2003/04 caused by a sharp drop in production, prices have since been decreasing (e.g., the 2004/05 price of US$516 per short ton represents only 76.51% of the previous 1999/00 to 2003/04 five-year average). As shown in figure 3, the downward trend in prices becomes more obvious when they are adjusted for inflation. The concern is that increases in the domestic supply of avocados along with significant increases in shipments from Mexico could serve to further aggravate the downward price trend.

**Methodology**

Following the inverse version of the Rotterdam demand system developed by Barten and Bettendorf (1989), our inverse demand equation for four different categories of avocado ($i$ = 1, 2, 3, and 4) is shown in equation 1. In our case, $i$ = 1 refers to Hass avocados produced in California, $i$ = 2 refers to Hass avocados produced in Chile, $i$ = 3 refers to Hass avocados produced in Mexico, and $i$ = 4 refers to green skin avocados produced in Florida.

(1) $$w_i d\ln(\pi_i) = h_i d\ln(Q) + \sum_j h_{ij} d\ln(q_j) + \upsilon_i, \qquad \text{for } i, j = 1, 2, 3, \text{and } 4$$

where $w_i = \pi_i q_i = (p_i q_i)/m$ is the budget share of the $i$th category of avocado, $p_i$ is the price of the $i$th category of avocado, $q_i$ is the quantity of the $i$th category of avocado, $\pi_i = p_i/m$ is the normalized price of the $i$th category of avocado where $m$ is the total expenditure of avocados for all categories, $d\ln(Q) = \pi(dq) = \sum_i w_i d\ln(q_i)$ is the Divisia quantity index, $\upsilon_i$ is the disturbance term, and scale effect ($h_i$) and quantity effect ($h_{ij}$) are parameters. To ensure that the four necessary demand properties (i.e., adding-up, homogeneity, Antonelli symmetry, and negativity properties) are satisfied, the estimated parameters $h_i$ and $h_{ij}$ (for $i, j$ = 1, 2, 3, and 4) are subjected to the following conditions (equations 2 to 5):

(2) $\sum_i h_i = -1$ and $\sum_i h_{ij} = 0$ (Adding-up)

(3) $\sum_j h_{ij} = 0$ (Homogeneity)

(4) $h_{ij} = h_{ji}$ (Antonelli symmetry)

(5) $\sum_i \sum_j x_i h_{ij} x_i < 0 \quad \forall x \neq \theta_I, \theta \in R$ (Negativity).

Following Barten (1969), each demand equation is estimated simultaneously. The Rotterdam inverse demand system is estimated using the maximum-likelihood method of estimation with constraints imposed. The homogeneity and symmetry constraints were imposed by working with the concentrated log-likelihood function.

Scale elasticity ($s_i$) and compensated quantity elasticity ($\varepsilon_{ij}$) can be derived from the estimated parameters $h_i$ and $h_{ij}$ (for $i, j$ = 1, 2, 3, and 4), respectively:

(6) $s_i = h_i / w_i$ , for $i$ = 1, 2, 3, and 4

(7) $\varepsilon_{ij} = h_{ij} / w_i$ , for $i, j$ = 1, 2, 3, and 4

where $s_i$ is the scale elasticity of the $i$th category of avocado, and $\varepsilon_{ij}$ is the compensated quantity elasticity between the price of the $i$th category of avocado and the quantity of the $j$th category of avocado. Uncompensated quantity elasticity ($\gamma_{ij}$) can be obtained using scale ($s_i$) and compensated quantity ($\varepsilon_{ij}$) elasticities so that

(8) $\gamma_{ij} = \varepsilon_{ij} + (s_i w_j)$ , for $i, j$ = 1, 2, 3, and 4

where $\gamma_{ij}$ is the uncompensated quantity elasticity between the price of the $i$th category of avocado and the quantity of the $j$th category of avocado.

## Data

Avocado data are supplied by the USDA Agricultural Marketing Service (AMS) and Foreign Agricultural Service (FAS). Monthly quantity data consist of domestically produced avocados (California Hass avocados and Florida green skin avocados) between 1998 and 2004 and monthly quantity data of U.S. Hass avocado imports from two importing countries (Chile and Mexico) during the same period. Due to data limitation, shipment data were used as a proxy for domestically produced avocado data. Weekly market prices of both Hass and green skin varieties for five markets between 1998 and 2004 were obtained from the fruit and vegetable market news portal maintained by USDA Agricultural Marketing Service (AMS). Avocado markets included Atlanta, Chicago, Miami, New York, and San Francisco. Monthly market prices were later calculated by averaging weekly market prices for all five markets and were deflated by the consumer price index (1982-1984 = 100) obtained from the U.S. Department of Labor.

## Empirical Results

Table 2 shows parameter estimates from the Rotterdam inverse demand system. Scale effect shows how much the normalized price of the *i*th category of avocado will change in response to a proportional increase in the total quantity avocados in the market, while quantity effect shows how much the price of the *i*th category of avocado must change to induce the consumer to absorb more of the *j*th category of avocado. Our results indicate that scale effects are significantly different from zero at the 5% level and are all negative, suggesting that the normalized price of each avocado category decreases as the aggregated quantity of avocados in the United States increases. Diagonal elements of the quantity effects are all negative and are significantly different from zero at the 5% level, except for own quantity effect of Hass avocados produced in Mexico. Negative diagonal elements of the quantity effects satisfy the negativity condition of the demand system.

Table 3 shows related scale and compensated quantity elasticities. Scale elasticities are all negative and are significantly different from zero at the 5% level. California and Chile have the largest absolute values of scale elasticities (-0.938), implying that the normalized prices of Hass avocados from California and Chile are the most responsive to the change in total quantity of avocados sold in the United States. On the other hand, the absolute value of the estimated scale elasticity for Florida (-0.863) is the smallest, implying that the normalized price of Florida green skin avocados is the least responsive to the change in total quantity of avocados sold in the United States. It also indicates that a 1% increase in total quantity of avocados in the market is likely to cause the normalized price of Florida green skin avocado to decrease by 0.863%. Diagonal elements of the compensated quantity elasticity are all negative. The compensated own-quantity elasticity of the Florida green skin avocado shows that a percent increase in the quantity of Florida green skin avocado is likely to decrease the normalized price of Florida green skin avocados by 0.008%, holding the quantities of other categories of avocado constant. Negative compensated cross-quantity elasticity denotes substitution and positive compensated cross-quantity elasticity denotes complementary relationship between two categories of avocado. For example, the negative compensated quantity elasticity between the quantity of Hass avocados produced in Chile and the price of Florida green skin avocados (-0.058) suggests that Hass avocados from Chile and Florida green skin avocados are substitutes. A percent increase in the quantity of avocados produced in Chile will cause the price of Florida green skin avocados to decrease by 0.058%, so as to induce consumers to buy the same quantity of Florida green skin avocados.

Table 4 shows estimated uncompensated quantity elasticities. The uncompensated quantity elasticity between the price of the *i*th category of avocado and the quantity of the *j*th category of avocado measures the percentage change of normalized price of the *i*th category of avocado for a one percentage change in quantity for the *j*th category of avocado. When the absolute values of the uncompensated quantity elasticities are less than one (inelastic), a one percentage change in quantity for the *j*th category of avocado will decrease normalized price of the *i*th category of avocado by less than 1%. In contrast, when the absolute values of the uncompensated quantity elasticities are greater than one (elastic), a one percentage change in quantity for the *j*th category of avocado will decrease the normalized price of the *i*th category of avocado by more than 1%. In general, our results show that all uncompensated quantity elasticities are inelastic. Negative own-quantity elasticities imply that avocado prices will decline, given an additional quantity of avocados. The normalized price of California Hass avocados is the most responsive to a change in its own quantity (i.e., the normalized price of California Hass avocados decreases by 0.538% for a 1% increase in the quantity of Hass avocados produced in California), while the normalized price of Florida green skin avocado is the least responsive to a change in its own quantity (i.e., the normalized price of Florida green skin avocado price decreases by 0.053% for a 1% increase in the quantity of green skin avocados produced in Florida).

*California Hass Avocado*

Uncompensated quantity elasticities suggest that a 1% increase in the quantity of avocados produced in California is likely to cause the normalized price of Hass avocados from California to decrease by 0.538%. It would also have the effect of causing the normalized prices of avocados produced in Chile, Mexico, and Florida to decrease by 0.489%, 0.474%, and 0.444%, respectively.

*Chile Hass Avocado*

Uncompensated quantity elasticities suggest that a 1% increase in the quantity of Hass avocados produced in Chile will potentially decrease the normalized price of Hass avocados from Chile by 0.270%. Likewise, under the same scenario, normalized prices of the California Hass avocado, Mexico Hass avocado, and Florida green skin avocado are likely to decrease by 0.246%, 0.264%, and 0.298%, respectively.

*Mexico Hass Avocado*

Uncompensated quantity elasticities suggest that a 1% increase in the quantity of Hass avocados produced in Mexico is expected to decrease the normalized price of Hass avocados from Mexico by 0.111%. This will also cause the normalized prices of California Hass avocado, Chile Hass avocado, and Florida green skin avocado to decrease by 0.108%, 0.119%, and 0.068%, respectively.

*Florida Green Skin Avocado*

Uncompensated quantity elasticities suggest that a 1% increase in the quantity of green skin avocados produced in Florida is likely to decrease the normalized price of Florida green skin avocados by 0.053%. Similar effect is also expected for the normalized prices of avocados produced in California, Chile, and Mexico, such that a 1% increase in the quantity of green skin avocados produced in Florida will cause the normalized prices of California Hass avocado, Chile Hass avocado, and Mexico Hass avocado to decrease by 0.046%, 0.060%, and 0.031%, respectively.

**Policy Implication for the Florida Avocado Industry**

From the uncompensated quantity elasticities reported above, conclusions can be drawn from the effect of increasing avocado supplies from different sources on the price of Florida green skin avocado. Uncompensated quantity elasticities suggest that a 1% increase in the quantity of Hass avocados produced in Mexico is likely to cause the normalized price of Florida green skin avocados to decrease by 0.068% (table 4). This is considered to be a smaller effect when compared to the effect of a 1% increase in the quantity of avocados produced in other sources on the price of Florida green skin avocados. For example, the uncompensated quantity elasticities also suggest that a 1% increase in the quantity of Hass avocados produced in California and Chile will potentially cause the normalized price of Florida green skin avocados to decrease by more than six and four times (0.444% and 0.298%), respectively, of the effect caused by a 1% increase in the quantity of Mexico Hass avocados. The result is supported by the fact that the green-skin avocados grown in Florida are different from the purplish-black skin avocados grown in Mexico. As a result, Florida green skin avocados do not compete directly with Mexico Hass avocados in the market, and it is therefore unusual for the increasing supplies of avocados from Mexico to have a significant impact on the price of the Florida green skin avocados.

Our main concern is what will happen to the price of Florida green skin avocado when avocados produced in Mexico gain full access to the U.S. market in 2007. Avocado imports from the 2004/05 season already have exceeded domestic production level for the first time, primarily because of the year-round launching of avocados from Mexico in 2005. The significant boost of imports from Mexico has resulted in an ample amount of U.S. avocado supplies and decreased avocado prices, including the price of the Florida green skin avocado. This is consistent with our finding from the scale effect, which suggests an inverse relationship between total supplies of avocado in the United States and the prices of avocado.

In the case of Florida avocado growers, a surge of avocado imports from Mexico together with an increase of green skin avocado production of 11 thousand short tons (64.71%) over the previous season already have fueled a downward trend of the prices received by Florida growers, from US$808 per short ton for the 2003/04 season to US$516 per short ton for the 2004/05 season (36.14%). With a strong growth of U.S. avocado consumption and supplies, particularly in 2007, avocado prices are expected to continue to decline.

**Conclusion**

This article evaluates demand for four categories of avocados (i.e., California Hass avocados, Chile Hass avocados, Mexico Hass avocados, and Florida green skin avocados) by incorporating avocado data from California, Chile, Mexico, and Florida into a Rotterdam inverse demand system to analyze the relationships among avocados from each category and assess potential impacts on the price of avocados, especially Florida green skin avocados, when Hass avocados from Mexico are allowed to enter all states in 2007.

Based on avocado data from 1998 to 2004, results suggest that the allowance of Hass avocados from Mexico to all 50 states in the United States is not likely to have a significant impact on the price of Florida green skin avocado. On the other hand, the increase of avocado imports over the years could mean a decrease in the price of avocados in the domestic market, including the price of Florida green skin avocados. For the future outlook of avocado prices, it is expected that U.S. consumers will continue to consume large amounts of avocado. To help compensate for potentially lower avocado prices and to effectively respond to increasing avocado demand, promotional program initiatives for the Florida green skin avocados will help boost the demand for Florida green skin avocados so that the Florida avocado industry can remain strong in a competitive avocado market.

**References**


Barten, A. P. 1969. "Maximum Likelihood Estimation of a Complete System of Demand Equations." *European Economic Review* 1:7-73.

Barten, A. P., and L. J. Bettendorf. 1989. "Price Formation of Fish: An Application of an Inverse Demand System." *European Economic Review* 33:1509-1525.

Carman, H. F. and R. K. Craft. 1998. *An Economic Evaluation of California Avocado Industry Marketing Programs, 1961-1995*. California Agricultural Experiment Station, Giannini Foundation Research Report No. 345 (July).

Carman, H. and A. M. Rodriguez. 2004. "The Hass Avocado Promotion and Research Order: Offsetting Price Impacts from Imports with Advertising and Promotion." Working paper, Department of Agricultural Economics, University of California, Davis.

Miller, M. 2005. *Ethnic Foods Market Profile*. Washington, D.C.: U.S. Department of Agriculture, Agricultural Marketing Resource Center. Available at http://www.agmrc.org/agmrc/markets/Food/ethnicfoodsmarketprofile.htm (accessed March 16, 2006).

U.S. Department of Agriculture, Animal and Plant Health Inspection Service (USDA, APHIS). 2004. *Economic Analysis Proposed Rule: Allow Fresh Hass Avocados Grown in Approved Orchards in Approved Municipalities in Michoacan, Mexico, to Be Imported into All States Year-Round*. Washington, D.C. (May).

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA, NASS). 2004. *2002 Census of Agriculture: State and County Profiles*. Washington, D.C.

Available at http://www.nass.usda.gov/census/census02/profiles/fl/cp12025.pdf, (accessed March 16, 2006).

___. 2005. *Non Citrus Fruits and Nuts: 2004 Summary*. Washington, D.C. (July). Available at http://usda.mannlib.cornell.edu/reports/nassr/fruit/pnf-bb/ncit0705.pdf (accessed March 16, 2006).

**Table 1. Distribution of Avocado Farms in Florida by Acre, 2002**

| Acres | Total | | Bearing Acres | | Nonbearing Acres | |
|---|---|---|---|---|---|---|
| | Farms | Acres | Farms | Acres | Farms | Acres |
| 0.1 to 0.9 acres | 164 | 60 | 112 | 41 | 73 | 19 |
| 1.0 to 4.9 acres | 377 | 846 | 338 | 665 | 132 | 180 |
| 5.0 to 14.9 acres | 207 | 1,550 | 196 | 1,384 | 52 | 166 |
| 15.0 to 24.9 acres | 34 | 607 | 34 | 556 | 7 | 51 |
| 25.0 to 49.9 acres | 25 | 839 | 25 | 762 | 9 | 77 |
| 50.0 to 99.9 acres | 19 | 1,253 | 19 | 1,143 | 4 | 110 |
| 100 acres or more | 13 | 2,100 | 13 | 2,058 | 4 | 42 |
| Total | 839 | 7,255 | 737 | 6,609 | 281 | 645 |

Note: Table 1 was obtained from the 2002 Census of Agriculture (USDA, NASS 2004).

**Table 2. Parameter Estimates from the Rotterdam Inverse Demand System**

| Origin | Scale Effects | Quantity Effects | | | | $R^2$ |
|---|---|---|---|---|---|---|
| | | California | Chile | Mexico | Florida | |
| California | -0.518* | -0.011* | 0.008* | 0.001 | -0.002 | 0.942 |
| | (0.008) | (0.002) | (0.001) | (0.001) | (0.001) | |
| Chile | -0.261* | 0.008* | -0.003* | -0.002* | 0.003* | 0.907 |
| | (0.005) | (0.001) | (0.001) | (0.001) | (0.001) | |
| Mexico | -0.104* | 0.001* | -0.002* | -0.001 | -0.002 | 0.900 |
| | (0.003) | (0.001) | (0.001) | (0.001) | (0.001) | |
| Florida | -0.045* | 0.002 | -0.003* | 0.002 | -0.000* | 0.703 |
| | (0.003) | (0.001) | (0.001) | (0.001) | (0.001) | |

Note: Asymptotic standard errors of parameter estimates are in parentheses and * denotes parameter estimates that are statistically different from zero at the 5% level.

**Table 3. Estimated Scale and Compensated Quantity Elasticities**

| Origin | Scale Elasticities | Compensated Quantity Elasticities | | | |
|---|---|---|---|---|---|
| | | California | Chile | Mexico | Florida |
| California | -0.938* | -0.020* | 0.014* | 0.003 | 0.003 |
| Chile | -0.938* | 0.029* | -0.009* | -0.008* | -0.011* |
| Mexico | -0.880* | 0.012* | -0.020* | -0.007 | 0.015 |
| Florida | -0.863* | 0.032 | -0.058* | 0.034 | -0.008* |

Note: * denotes elasticities calculated from parameters that are statistically different from zero at the 5% level.

**Table 4. Estimated Uncompensated Quantity Elasticities**

| Origin | California | Chile | Mexico | Florida |
|---|---|---|---|---|
| California | -0.538 | -0.246 | -0.108 | -0.046 |
| Chile | -0.489 | -0.270 | -0.119 | -0.060 |
| Mexico | -0.474 | -0.264 | -0.111 | -0.031 |
| Florida | -0.444 | -0.298 | -0.068 | -0.053 |

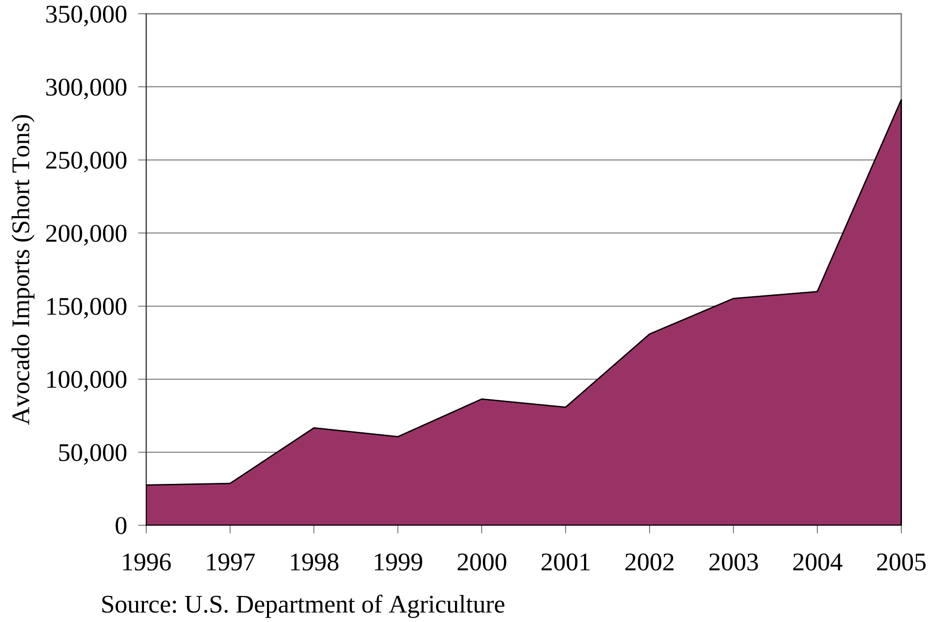



**Figure 1. Total U.S. avocado imports (short tons), 1996-2005**

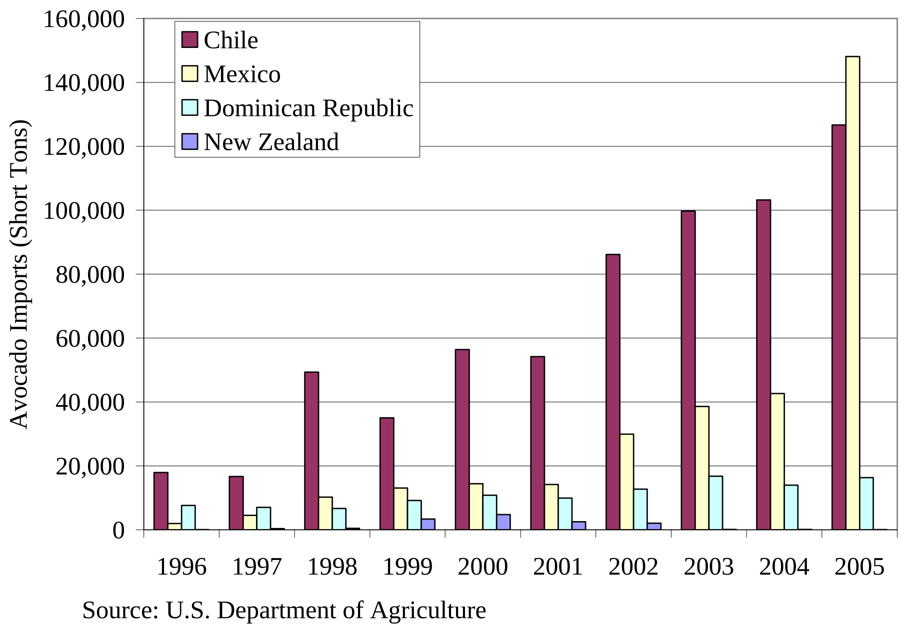
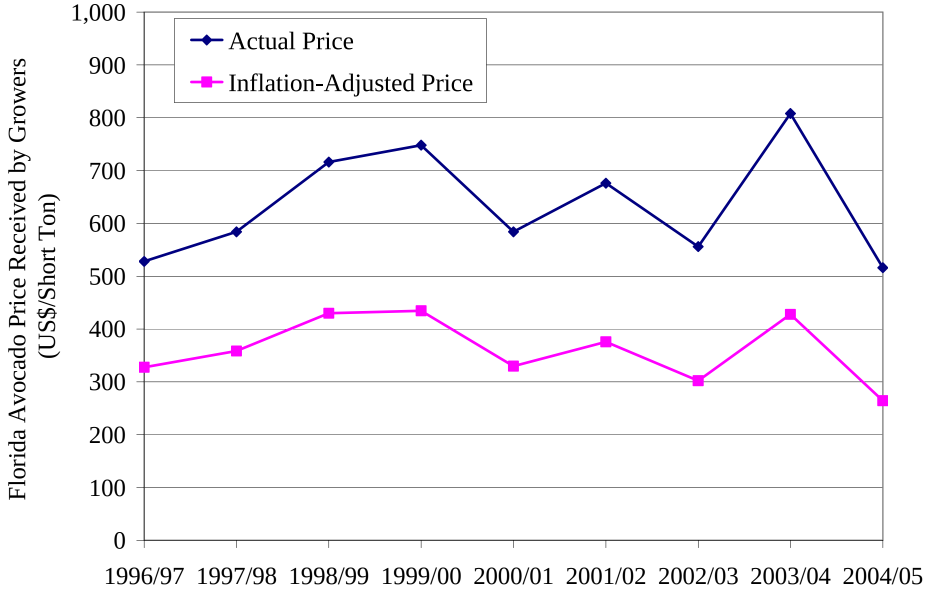



**Figure 2. Total U.S. avocado imports by country (short tons), 1996-2005**




Source: U.S. Department of Agriculture

**Figure 3. Actual and inflation-adjusted trends of the Florida avocado prices received by growers (US$/short ton, 1982-1984 = 100), 1996/97-2004/05**