



The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

Jose de Jesus
Espinoza-
Arellano
*National Institute of
Agricultural
Research (INIFAP)*

Stephen Fuller
*Texas A&M
University*

Jaime Malaga
*Texas A&M
University*

Analysis of Forces Affecting Competitive Position of Mexico in Supplying U.S. Winter Melon Market

ABSTRACT: An econometric model representing the United States, Mexico and Caribbean nations melon sectors was estimated to analyze the primary economic forces influencing Mexico's competitiveness in the U.S. winter melon market, a period when about two-thirds of U.S. consumption is imported. Results show peso-devaluation to be important in the short-run and yield-enhancing technology to be important in the short- and long-run. Increased rates of growth in Mexican yields were about six times more effective at increasing market share than NAFTA provisions which phase-out U.S. tariffs. An accelerated rate of growth in Mexican per capita income was found to reduce melon exports about 75% while higher wages would reduce exports about 20% in the long-run.

American consumers have found fresh melons to be an increasingly attractive food choice in the winter season. About 40% of the United States annual fresh melon consumption (28.7 lbs/capita) occurs during December through May (winter) when nearly two-thirds of the melon supply is imported (USDA, 1997).

Mexico and Caribbean nations supply virtually all imported quantities during this period: in 1996, the value of U.S. fresh melon imports was over \$0.20 billion or about one-third of tomato imports, the leading fresh vegetable import (USDA, 1997). Historically, Mexico was the primary foreign source of melons for the U.S. winter market. However, over the past two decades, Mexico's share of the U.S. melon market has declined while that of Caribbean nations increased (Espinoza, 1998). Some believe that Caribbean nations have been advantageously positioned in the U.S. market because of (1) the most-favored-nation status that has been extended to these countries along with its duty-free provisions and (2) the Caribbean Basin Initiative (1983). It is argued that the NAFTA (North American Free Trade Agreement) provisions which phase-out U.S. melon tariffs on Mexican imports will again establish Mexico as the dominate supplier to the U.S. winter market. Others hold that Caribbean nations enjoy a technological advantage that will not be erased by the tariff-reducing provisions of NAFTA. The objective of this study is to identify and measure the primary economic forces influencing Mexico's ability to compete with Caribbean nations and U.S. melon suppliers in the U.S. winter melon market. Analysis focuses on (1) the Mexican peso devaluation in late 1994/95, (2) growth in Mexican agricultural wage rates, (3) yield-enhancing technologies, (4) heightened rates of per capita income growth in Mexico, and (5) NAFTA and its associated phase-out of U.S. melon tariffs. Analysis is accomplished with an estimated price equilibrium econometric simulation model that represents the cantaloupe, honeydew and watermelon industries in the United States, Mexico and Caribbean nations. This study will be of particular interest to agribusinesses in developing nations who are attempting to evaluate the role of technology (crop yields) and tariff elimination policies as forces affecting their competitive position in U.S. markets.

LITERATURE REVIEW

A review of refereed literature showed little economic analysis regarding melons or international melon trade. Suits estimated a farm-level demand equation for U.S. watermelon based on national data covering the 1930-1951 period: the estimated income and own-price elasticities were 1.37 and -0.90, respectively. Buxton estimated U.S. supply response equations for honeydew and watermelon with 1970-1991 data: the estimated supply elasticities for watermelon and honeydew were 0.34 and 1.16, respectively. Buxton found supply was primarily dependent on lagged own price and the cross-price effects generally were small and not statistically significant. Fuller and Hall suggested that the tariff-reducing provisions of NAFTA and the U.S./Mexico exchange rate may have an important influence on U.S./Mexico melon/vegetable trade. Cook, Benito, Matson, Runsten, Shwedel, and Taylor indicated that melon production in Mexico is generally

complementary with U.S. production in December through April but note some competition in May. Brown and Suarez observed that California, Texas, and Arizona producers dominate the U.S. market from May to December while Mexico and Caribbean nations become primary suppliers from January through April.

Several international vegetable trade studies had objectives that parallel this study thus, a review of that literature is included. Simmons and Pomerada (1975) and Zabin (1997) examined the effect of Mexican wage rates on winter exports of fresh vegetables to the United States. Simmons et al. estimated a 10% increase in Mexican wage rates would lower exports 7%. Zabin found the real cost of labor for growers in Mexico was less than that for California growers, however, the difference in costs was considerably smaller than the differential in wage rates. Taylor and Wilkowske (1984) showed productivity growth was central to the ability of U.S. vegetable producers to compete with foreign competition and Cook (1992) identified technological developments as important in determining the competitiveness of Mexican producers in the U.S. market. Schuh (1987) demonstrated the importance of the exchange rate in affecting U.S./Mexico trade and Fuller, Capps, Bello, and Shafer (1991) found the real peso/dollar exchange rate to have a statistically significant affect on Mexican onion exports to the United States. Schulthies and Williams (1992) suggested the rapidly growing demand for fresh vegetables and melons in Mexico may limit the ability of that country to export these commodities. Finally, several studies focused on the importance of U.S. vegetable tariffs in shaping trade. Hammig and Mittelhammer (1982) estimated that removal of U.S. tomato tariffs would reduce domestic supply 24%. Others have shown that selected U.S. vegetable tariffs increase the cost of Mexican exports to the U.S. beyond total Florida producer costs (Buckley, VanSickle, Bredahl, Belibasis, and Gutierrez, 1986).

BACKGROUND

United States cantaloupe and honeydew production in late May overlaps imports while watermelon imports and domestic production compete during April and May. Florida is a significant source of watermelon in April, while Florida, California, and Texas supply nearly 85% of consumption in May (USDA, 1970-1994b). In this analysis, cantaloupe and honeydew imports in the December through May period were viewed as complementary with U.S. production while watermelon imports were competitive.

Melon shipment data suggests Costa Rica, Guatemala, and Honduras have gained important shares of the U.S. winter cantaloupe and honeydew markets over the 1972/74 to 1992/94 period (USDA, 1970-1994b). In 1972/74, Mexico supplied 93% of the U.S.'s imported cantaloupe supply while the remainder was

supplied by Caribbean nations. By 1992/94, Mexico and Caribbean nations supplied 36 and 64%, respectively. The Caribbean nations share of the U.S. imported honeydew market increased from about 8 to 57% over the 1972/74 to 1992/94 period while Mexico's share declined from about 67 to 40%. The share of the U.S. watermelon market held by Caribbean nations increased to about five percent over the two decade period, thus Caribbean nations have not become a force in this market. The U.S. producers have an important share of the winter watermelon market and over the 1972/74-1992/94 period their share edged upward from 59 to 65% while Mexican producers share declined from 40 to 30%.

Melon imports from Caribbean nations have entered the U.S. duty-free for an extended period because of these countries most-favored-nation status. In contrast, melon imports from Mexico have experienced a variety of tariffs during the December through May period. Prior to NAFTA, watermelon imports were levied a 20% *ad valorem* tariff throughout the December through May period: NAFTA provisions immediately phased-out all tariffs except for imports in May which are subject to a 10 year phase-out. Historically, Mexican honeydew imports were subject to an 8.5% *ad valorem* tariff during the December through May period. The May tariff is to be phased-out by 2004 (10 years) while the December 1 through April 30 tariff is to be phased-out over a five year period. Currently, no effective U.S. tariffs exist on Mexican cantaloupe imports since they were historically duty-free from January 1 through May 15 and in 1994 the December tariff was removed (Espinoza, 1998).

The melon industries in Caribbean nations have benefitted from investments in melon production technology over the 1972/74-1992/94 period. In 1972/74, cantaloupe yields in the major Caribbean exporting nations averaged 4.12 tons/hectare or about one-third of Mexican yields (12.89 tons/hectare). However, by 1992/94, cantaloupe yields in Caribbean nations had grown to nearly 19 tons/hectare while Mexican yields were about unchanged. Similar trends have occurred for honeydew with Caribbean nation yields increasing from 1.12 tons/hectare to nearly 16 tons per hectare over the 1972/74-1992/94 period (FAO).

METHODOLOGY

Model, Data, and Model Validation

The specified model included three regions (United States, Mexico, Caribbean nations) and three commodities (cantaloupe, honeydew, watermelon) with individual melon demands and supplies for each region. Because U.S. honeydew and cantaloupe production during the December through May period is comparatively small, the domestic supply of these melons was viewed as exogenous in the specified model: in contrast, U.S. watermelon supply was treated endogenously since imports compete with U.S. production. Price linkage equations connected

retail and farm-level prices in each region. Price transmission equations linked Mexico and Caribbean nations to the U.S. markets and included tariffs and exchange rates. The excess supplies of Mexico and Caribbean nations were equated with U.S. excess demands to determine market clearing conditions.

Per capita melon demands were specified as a function of own-retail price, other melon prices and per capita income while supplies were estimated with an acreage equation and yield. Harvested acreage was assumed to be a function of lagged farm melon price, lagged price of a competing crop and a production input cost. Mexican and Caribbean nation prices were specified as a function of U.S. prices, the real exchange rate and applicable tariffs (Chambers and Just, 1979). This specification seemed reasonable since the U.S. import market dominates melon markets in both countries during the December through May period. Mexico and Caribbean nations' excess supply equations were the difference between their respective domestic supplies and demands. The excess demands of the United States were formulated as the difference between U.S. demand and supply plus exports. Equilibrium conditions were obtained with the trade equations by equating the exporters excess supplies with U.S. excess demands. Since the U.S. imports small quantities of fresh melons from other countries than Mexico and Caribbean nations during the December to May period, they were treated as exogenous in the trade equations. Similarly, Mexico and Caribbean nations export small quantities of melons to other countries than the United States, thus these supplies were treated as exogenous in the model.

Data to estimate model parameters represented the December through May period (winter) for 1970-1994. Unfortunately, the availability of Mexican and Caribbean nation data limited the estimation of selected specified equations. In particular, inadequate data were available to estimate honeydew demand and supply for Mexico and melon demands and supplies for the Caribbean nations. Mexican data on honeydew production and harvested area were not available for the study period and a continuous melon price and production data series for the major Caribbean nation producers were not available for 1970-94. In lieu of the specified demands and supplies, excess supply relationships were estimated for Mexican honeydew and for each of the melons produced and exported by the Caribbean nations. Estimation of the excess supply relationships facilitated the analysis, however, it reduced the number of scenarios that could be successfully analyzed for Caribbean nations and Mexican honeydew.

Mexican state-level data regarding cantaloupe and watermelon production, farm price, yield and harvested area came from the Secretaria de Agricultura y Recursos Hidraulicos. Mexican melon input costs came from the Comision Nacional de los Salarios Minimos, Fertilizantes Mexicanos, and *Boletin Mensual de Informacion Basica del Sector Agropecuario y Forestal*. The Banco de Mexico provided information on melon retail price and an International Monetary Fund document provided information on populations, per capita incomes and exchange

rates. Information on U.S. melon imports came from Bureau of the Census, U.S. Department of Commerce and the Agricultural Marketing Service (AMS) of the U.S. Department of Agriculture (USDA, 1970-1994b). The U.S. Department of Agriculture publications provided data on U.S. melon prices and production and the Florida Department of Agriculture provided information on watermelon yields and farm-level prices (USDA, 1970-1994a, 1989c, 1993d, 1970-1994e). The *Economic Report of the President* was a source of information on labor and fertilizer input costs. Information on melon production, yields and input costs in Caribbean nations came from the Food and Agricultural Organization and the International Labor Office.

Three-stage least squares was used to estimate model parameters. The final fresh melon model included 19 behavioral equations and 70 estimated parameters. Forty-four of the 70 parameter estimates were significant at the 0.05 level and the goodness-of-fit measures (R^2) ranged from 0.35 to 0.94. The Durbin-Watson and Durbin-h statistics showed no autocorrelation problems (Pindyck and Rubinfeld, 1991). Signs on all estimated parameters were consistent with economic theory and were, in general, in the expected range and in agreement with previous estimates. See Espinoza to view the estimated econometric model.

The estimated melon model was validated using within-sample simulation. In general, the root mean square percentage errors (RMS% errors) were low ($< 20\%$) except for selected endogenously-determined excess supplies. Excess melon supplies were estimated for Caribbean nations because of inadequate data to estimate melon demands and supplies. The Theil-U coefficient was near zero for nearly all predicted values and decomposition of the Theil inequality coefficient indicated no systematic error for any endogenously-determined variable. In addition, selected exogenous variables were shocked and dynamic multipliers calculated to determine model stability. All endogenous variables moved in the expected direction and returned to equilibrium after four periods. Results of the validation process suggested the melon model satisfactorily replicated historical time periods and was adequate to carry out the proposed analysis (Pindyck and Rubinfeld, 1991).

Procedure

First, the validated fresh melon model was used to estimate a baseline forecast of the model's endogenous variables through 2004, the year when U.S. melon tariffs will be phased out. This was accomplished by incorporating into the melon model the projected values of exogenous variables through this time period. The resulting baseline forecast of endogenous variables served as a benchmark that could be compared with melon model simulations that included changes in critical exogenous variables such as melon yields, exchange rates, input costs, per capita income growth, and tariffs. The effects of the selected exogenous variables were

isolated by comparing the baseline forecast with the outcomes associated with melon model simulations that included adjustments in the exogenous variables.

The projected values for the macroeconomic exogenous variables included in the baseline estimates came from the Food and Agricultural Policy Research Institute (FAPRI) while projected melon yields for the various regions were based on historical trends. The projected real per capita growth rate in GDP for the U.S. was projected at 1.2 to 1.4% from 1996 through 2004 while Mexico's growth rate was projected at 2%. The annual rate of population growth in the U.S. was projected to decline from about one percent to 0.84% over the 1996-2004 period while Mexico's population growth rate was projected to decline from about 2 to 1.6%. Real Mexican wage rates were projected to increase at an annual rate of 1.5% whereas U.S. wages increased at rates of 2.6 to 3.2%. The baseline estimate reflected the 1994/95 devaluation of the peso. The peso/dollar exchange rate was projected to increase about 20% in 1996 with the annual increase declining to about 8% by 2004, thus a continuing weakening of the peso relative to the dollar. Yields for U.S. watermelon were projected to increase at rates of 2 and 3% while Mexico watermelon yields were projected to increase at a 1.5% rate. All melon yields in Caribbean nations were projected to increase at an annual rate of 1.85% while Mexico cantaloupe yields were projected to increase at a 0.92% rate. The baseline forecast assumed the U.S.'s scheduled tariff phase-out under provisions of NAFTA would continue unimpeded: watermelon and honeydew tariffs are to be totally eliminated by 2004.

RESULTS

Baseline Forecast

The baseline forecast extends through 2004: it showed aggregate U.S. consumption of cantaloupe and honeydew increasing during the winter while aggregate consumption of watermelon edged downward. The decline in U.S. watermelon consumption appeared to result from the relatively low income elasticity for watermelon and a comparatively modest decline in real price over the projected time period. Imports of cantaloupe and honeydew by the United States were projected to increase about 16 and 5%, respectively, over the 1996-2004 period, while watermelon imports decrease. The decline in watermelon imports from Mexico was due to increased market share held by U.S. producers in combination with a modest decline in per capita consumption (Espinoza, 1991).

The baseline forecast (1996-2004) showed Mexico to supply a declining share of U.S. imported winter melon consumption, thus continuation of the historical trend (Table 1). Over the forecast period, Mexico's share of U.S. imported cantaloupe consumption was projected to decline from 36 to 16%, while Caribbean nations share increases from about 64 to 84%. Similarly, Caribbean

Table 1. Projected Baseline Estimates of Melon Supplies to U.S. in Winter Season and Associated Market Shares, 1996–2004¹

	1996	2000	2004
Cantaloupe			
Mexico Imports (1,000 lbs.)	256,993	198,739	133,737
Market Share (%)	36.0	25.3	16.2
Caribbean Imports (1,000 lbs.)	456,061	587,681	691,674
Market Share (%)	63.9	74.7	83.8
Honeydew			
Mexico Imports (1,000 lbs.)	119,398	109,544	103,746
Market Share (%)	40.3	36.2	33.5
Caribbean Imports (1,000 lbs.)	166,478	182,569	195,214
Market Share (%)	56.2	60.3	63.1
Watermelon			
Mexico Imports (1,000 lbs.)	214,069	145,474	80,799
Market Share (%)	30.5	21.6	12.6
U.S. Shipments (1,000 lbs.)	457,676	496,037	524,946
Market Share (%)	65.2	73.6	81.6

¹ Market shares do not sum to 100% because of other suppliers.

nations were projected to supply an increasing share of U.S. imported winter honeydew consumption by upping their market share from 56 to 63% over the 1996 to 2004 period. Over this time period, Mexico's share of the imported U.S. honeydew supply was projected to decline from 40 to 33%. Mexico and U.S. producers vie for the U.S. winter watermelon market and, based on the baseline forecast, Mexico's share will continue to decline. In particular, Mexico's share was projected to decline from 30 to 13% over the forecast period (1996-2004) while U.S. producers share increases from 65 to 82%.

Results of Simulation Analysis

To determine the effect of selected forces on the competitiveness of Mexico in supplying U.S. winter melon markets, the baseline forecast for selected endogenous variables was contrasted with melon model projections that reflected changes in exogenous variables thought to be important in determining the competitiveness of Mexico. Analysis focused on (1) changes in the Mexican peso/U.S. dollar exchange rate, (2) phase-out of U.S. melon import tariffs under the provisions of NAFTA, (3) accelerated per capita income growth in Mexico, (4) an increasing rate of growth in Mexican cantaloupe and watermelon yields, and (5) an increasing rate of growth in Mexican wage rates. The effect of the 1994/95 Mexican peso devaluation on that country's exports to the U.S. melon market was evaluated by presuming that the peso/dollar exchange rate had been fixed at the 1993 level from 1996 through 2004 and, then, contrasting that simulated outcome with a forecast that reflected the 1994/95 devaluation. Results

Table 2. Effects of Major Exogenous Forces on Melon Imports from Mexico: Percent Change from Baseline, 1996, 2000, and 2004¹

	1996	2000	2004
Cantaloupe			
NAFTA	NA	NA	NA
Peso Devaluation	3.9	3.1	2.0
Accelerated Growth Rate Assumption			
Mexico Yields	22.0	40.6	79.2
Mexico Income	-1.0	-12.4	-60.2
Mexico Wages	-0.3	-3.9	-14.8
Honeydew			
NAFTA	0.2	0.8	0.9
Peso Devaluation	17.7	9.7	4.7
Accelerated Growth Rate Assumption			
Mexico Yields	NA	NA	NA
Mexico Income	NA	NA	NA
Mexico Wages	-0.3	-2.7	-7.4
Watermelon			
NAFTA	2.1	6.4	17.5
Peso Devaluation	36.0	32.9	23.5
Accelerated Growth Rate Assumption			
Mexico Yields	8.7	38.0	119.5
Mexico Income	-1.1	-16.0	-92.4
Mexico Wages	-0.5	-7.2	-32.4

¹ Provisions of NAFTA have inconsequential affect on U.S. cantaloupe tariffs, thus the influence of NAFTA is NA. Mexican data were not available to estimate Mexican honeydew supply, thus the influence of accelerated Mexican yield and wage rates could not be measured.

showed, as expected, that the 1994/95 devaluation had an important short-run affect on Mexican melon exports to the United States (Table 2). The analysis projected Mexico's respective watermelon, honeydew, and cantaloupe exports to the United States to have increased about 36, 18, and 4% relative to the baseline estimate as a result of the 1994/95 peso devaluation. The 1994/95 devaluation was estimated to have increased Mexico's share of the U.S. imported watermelon, honeydew, and cantaloupe market 11, 7, and about 2 percentage points, respectively, in 1996. However, by 2004, the effect of the 1994/95 devaluation was more modest: this occurred because of the comparatively rapid rise in Mexican price levels over the forecast period.

To evaluate the effect of scheduled reductions in U.S. honeydew and watermelon tariffs (NAFTA) on Mexican melon exports to the United States in the winter season, the baseline forecasts with their scheduled tariff reductions were contrasted with melon model projections that assumed no tariff reductions. As expected, the greatest influence of the tariff phase-out occurs in 2004, when all tariffs are scheduled to be removed (Table 2). For watermelon, the U.S. tariff phase-out was projected to increase Mexican exports to the U.S. about 17% above the baseline estimate by 2004 while honeydew exports were projected to increase about one percent. As a result of the tariff removal, Mexico's share of the U.S.

watermelon market was projected to increase about 2 percentage points while the affect on Mexico's share of the honeydew market was inconsequential.

The comparatively low wages paid to Mexican labor is generally believed to be critical to Mexico's competitiveness in international vegetable/melon markets. To evaluate this notion, the baseline forecast was contrasted with a melon model simulation that assumed real agricultural wages grew at an annual rate of 2% rather than the historical 1.5%. When all forces were held constant except agricultural wages, Mexico's exports of watermelon, cantaloupe, and honeydew declined about 32, 15, and 7%, respectively, relative to baseline estimates in 2004 (Table 2). Higher real Mexican agricultural wages were projected to decrease Mexico's share of the U.S. import market for watermelon about 4 percentage points and for remaining melons about 2 percentage points in 2004.

The baseline forecast presumed real per capita income in Mexico to increase at an annual rate of 2%. Some believe Mexico's economic growth over the next decade will be considerably higher than the baseline estimate. Heightened economic growth and per capita income could reduce Mexican melon exports since higher incomes would increase domestic melon demand and consumption. To measure the effect of higher incomes, baseline estimates were contrasted with estimates that assumed real per capita incomes increase from 2.3 to 4.9% over the 1996 to 2004 period (Table 2). Results show accelerated economic growth to have an important affect on Mexico's melon exports. By 2004, Mexico's cantaloupe and watermelon exports to the United States were projected to decline 60 and 92%, respectively, relative to baseline estimates as a result of the heightened growth in per capita income. As a result, Mexico's share of the U.S. winter melon import market declined: analysis showed Mexico's share of the U.S. cantaloupe and watermelon market to decline about 9 and 12 percentage points, respectively, relative to baseline estimates in 2004.

Finally, analysis focused on the effect of yield-enhancing technology. Mexico cantaloupe and watermelon yields in the baseline estimates were assumed to increase at their historical annual rate of 0.9 and 1.5%, respectively. To evaluate the effect of yield-improving technology on Mexico's international competitiveness, cantaloupe and watermelon yields were projected to increase at respective annual rates of 1.8 and 3%: these are the yield growth rates in competing regions. The rates at which yields increase over time have an important affect on competitiveness (Table 2). In the short-run, Mexico's exports of cantaloupe and watermelon increased 22 and 9%, respectively, as a result of heightened yields. However, by 2004, Mexico cantaloupe and watermelon exports were projected to increase about 79 and 119%, respectively, relative to the baseline solution. As a result, Mexico's share of the U.S. winter cantaloupe and watermelon market was projected to increase 10 and 12 percentage points, respectively, relative to the baseline solution in 2004.

SUMMARY OF FINDINGS AND IMPLICATIONS

The effects of the peso/dollar exchange rate, relaxation of U.S. melon tariffs under provisions of the NAFTA, and accelerated growth rates in Mexico's per capita income, agricultural wages and melon yields were analyzed to determine their affect on Mexico's ability to expand melon exports to the U.S. winter market. In the short-run, devaluation of the peso and an accelerated rate of growth in melon yields had the greatest impact on Mexico's ability to export. On average, the heightened growth rate in melon yields was about 75% as effective as the 1994/95 peso devaluation in increasing Mexico's melon exports in the short-run. In the long-run, yield-enhancing technology, phase-out of U.S. tariffs, and a heightened rate of growth in Mexican per capita income and agricultural wages were important. Clearly, the accelerated growth rate in melon yields had the most important positive influence on Mexico's ability to export to the U.S. market: the accelerated rates of growth in yields were, on average, about six times more effective at increasing exports than removal of U.S. melon tariffs. Further, results show an accelerated economic rate of growth (accelerated growth rate in per capita incomes and agricultural wages) in Mexico dramatically reduces Mexican melon exports to the United States. On average, accelerated growth in per capita income would reduce Mexican exports about 75% while higher wages would reduce exports about 20% in the long-run.

Although many of the analyzed forces are not directly controlled by the business firm (i.e., exchange rates, tariff negotiations, per capita income growth), these findings suggest their importance to the agribusiness firm. First, exchange rates do have an important effect on trade, in particular, the weakening of the peso (exporters currency) increases export opportunities in the short-run. However, in the long-run, the one-time devaluations tend to dissipate. These findings suggest potential value in using currency futures/options to lock-in attractive exchange rates or to protect against adverse movements in exchange rates. Second, for commodities that encounter substantial tariffs (i.e., watermelons) the trend towards freer trade increases export opportunities, however, in the long-run, the tariff phase-out ranked last among the forces influencing exports. Thus, this analysis shows tariff removal is not a dominate force impacting trade. Third, Mexican exports of horticultural products would be severely hampered by an accelerated rate of growth in Mexican per capita income and Mexican agricultural wages. If accelerated economic growth were to occur in Mexico, Mexican producers/exporters would need to increasingly focus on the domestic market. Further, U.S. producers or export operations in other regions/countries may have enhanced opportunities to penetrate U.S. winter horticultural markets if economic growth in Mexico is accelerated. Because Mexican exports of horticultural products are sensitive to accelerated rates of growth in agricultural wages, it is important for Mexican producers/exporters to be vigilant regarding wages and to

be knowledgeable of labor-saving methods. Finally, the most important factor affecting export opportunities in the long-run are yield-improving technologies. Study results suggest that Caribbean nations' increasing role in the U.S. winter melon market over the 1973/74-1993/94 period was more related to their increasing yields than the tariffs faced by the competing Mexican melons. Thus, the single most important factor affecting export opportunities in the long-run are yield-improving technologies which are under the direct control of the agribusiness firm.

In summary, the analysis shows that adoption of yield-enhancing technology is critical for developing nations who wish to compete in U.S. horticultural markets. The current trend toward freer trade will favorably influence nations export opportunities, however, the most important factor influencing long-run competitiveness appears to be technology improvements that lead to growth in crop yields.

REFERENCES

- Banco de Mexico. 1970-1994. Subdireccion de Investigacion Economica. *Indicadores Economicos*. Mexico, D.F.
- Brown, R. N. and N. R. Suarez. 1991. *U.S. Markets for Caribbean Basin Fruits and Vegetables: Selected Characteristics for 17 Fresh and Frozen Imports, 1975-87*. USDA- ERS. Statistical Bulletin Number 821. Washington D.C.
- Buckley, K. C., J. VanSickle, M. E. Bredahl, E. Belibasis, and N. Gutierrez. 1986. *Florida and Mexico Competition for the Winter Fresh Vegetable Market*. Agricultural Economic Report #556, USDA, ERS, Washington D.C.
- Buxton, B. M. 1992. "Supply Response to Price Changes for Selected Vegetables." *Vegetables and Specialties*. USDA, ERS, TVS 256, Washington, DC.
- Chambers, R. G. and R. E. Just. 1979. "A Critique of Exchange Rate Treatment in Agricultural Trade Models." *American Journal of Agricultural Economics* 61(2), 249-57.
- Cook, R. 1992. "Competition to Coordination in Vegetable Trade: The Case of Mexico and California." Pp. in R. C. Lopez and L. Polopolus, eds., *Vegetable Markets in the Western Hemisphere* (pp. 129-147). Ames, Iowa: Iowa State University Press.
- Cook, R. L., C. Benito, J. Matson, D. Runsten, K. Shwedel, and T. Taylor. 1991. Implications of the North American Free Trade Agreement (NAFTA) for the U.S. Horticultural Sector. *NAFTA, Effects on Agriculture Vol. IV, Fruit and Vegetable Issues*. USDA, Washington, DC.
- Espinoza, J. J. 1998. *Mexico-U.S. Melon Trade: An Analysis of Economic Forces and Government Policy*. Unpublished Ph.D. dissertation, Texas A&M University.
- Food and Agricultural Policy Research Institute (FAPRI). 1995. *FAPRI Preliminary Baseline*. Iowa State University and University of Missouri-Columbia.
- Food and Agriculture Organization of the United Nations, (FAO). 1970-1994. *Production Yearbook*. Rome: FAO.
- Fuller, S., O. Capps, H. Bello, and C. Shafer. 1991. "Structure of Fresh Onion Market in the Spring Season: A Focus on Texas and its Competition." *Western Journal of Agricultural Economics*, 16(2), 404-416.
- Fuller, S. and C. Hall. 1991. *The U.S.- Mexico Free Trade Agreement: Issues and Implications for the U.S. and Texas Fresh Vegetable/Melon Industry*. Texas Agricultural Market Research Center, Texas A&M University. Research Report No. IM-2-91, College Station, Texas.

- Hammig, S. R. And R. C. Mittelhammer. 1982. "An Evaluation of Import Tariff in the Canada-US Fresh Tomato Market." *Canadian Journal of Agricultural Economics* 30(2), 133-152.
- International Labor Office. 1994. *Yearbook of Labor Statistics*, Geneva, Switzerland.
- International Monetary Fund, IMF. 1996. *International Financial Statistics, Yearbook 1996*. Washington, D.C.
- Pindyck, R. S. and D. L. Rubinfeld. 1991. *Econometric Models and Economic Forecast*. New York: McGraw Hill Inc.
- Schulthies, B. K. and G. W. Williams. 1992. *U.S.-Mexico Agricultural Trade & Mexican Agriculture: Linkages and Prospects under a FTA*. Texas Agricultural Market Research Center, Texas A&M University, Research Report No. IM 6-92, College Station, Texas.
- Schuh, G. 1987. "Monetary Disturbances in a Changed International Economy: The Case of Mexico's Agriculture and Mexican-U.S. Trade. Pp. 107-122 in B. Johnston, C. Luiselli, C. Contreras, and R. Norton, eds., *Agriculture and Rural Development*. Stanford, California: Stanford University Press.
- Seale, J. 1992. "Vegetables Trade in the Caribbean Basin Initiative. Pp. 202-206 in R. Lopez and L. Polopolus, eds., *Vegetables Markets in the Western Hemisphere*. Ames, Iowa: Iowa State University Press.
- Secretaría de Agricultura y Recursos Hidraulicos (SARH). 1970-1994. Subsecretaría de Planeación. *Anuarios Estadísticos de la Producción Agrícola de Los Estados Unidos Mexicanos*. México, D.F.
- Secretaria de Agricultura y Recursos Hidraulicos (SARH). 1995. Subsecretaria de Planeacion. *Boletin Mensual de Informacion Basica del Agropecuaria y Forestal*. Mexico, D.F.
- Simmons, R. L. and C. Pomareda. 1975. "Equilibrium Quantity and Timing of Mexican Vegetable Exports." *American Journal of Agricultural Economics*, 57(3), 472-479.
- Suits, D. 1955. "An Econometric Model of the Watermelon Market." *Journal of Farm Economics*, 37(2), 237-251.
- Taylor, T. and G. Wilkowske. 1994. "Productivity Growth in the Florida Fresh Winter Vegetable Industry. *Southern Journal of Agricultural Economics*, 16(2), 55-61.
- United States Department of Agriculture. 1970-1994a. *Fresh Fruit and Vegetables Prices, Wholesale Chicago and New York Prices*. Agriculture Marketing Service: Washington, D.C.
- United States Department of Agriculture. 1970-1994b. Agriculture Marketing Service. *Fresh Fruit and Vegetables Shipments by Commodities, States, and Months*. Agriculture Marketing Service: Washington, D.C.
- United States Department of Agriculture. 1989c. *Marketing Mexico Fruit and Vegetables 1988-1989*. Agriculture Marketing Service: Washington, D.C.
- United States Department of Agriculture. 1993d. *Marketing Mexico Fruit and Vegetables 1992-1993*. Agriculture Marketing Service: Washington, D.C.
- United States Department of Agriculture. 1997e. *Vegetables and Specialties, Situation and Outlook Report #VGS-271*. Economic Research Service, Washington, D.C.
- United States Department of Agriculture. 1970-1994f. *Agricultural Statistics*. National Agricultural Statistics Service: Washington, D.C.
- United States Department of Commerce. 1970-1994. *U.S. Trade Data*. Bureau of the Census: Washington, D.C.
- United States Government. 1995. *Economic Report of the President*. Office of the President, Washington, D.C.
- Zabin, C. 1997. U.S.-Mexico Economic integration: Labor relations and the organization of work in California and Baja California agriculture. *Economic Geography*, 73(3), 337-354.