Profitability of Geographic Diversification Strategy

Angela Krueger, Victoria Salin, Gary Williams, Lorraine Eden, and Alan Gray

Historically, agricultural producers have been constrained by the seasonal nature of their goods. The geographic diversification strategy offers alternative production plans to the firm by allowing it to shift production capabilities across complementary geographic climates. We examine international geographic diversification strategy, in combination with free-trade policy, as it applies to the California-Chile table grape market. Profit potential is a function of how distinct the markets are. Tests for market integration are applied to primary U.S. ports of entry for Chilean grapes. The probability that the California-Chile (Los Angeles, California) and California-Chile (Philadelphia, Pennsylvania) markets are integrated is 9 percent and 19 percent, respectively, during the month of December, when there is overlapping supply. A strategy of diversifying into the Southern Hemisphere may work against the firm if market supply levels increase enough to lower prices. Partial equilibrium analysis suggests that free trade will increase world trade levels, Chilean domestic prices, and U.S. demand for table grapes but reduce U.S. domestic prices. Under conditions of incomplete market integration, price effects are less pronounced. For a hypothetical U.S. producer, simulation modeling reveals that the geographic diversification strategy could be a profitable alternative to producing solely in the United States.

Introduction

Agribusinesses face a unique opportunity in geographic diversification strategy because of the inherent seasonality of agricultural commodities. The issue of geographic diversification examines the economic feasibility of expanding production across several regions in pursuit of increased profits. Firms that follow this strategy would shift production across locations throughout the year. As a result, agribusinesses stand to supply markets year-round if production facilities span complementary geographic climates. Firm-level implications from increased production capabilities are two-fold: Geographic diversification could potentially increase supply levels such that prices fall, or increased market sales could translate to greater total revenue. The net effect on profit would depend on the sensitivity of market price to supplies from other areas, measured by the level of market integration, and the extent of the overlapping of the production seasons in the geographic areas.

U.S. agribusinesses' opportunity to extend the North American growing and shipping season through international geographic diversification is examined in this paper. Analysis is applied to the California-Chile table grape industry. Geographic diversification looks at the viability of U.S. producers extending their growing and shipping seasons by shifting production capabilities to Chile. Assuming that all other market conditions remain constant, an individual firm could potentially capture market premiums across global markets.

The California table grape industry is profiled in the first section of this paper. The table grape trade between the United States and Chile is characterized in the second section. In this analysis, trade is assumed to be one-sided since Chilean markets have not historically been open to U.S. producers. Degrees of market integration, as a factor for consideration in geographic diversification strategy, are examined in the third section. Market integration test results, applied separately to the California-Chile (Los Angeles, California) and California-Chile (Philadelphia, Pennsylvania) table grape markets, are revealed in the fourth section. The effect of the implementation of a free trade agreement in the Western Hemisphere on a firm's decision to geographically diversify in South America is evaluated in the fifth section. Finally, firm profitability is simulated for a hypothetical U.S. producer diversifying in Chile.

Within the United States, geographic diversification strategy is already being implemented in the produce industry (Wilson, Thompson, and Cook, 1997). Geographic diversification is leading to longer growing seasons for grower-shippers of fresh tomatoes in Florida, Northwest Mexico,

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and California. The desirability of geographic diversification is reflected in the number of firms adopting the strategy. The question remains whether expansion of production facilities to the Southern Hemisphere will be profitable for producers of perishable agricultural commodities. One result is an increase in competition for expected higher, early season prices. Formerly, market premiums went to the southernmost producers whose growing season preempted that of producers farther north. The higher price, however, is contingent upon all other market factors being held constant.

Objectives

(1) Evaluate market integration as a factor influencing a firm's decision to geographically diversify.

(2) Examine how implementation of a free trade area influences a firm's decision to geographically diversify.

(3) Quantify potential total annual revenue effects to a hypothetical U.S. producer implementing a geographic diversification strategy.

California Industry Profile[1]

California table grape production emanates from three distinct subregions: Coachella Valley, Imperial Valley, and San Joaquin Valley. The relative diversity of geographic production areas allows for prolonged (sequenced) growing seasons and market access, both domestically and internationally. Primary months of production in California are May through February, depending on variety and weather conditions. More than 744,000 acres in California are dedicated to grape (raisin, wine, and table) production. Table grapes account for 15 percent, or 111,600 acres, of said total.

The California Table Grape Commission releases annual situation analyses regarding seasonal flow patterns, crop values, box prices, demand trends, consumption patterns, and import/export shipments. The Commission's 1997 analysis notes unprecedented high harvest levels, recent openings of Chilean and Chinese markets to U.S. producers, and an increase in the overall crop value of 82 percent ($937 million) from the 1984 values ($515 million).

Crop estimates for 1997 peaked at 72 million 21-pound boxes, surpassing both 1996 and 1995 yields (63.9 million and 74.2 million, respectively). Recent demand trends have, on average, increased faster than production volumes. Years 1990, 1993, and 1995 are examples of increased volume (over preceding years) accompanied by increased prices. In 1997, increases in volume supplied were accompanied by an increase in quantity demanded and lower free-on-board (FOB) prices.

The 1997 box price averaged $12.33 per 21-pound box (FOB). In comparison to the 1996 record high average of $14.13 per box, the 1997 per-box average was down 12.5 percent with respect to 1995 ($11.93 per box); the 1997 average price increased by almost 4 percent. Monthly prices for the Thompson seedless variety are presented in Figure 1, using data provided by the U.S. Department of Agriculture (USDA).

U.S. consumption of table grapes totaled 899,476 metric tons for 1997. Supplies originated from California (61.2 percent), Chile (29.6 percent), Mexico (8.2 percent), and Arizona (1.0 percent), based on 1996 statistics (Figure 2). At almost 900,000 metric tons, domestic demand surpassed a former record high of 858,000 metric tons in 1995, wherein California alone supplied 514,800 metric tons. Per capita consumption reached 4.5 pounds in 1997. This increase over 1996 levels, of 3.8 pounds, can be attributed to an increase in both domestic harvests and import volumes.

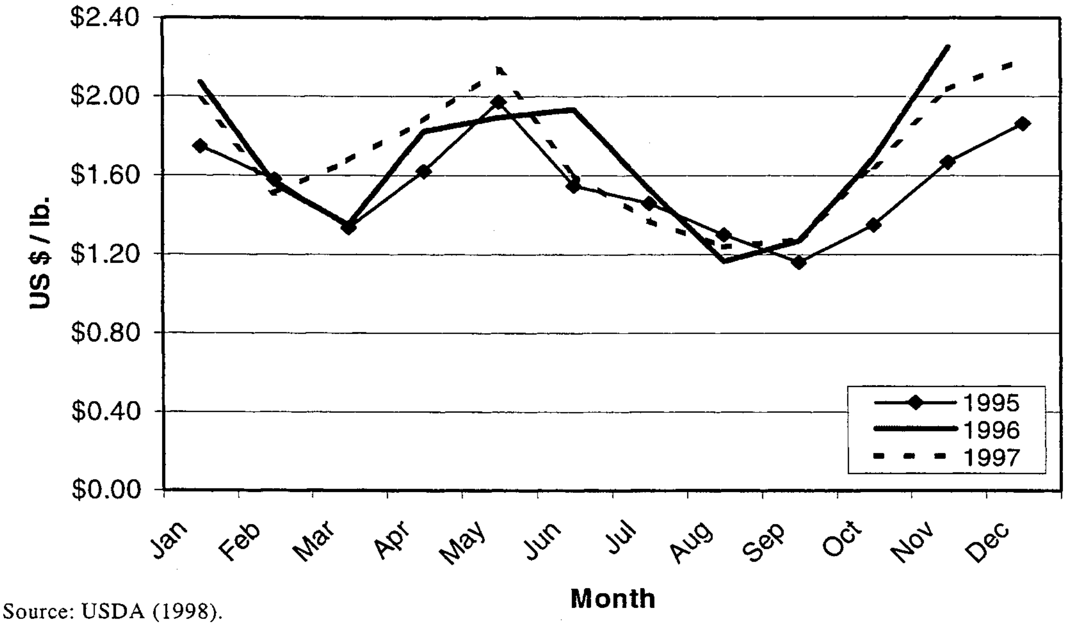
Trade in Table Grapes

International suppliers to the U.S. table grape market include Chile and Mexico. While Chilean volume supplied to U.S. markets far exceeds that of Mexico, both countries have strong positions in the U.S. market at specific times throughout the year. Imports from Mexico tend to be isolated in May whereas imports from Chile span several months during North America's off-season.

At first glance U.S. and Chilean grape-growing seasons look to be perfect complements. California's season extends from May to November while Chilean production runs from November until May. On the whole, Californian and Chilean table grape seasons are characterized as

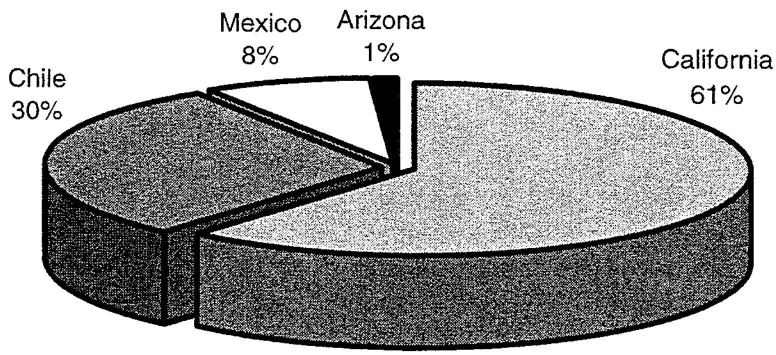
[1]Information for this section was provided by the California Table Grape Commission.

Figure 1. Thompson Seedless, Monthly Prices, 1997.



Source: USDA (1998).

Figure 2. Supply Sources, U.S. Table Grape Market, 1997.



Source: California Table Grape Commission (1997).

complementary, grounded in reverse hemispheric climatic conditions. The degree to which firms producing in the Northern and Southern Hemispheres compete is a function of the amount of overlap at the start and close of harvest seasons. Chilean imports compete for U.S. market share at the open and close of each U.S. harvest season.

During the respective growing seasons of each country, the competitor produces little, if at all. Months of overlapping supply, namely May and December, raise a question as to whether prices are influenced by competition. We expect prices to converge where supply overlaps.

In periods of short supply, opportunities for premiums exist. Specifically, these premiums could come at the start or close of the U.S. harvest season. Seasonal market premiums reflect consumers' willingness to pay higher prices in the pre-harvest weeks. Increased market power allows producers who can supply the market at this time to ask, and receive, higher prices.

During May, there are very few shipments from Chile to the United States. Competition for U.S. markets shifts from Chile to Mexico. In part, this can be expected, given the geographic proximity and closely aligned growing seasons. Mexico's ability to supply U.S. markets slightly ahead of Californian producers may be attributed to a more southerly geographic locale. To the extent that physical proximity to U.S. markets is a factor of market integration, there is some expectation that the U.S.-Mexican market will be integrated.

Price differences between domestic and Mexican supplies are small (Table 1), and on six of the 86 observations, the calculated difference is 0. This tendency toward very small price differences suggests that price convergence is a result of market integration. Californian and Mexican terminal wholesale prices in May 1997 are shown in Figure 3.

Table 1. Price Statistics for California-Mexico Market, May 1993–97.

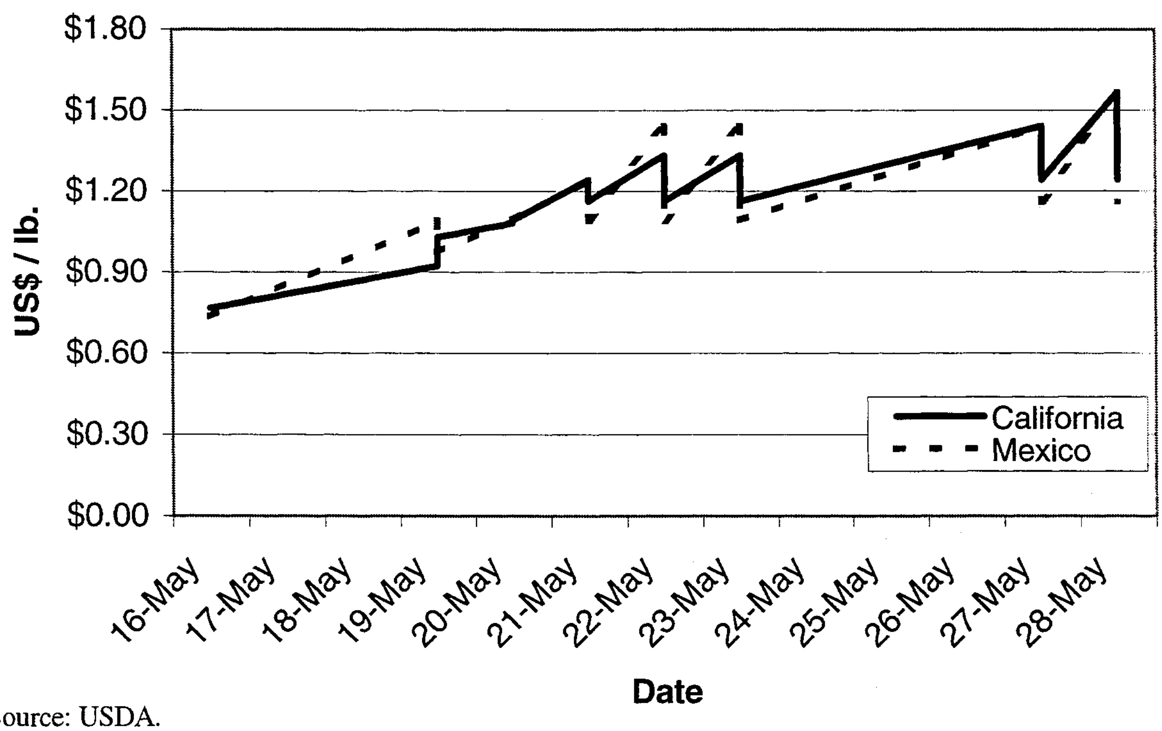
	Mean	Std. Dev.	Minimum	Maximum
	-US$/lb.-		-US$/lb.-	-US$/lb.-
California	1.29472	0.32249	0.76596	2.20000
Mexico	1.27654	0.37646	0.73469	2.63473
Price Difference	0.14010	0.13478	0.01318	0.60392

Mexico and Chile both compete for U.S. market share. Two factors that suggest that the U.S.-Mexican market will be integrated are Mexico's membership in the North American Free Trade Agreement and Mexico's geographic proximity to U.S. markets. We do not have clear evidence of market integration between the United States and Chile and, therefore, need to test the data with a more rigorous application.

Geographic Diversification

Geographic diversification strategy presents the firm with an alternative profit strategy and corresponding risk. The primary benefit of geographical diversification would be increased sales volumes through year-round production capabilities. The corresponding risk is that a large number of California firms diversify and oversupply the early season market such that the market price is bid down.

Figure 3. California-Mexico Table Grapes, May 1997.



Source: USDA.

Producers' objective to increase sales volume is couched in the expectation of increased profit, holding all other factors constant. Target markets for U.S. producers of grapes in Chile include off-season U.S. markets and all international markets now served by producers in the Southern Hemisphere. Historically, Chile's primary markets have been the United States and Europe and, to a lesser extent, Japan. Geographic diversification offers year-round access to global markets with allowances for both Northern and Southern Hemispheric production capabilities.

Benefits from geographic diversification may come from being the first to implement diversification strategy. First-mover advantages often create strengthened long-run market positions by firms. For example, Dole Food Company, Inc., is seeking to capture such benefits by immersing itself in production, marketing, and transportation operations of fresh Chilean fruits. Among the advantages of early market entry are claims on premier factor inputs, namely managerial talent, laborers, and land. An important note is that first-mover advantages are presumably temporary. Market power achieved from first-mover gains is likely to erode once other firms follow the lead.

The combination of lower production costs and improved economies of scale are attractive arguments for geographic diversification as well. Naturally favorable geographic conditions in Chile favor geographic diversification for agribusiness. Natural barriers (Pacific Ocean, Andes Mountains, Atacama Desert) contribute to produce production typically free of pests and disease (California Table Grape Commission, 1998). Subsequently, costs for chemical treatments to deter infectious diseases and pests are significantly reduced.

In response, increased sales volume, resulting from extended growing seasons, could also imply heightened market competition for price premiums at the start and close of harvest seasons. Consumer approval from longer supply periods may come at the expense of tougher competition for producers.

Arguments against geographic diversification also include the increased complexity in international financing efforts (Thompson and Wilson, 1997). Firms that are unfamiliar with foreign institutional constraints typically face increased "organizational requirements." Such requirements may include costs associated with compliance with foreign administrative and legal regulations.

Within the United States, industry-wide geographic diversification has already occurred in the fresh tomato industry. Thompson and Wilson (1997) examine firm-level organizational strategies used by grower-shippers trying to gain competitive advantages through diversification. Firm interest in extending traditional growing seasons requires access to production factors (that is, land, labor) located in microclimates of an agricultural region. The example of tomato producers now growing in various sites across southern California shows how geographic diversification strategy is manifesting itself within a single state. Accessibility to land alone generates new linkages within the industry as ownership, leasing, and contracting options confront the grower-shipper.

Not all firms choose to extend their season through geographic diversification. Instead, some look to differentiate their produce in the hopes of carving a niche in the industry. The objective is to cater to a specialty market where the shipper-grower receives high enough prices for their differentiated product, over an abbreviated time period, such that it offsets the seasonal constraint.

Traditionally, producers have harvested where marginal revenue equals marginal cost, meaning zero profits (Sexton, Kling, and Carman, 1991). Continuous, year-round production capabilities imply an opportunity for producers to harvest beyond negative price-cost differentials, with the intention of gaining back current losses later in the year. Geographic diversification offers new risk management options that were previously not available to the produce grower-shipper.

On the whole, geographic diversification has worked well within the United States for some firms (Thompson and Wilson, 1997). The question remains whether a firm will find it profitable to geographically diversify on a global scale. To answer this we look at the price dynamics of the California-Chile table grape market.

Market Integration

Market integration examines the degree to which market prices will equalize across locations. Market integration is significant to a firm, in part because it explores how much market power a firm could exert without having their price bid down by other suppliers. Highly integrated markets imply that the *law of one price* holds. If two markets exhibit low levels of integration, price determination in one market is not greatly affected by supplies in other markets.

Factors affecting market integration include geographic proximity of suppliers to market, transaction cost variables (that is, trade barriers), and volume supplied to the market (Spiller and Huang, 1986). Where producers are close to market and transaction costs is low; there is a higher probability that the market is integrated. If transaction costs are high, firms will not find it profitable to sell in particular markets because the costs to supply the commodity are greater than potential revenue from sales. Non-integrated markets can result from prohibitive transaction costs that exceed price.

A test for market integration is applied to the California-Chile table grape market. Results from this test will reflect the likelihood of prices equalizing during periods of overlapping supply. The likelihood of price equalization will affect a firm's geographic diversification approach. Market integration is evaluated as a probability, noting the likelihood that a supplier's price will be influenced by other sellers in the market over a given time period.

Traditionally, short-run market integration has been evaluated using the following regression:

$$(1) \qquad P_t^1 = \beta_0 + \beta_1 P_t^2 + \beta_2 T_2 + \varepsilon_t,$$

where P_t^i, i = 1, 2 is the price in region i at time t for a homogenous good; T_t is the transaction cost at time t required to ship a unit of the good between the two regions; and e_t is a random error term. The test for short-run integration is based on the following hypotheses:

$$(2) \qquad H_0 : \beta_0 = 0, \beta_1 = \beta_2 = 1.$$

The Model

A more recent approach is to consider short-run market integration in a probabilistic framework. Integration is not an "all or nothing" result, but degrees of integration can be estimated. We use a variation of the Sexton, Kling, and Carman (1991) model to investigate the degree of integration of markets for imported Chilean grapes and California-produced grapes. Sexton, Kling, and Carman tailor a switching regression model and maximum likelihood estimation procedures to fit agricultural commodities markets.[2] This approach allows for varying degrees of integration over time due to exogenous time-period, specific supply-demand terms (in each country), and changing transportation costs. The magnitude of the probability of market integration will reflect time/season, autarkic prices, and shipping costs, endogenous to this model.

Equations (3) and (4) define market prices in two locations, where π^i represents constant means and ε_t^i represents random shocks to the market.

$$(3) \qquad P_t^{1A} = \pi^1 + \varepsilon_t^1.$$

$$(4) \qquad P_t^{2A} = \pi^2 + \varepsilon_t^2.$$

Firms will find profitable trade opportunities across markets, and prices will tend to equalize where

$$(5) \qquad P_t^2 - P_t^1 = T > 0.$$

Let T=transaction cost. Transaction costs are also random.

$$(6) \qquad T_t = T + v_t, \qquad v_t \sim N(0, \sigma_v^2).$$

Prices will not equalize where

$$(7) \qquad P_t^2 - P_t^1 = T + v_t + u_t.$$

The random variable, v_t, associated with transaction cost accounts for stochastic shocks to the transaction cost component; it is assumed that v_t is normally distributed. σ_v^2 is the variance associated with the variable v_t. The variable u_t is a positive error term measuring the propensity to trade. It is assumed to be distributed one-half normal, with a variance of σ_u^2. We also assume v_t and u_t are uncorrelated. The probability at time t of no integration between the two regions is represented as

$$(8) \qquad \begin{aligned} \lambda &= prob \left\{ P_t^{2A} - P_t^{1A} < T + v_t \right\} \\ \lambda &= prob \left\{ (\pi^1 - \pi^2) + (\varepsilon_t^1 - \varepsilon_t^2) - v_t < T \right\} \end{aligned}.$$

In this analysis, λ represents the probability that the market is not integrated, implying that the market is not defined by a common geographical boundary and supplies in one market have little effect on prices in another market. It

[2] Sexton, Kling, and Carman's model adapts Spiller and Huang's (1986) model to agricultural commodities.

is the likelihood that transaction costs exceed price differences. A λ value that approaches 1 (0) denotes regions that are almost continuously (never) integrated. Conversely, $1 - \lambda$ is the probability of an integrated market. Fully integrated global markets would exhibit price equalization of imports and domestically produced grapes.

Market integration is tested using a switching regression model. Parameters are estimated using maximum likelihood methods in the Time Series Program (TSP).

We examine the degree of market integration in the California-Chile table grape market. *Fruit & Vegetable Market News* (USDA) provided daily price data for the years 1993 through 1997. All prices reflect wholesale terminal market prices.[3] We assume homogeneity of table grape varieties for empirical analysis.

Market Integration Test Results

Chilean table grapes enter the United States in greatest quantities through the ports of Philadelphia, Pennsylvania, and Los Angeles, California. Due to the geographic distance between the two ports of entry, each port is treated as a market and is tested for degree of integration with the California market. Tests for market integration were conducted for May and December because these two months are periods of overlapping supply. During December, Chile is the primary competitor of California producers in the U.S. market. During May, Mexico is the primary competitor of California producers in the U.S. market.

The California-Chile (Los Angeles) market is evaluated first. A total of 19 daily price observations were used. Descriptive statistics are shown in Table 2. Test results for the California-Chile (Los Angeles) market are shown in Table 3.

The results for the parameter λ are interpreted as a 91 percent chance that the markets are not integrated. The λ value represents the chance that Californian and Chilean prices are independent of one another in this time period. The probability that Chilean supplies affect the direction of Californian price movements in December is $1 - \lambda$, or 9 percent. For the producer, this means that geographic diversification will not completely erode domestic price.

[3] This implies that Chilean prices are transaction cost-inclusive.

A total of 41 daily price observations were used in the California-Chile (Philadelphia) market (Table 4). Test results for the California-Chile/Philadelphia table grape market in December are presented in Table 5.

In the California–Chile (Philadelphia) December market, there is an 81 percent chance that other producers' supplies do not affect U.S. market price. Conversely, there is a 19 percent probability that Chilean supplies influence U.S. prices. For the producer, this implies that, even during months of overlapping supply, geographic diversification could be undertaken without complete loss of U.S. market premiums.

International Trade Policy

International geographic diversification requires that agribusinesses confront trade-specific risk factors, such as trade policy. Trade policy affects the market's inclination toward price equalization based on buyers' and sellers' behavior alone. To this end, U.S. table grape producers reference trade policy as it influences quantities demanded and supplied.

Market fluctuations that stem from changes in trade policy signal producers to adjust production strategies. A firm's response to a potential free trade policy is a function of its ability to continually access markets and to stay competitive within the industry. The effect of changes to components of transaction costs, namely tariff rates, on a firm's ability to access a market and influence international geographic diversification strategy will be illustrated in this section. When tariff rates cause transaction costs to escalate, they effectively reduce the producer's strength in the market.

Unrestricted trade is defined as an absence of import taxes or other nontariff barriers that impede perfect competition in a market. Implementation of a zero-rate tariff would shift transaction cost emphasis to shipping and handling fees completely. If Chile and the United States enter a free trade agreement, only shipping and handling charges remain. Subsequently, market integration would be expected to be greater, and firms' profits would be influenced by the price equalization effects.

The U.S. Harmonized Tariff Schedule provides existing tariff rates for imported table grapes. Chile is recognized as a Most Favored Nation (MFN) that entitles exporters to the United

Table 2. Price Statistics for California-Chile (Los Angeles) Table Grapes, December 1993–97.

	Mean	Std. Deviation	Minimum	Maximum
	- US$/ lb. -		- US$/ lb. -	- US$/ lb. -
California	0.45998	0.07016	0.30947	0.61246
Chile (Los Angeles)	1.46170	0.25697	0.96278	2.09722
Price Difference	1.00171	0.24504	0.56303	1.56568

Table 3. Parameter Estimates for California-Chile (Los Angeles) Market, December 1993–97.[a]

Parameter	Estimate	Std. Error	T-Statistic
σ_v^2	0.046362	0.021986	2.10867
T	0.195233	0.106531	1.83263
u_t	0.118548	0.091963	1.28908
λ	0.914006	0.156050	5.85714

[a] Convergence of maximum likelihood estimates occurred after 14 iterations.

Table 4. Price Statistics for California-Chile (Philadelphia) Table Grapes, December 1993–97.

	Mean	Std. Deviation	Minimum	Maximum
	- US$/ lb. -		- US$/ lb. -	- US$/ lb. -
California	0.45998	0.07016	0.30947	0.61246
Chile (Philadelphia)	1.46170	0.25697	0.96278	2.09722
Price Difference	1.00171	0.24504	0.56303	1.56568

Table 5. Parameter Estimates for California-Chile (Philadelphia) Market, December 1993–97.[a]

Parameter	Estimate	Std. Error	T-Statistic
σ_v^2	0.045775	0.015459	2.96107
T	0.116000	0.037525	3.09132
u_t	0.042945	0.022178	1.93637
λ	0.813626	0.129685	6.27387

[a] Convergence of maximum likelihood estimates occurred after 13 iterations.

States to reduced tariff rates. The MFN tariff rate for grapes entering between 15 February and 1 March, inclusive, in any year is $1.22 per cubic meter. If table grapes enter the U.S. market between 01 April and 30 June, inclusive, in any year, they enter free of duty. Table grapes imported at any other time of the year are subject to a $1.91 per cubic meter tax. Chilean table grapes do not receive Generalized System of Preferences (GSP) status since the quantity imported exceeds the amount allotted Chile.

A partial equilibrium trade analysis provides anticipated results from implementation of a free trade regime. The analysis will indicate economy-wide benefits of tariff reduction. We assume four conditions in using a partial equilibrium model to illustrate gains from a reduction in tariff levels, as would occur if NAFTA is extended to South America. It is assumed that there is perfect factor mobility, constant costs of production, no technological change or transportation costs, and perfectly competitive markets. These assumptions are applied to analysis during the month of December, indicating the close of the U.S. production season and overlapping supply from Chile. Moreover, U.S. tariff rates are highest at this time. The United States and Chile are considered large trading countries. Other large grape-producing nations affect the United States and Chile only peripherally since trade volume is insignificant between the United States and Chile and the remaining grape-producing nations.

The levels of trade by market participants, under the current U.S. duty rate, are illustrated in Figure 4. The quantity demanded in Chile is denoted *0-A*, and the quantity supplied is denoted *0-B*. The quantity demanded in the United States is represented by *0-Z*, and the quantity supplied is represented by *0-W*. With the existing tariff rate, the distance 0-Qw represents world trade. The amount of the tariff revenue is represented by the rectangle *mnpq*. Revenues generated from tariff collection accrue to the U.S. government.

In a free trade environment, quantity demanded by Chile equals *0-C*, and quantity supplied equals *0-D*. The U.S. market shows domestic quantity demanded represented by *0-X* and quantity supplied represented by *0-Y*. World trade volume is $0\text{-}Q_w'$.

Changes about quantities demanded and supplied and about price levels in each of the three markets are revealed in the model. In the Chilean market, quantity demanded decreases under free trade as a result of a price increase, and quantity supplied increases due to producers' interest in selling greater amounts at the higher price. In the United States, the market price falls under free trade, leading to an increase in quantity demanded by consumers and a reduction in quantity supplied by producers. In the international market, world trade volume increases from $0\text{-}Q_w$ to $0\text{-}Q_w'$.

Partial equilibrium analysis indicates that moving from a specific tax to free trade will lead to an increase in three areas: world trade volume, U.S. imports, and Chilean exports. Quantitatively, the magnitude of the effects of a free trade agreement will depend on the elasticities of the supply and demand curves of markets.

Profitability of International Geographic Diversification

The final phase of this study examines the effects of geographic diversification on a producer's profit margin. Alternative production scenarios confronting a hypothetical U.S. producer are simulated from stochastic price and quantity distributions.

The Model

The proposed model is a firm-level, one year-ahead forecast of potential annual revenue for a hypothetical firm assumed to supply a given percent of the market. Forecasts will take trend and seasonality characteristics into account.

The model uses monthly price and quantity data for Chilean and Californian producers. Monthly analysis is preferred given the highly seasonal nature of the commodity. A total of 156 price and quantity observations are evaluated from 1985–1997 U.S. Department of Agriculture and California Table Grape Commission data.

To estimate 1998 price distribution, Californian and Chilean quantity supplied forecasts are necessary. They are evaluated as a function of year and month variables to capture trend and seasonality components. Californian and Chilean quantity supplied distributions are estimated on a monthly basis. We identify price volatility as a function of stochastic monthly supply volumes and a random error component, assumed to be distributed $N(0,\sigma^2)$.

To capture the variability in monthly prices associated with variability in production in each country, residuals from the quantity equations are grouped by month across the 13-year period. The mean and standard deviation for the appropriate months' residuals are used to simulate the variability in production of grapes in each country in each month. These stochastic values are used, along with a random error term, to estimate the price distribution for grapes in the United States.

Finally, three diversification scenarios are simulated from the above cross-sectional time-series analysis. Scenarios 1 and 3 calculate total revenue, assuming a U.S. producer produces their total annual volume supplied to market in either California or Chile solely. Scenario 2 allows for diversification and calculates total revenue if the firm's volume is halved and produced in both countries.

Using Monte Carlo simulation techniques, three alternative diversification plans are run with 500 iterations each. Summary statistics for each plan are provided in
Table 6.

Figure 5 graphically illustrates the three cumulative distribution functions associated with each production plan. Stochastic dominance theory would suggest that the geographic diversification strategy dominates the single location strategies despite having a slightly higher variance than producing only in the United States.

Figure 4. Partial Equilibrium Analysis of California – Chile Table Grape Trade.

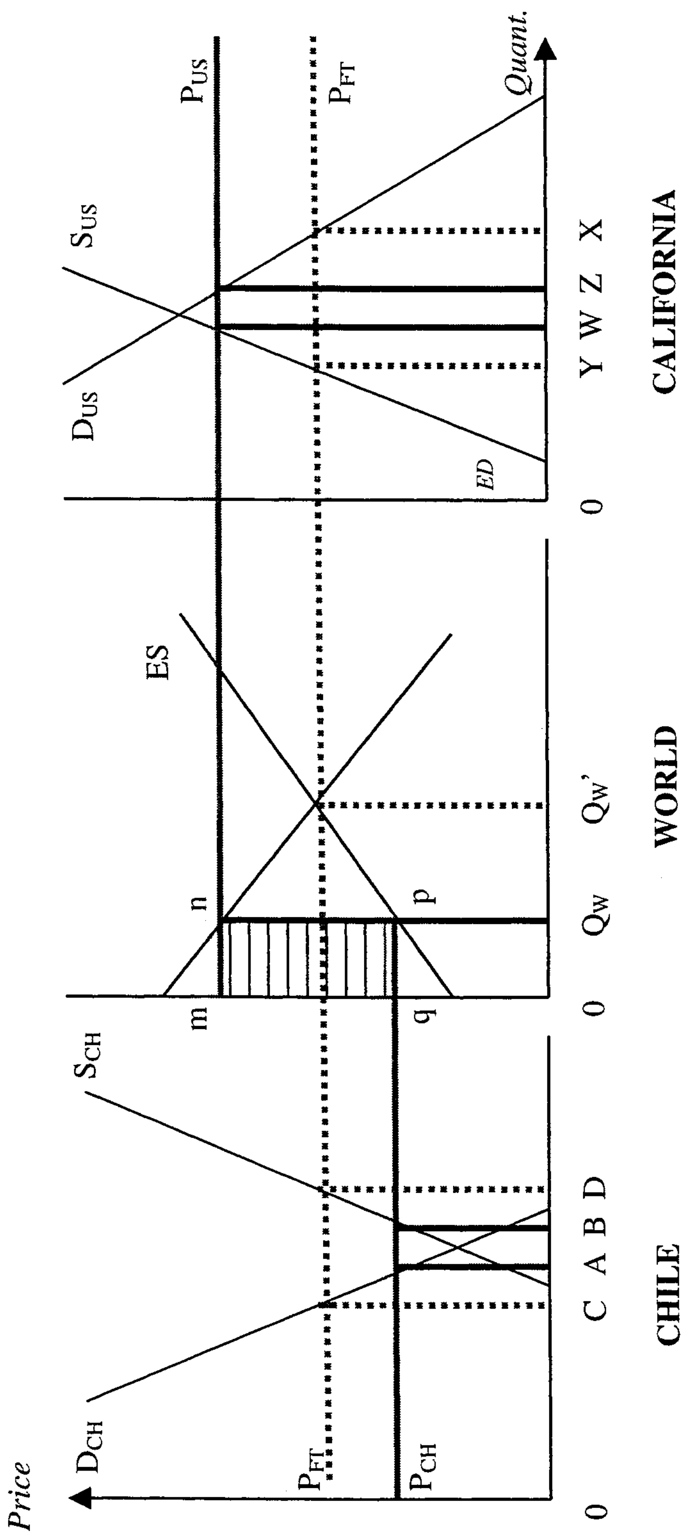
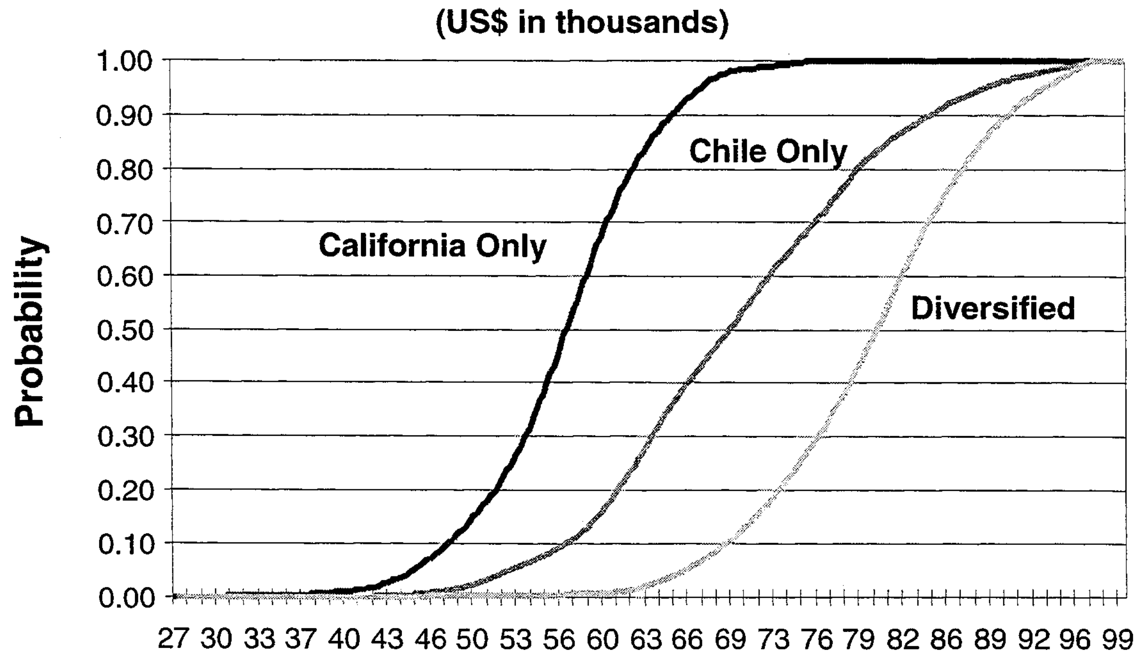


Table 6. Projected 1998 Revenue from Diversification Plans.

Scenario	Mean	Std. Deviation	Minimum	Maximum
	- US$ -		- US$ -	- US$ -
California Only	52844.91	6628.305	26767.49	72061.26
California & Chile	76312.48	8410.033	42196.39	99530.63
Chile Only	66147.28	10838.39	37536.62	98656.95

Figure 5. Revenue Distributions for Production Plans.



Preliminary results suggest that U.S. producers could profit from implementing a diversification strategy. It should be noted, however, that cost-related measures have not been accounted for; once they are, results may change. In addition, the reported results are from initial simulation trials that assume zero-rate tariffs and perfectly integrated markets, or complete price convergence. The next step will incorporate tariff rates and market integration into the model to more closely resemble real time conditions in the event that the North American Free Trade Agreement is extended to the Southern Hemisphere.

Conclusions

This paper evaluated relevant factors facing a U.S. table grape producer considering geographical diversification in the Southern Hemisphere. Market integration and free trade policy are examined in terms of their likely effect on domestic prices received by U.S. table grape producers during periods of overlapping supply.

The leading benefit to firms that geographically diversify is the potential for year-round production. The tradeoff is that early-season and late-season domestic price premiums might be eroded if markets are integrated. If many firms geographically diversify, an increase in market supply levels could generate lower prices.

Tests for market integration in the California-Chile (Los Angeles) market indicate that U.S. table grape producers face a 9 percent probability that their price will be bid down by low-cost Chilean imports. With respect to the California-Chile (Philadelphia) market, there is a 19 percent chance that U.S. producers' prices will be affected by Chilean imports. These results indicate that, while U.S. prices are likely to be influenced by competitors in the market, seasonal premiums should not be significantly eroded.

Implementing free trade will reduce transaction costs to shipping and handling fees. Without U.S. import taxes, producers in Chile should find it less expensive to access U.S. markets. Ease of accessibility to U.S. markets could lead to increased degrees of market integration. A partial equilibrium model suggests that free trade will lead to higher Chilean prices but is countered by an increase in quantity demanded in the U.S. market. The shift to free trade transfers price gains from the U.S. government to Chilean producers. U.S. producers interested in geographical diversification seek to capture a portion of these increased revenues.

International geographic diversification strategy applied to perishable agricultural commodities could lead to a continuously integrated market where producers are rarely able to capture any off-season price premiums. The opportunity for increased market sales could lead to increased revenue despite a "lower" market price.

A firm-level simulation model reveals that geographic diversification is profitable from a total annual revenue perspective. Producers who split production between the two countries could possibly achieve greater total annual revenue against those firms producing solely in one country. It appears that geographic diversification could be profitable although further research should be undertaken to account for cost-related factors in diversification modeling as they influence firm revenue.

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