

The 2007 Freeze: Tallying the Toll Two Months Later

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This paper assesses the production losses and the resulting price impacts from the severe January freeze in California. Predictions made at the time of the freeze concerning product shortages were largely incorrect due to market adjustments in the form of revised trade flows and higher prices. Indeed, positive price effects offset much of the aggregate revenue loss from reduced harvests.



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Photo by Julie McNamara

California crop producers endured freezing temperatures from January 11-17, 2007, which led President Bush to declare a major disaster in the state. As of March 2, the state's County Agricultural Commissioners had estimated losses from the freeze totaling \$1.38 billion, with the most extensive losses incurred in the major citrus- and vegetable-producing counties (Table 1).

The commodities hardest hit included citrus fruit, especially navel oranges and lemons, avocados, where the crop loss is estimated at 27 percent, strawberries, where most of the early coastal harvest was lost, and winter and spring vegetables. The winter vegetable loss was focused in the Imperial and Coachella Valleys, affecting crops such as head and leaf lettuce, broccoli, and celery. Elsewhere, e.g., in San Joaquin County, spring vegetables were damaged in their nascent state, and those losses are only now beginning to be noticed in the supermarkets.

This paper assesses the production losses and the resulting price impacts. Predictions made at the time of the freeze concerning product shortages were largely incorrect due to market adjustments in the form of revised trade

flows and higher prices. Indeed, positive price effects were able to offset much of the aggregate revenue loss from reduced harvest. However, the aggregate, commodity-level analysis masks considerable variation in the distributional impact of the freeze across growers and producing regions.

Production Impacts

Estimated 2006-07 production of California citrus fruits is reported in Table 2, with comparisons to the 2005-06 crop. California's total orange harvest is now estimated at 37.0 million boxes, 39 percent lower than last year's 60.5 million boxes. Although harvesting of navels was well underway prior to the freeze, the production forecast is 20 million boxes less than last year. Further, much of the crop that was harvested after the freeze is suitable only for juice. Although the Valencia harvest is yet to begin, the USDA forecast is that it will be down 25.9 percent from last year, but other forecasts are for an even higher decline, in the range of 40-60 percent. As Table 2 indicates, reductions in harvest of a comparable percentage magnitude are forecast for grapefruit, lemons, and tangerines. Losses, however, varied

Table 1. Preliminary Crop-Loss Estimates

County	Current Loss Figure (Millions \$\$)	Major Impacted Crops
Tulare	418.6	Citrus Fruit
Ventura	280.9	Nursery Stock, Avocados, Citrus Fruit
Kern	178.9	Citrus Fruit
San Diego	114.7	Avocados, Bedding Plants
Fresno	104.1	Citrus Fruit
Riverside	86.0	Table Grapes, Citrus Fruit, Avocados
Imperial	77.5	Lettuce, Sweet Corn, Potatoes

Source: California Farm Bureau Federation

Table 2. California Citrus Production: 2005-06 and Forecast 2006-07

Commodity	2005-06 Production (1,000 Boxes)	2006-07 Forecast Production (1,000 Boxes)
Navel oranges	47,000	27,000
Valencia oranges	13,500	10,000
Grapefruit	6,000	4,800
Lemons	21,000	16,500
Tangerines	3,600	2,600

widely by region and, no doubt, by grower within regions. In the Central Valley and desert regions, for example, shippers were reported to have lost 70-80 percent of on-tree lemons, whereas those losses were in the range of 20-30 percent in the Oxnard region. Similarly, some navel orange groves were reported to be unaffected by the freeze, while production from other groves was considered a total loss.

The freeze had a widely varying impact on avocado production as well, based upon estimates compiled by the California Avocado Commission (CAC). Production in Orange County and in the Ventura region is estimated to have been reduced by only five percent, whereas other areas such as Poway in San Diego County, Fillmore in

Ventura County, and San Luis Obispo County lost from 50-75 percent of their production.

Although specific crop-loss estimates for vegetables are unavailable at present, it is known that the freeze had a severe impact on desert production of broccoli, cauliflower, celery, and leaf and head lettuce crops. Portions of these crops were destroyed, as, for example, in Oxnard where shippers were forced to disc under much of their celery acreage. Furthermore, parts of the surviving crop suffered a severe degradation in quality, due to blistering, peeling, and reduced shelf life. Iceberg lettuce suffered from abnormally small and compact heads.

In contrast to the annual production cycle for citrus crops, California

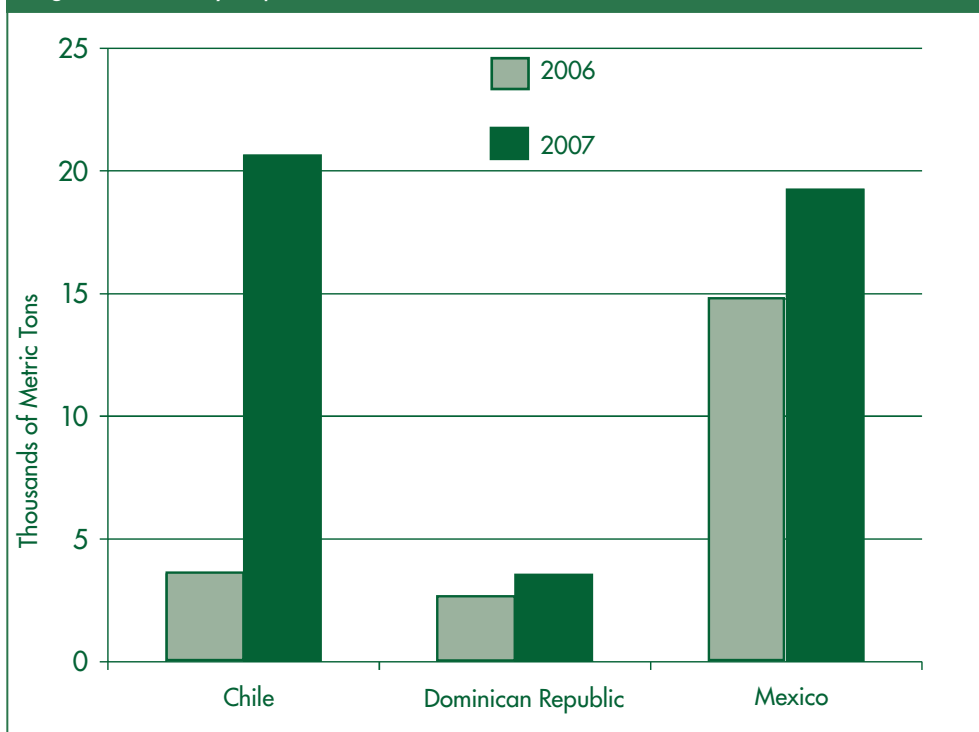
produces vegetables on a continuous year-round cycle. Thus, losses on the vegetable side were much more transitory than for citrus but still varied widely by commodity. By mid-February some shippers were reporting close to 100 percent harvest of leaf lettuce, with improving quality but still below normal levels. Iceberg lettuce and celery had returned to normal quality by early March. In fact, a market glut for broccoli was reported at the end of February caused by warm desert temperatures increasing supplies that had been stifled by the freeze. For celery, however, a return to normalcy is not expected until mid-March, and shippers were reported to be harvesting in advance of normal timing in order to capture freeze-induced price premiums. This optimism about recovery is tempered, however, by reports that some crops scheduled for spring harvest were damaged in their early production stages, so vegetable consumers may still have not felt the final price and quality impacts of the 2007 freeze.

Market Adjustments

One reason forecasted impacts from a crop disruption that are made in the immediate aftermath of the event are often erroneous is that commentators fail to consider market adjustments that will occur due to the disruption. One adjustment is prices. If prices are allowed to move freely, they will rise to clear the market at the reduced volume of sales. So shortages, if they materialize at all, will be transitory, and anyone who wants to purchase at the higher prices will be able to do so.

Another adjustment is reallocation of product flows to direct more product to regions affected by the supply disruption. The ability of trade adjustments to ameliorate the impact of the California freeze, however, varied greatly by commodity. For fresh vegetables, the Coachella and Imperial Valleys, along with regions in western

Figure 1. January Imports of Avocados: 2006 and 2007



Arizona that were also impacted by the freeze, represent nearly the entire U.S. supply during the winter season. Given that these commodities are highly perishable, imports from remote destinations are not even a consideration.

Avocados represent somewhat of the opposite extreme among the major freeze-impacted commodities. Avocados imported from Chile compete directly with California avocados, and imports from Mexico have been on the rise in recent years due to a loosening of import restrictions. By coincidence, Mexican avocados were allowed into California for the first time on February 1, 2007, just two weeks after the freeze. Before the freeze, imported avocados were expected to account for about 58.5 percent of total 2006-2007 U.S. supplies of 1.03 billion pounds. Now imports are expected to be two-thirds of total U.S. supplies of about 966 million pounds. Figure 1 compares January 2006 and January 2007 avocado imports from Chile, Dominican Republic, and Mexico. Even though the freeze occurred mid-month, we see that imports were dramatically higher in 2007 for all three countries—477 percent higher in the case of Chile. The CAC estimates that 49,256 metric tons of California avocados were lost to the freeze. However, in the month of January alone, 22,476 more metric tons were imported from Chile, Dominican Republic, and Mexico. This means that about 46 percent of the projected California decrement in production was offset by increased imports in the first month alone.

Chilean avocado imports to the United States typically end during February, resuming again in June or July. Although official import figures for February 2007 are unavailable at present, it is known that avocado imports to the United States from Chile continued throughout the month of February in 2007. In fact, it has been reported that California growers temporarily ceased

Table 3. Grower Prices for California Citrus¹

Commodity	January Price/Box		February Price/Box	
	2006	2007	2006	2007 ²
Grapefruit	13.93	15.46	13.33	15.36
Lemons	15.19	21.73	15.59	43.53
Navel Oranges	12.12	14.89	12.42	27.19
Tangerines	22.06	23.76	19.86	24.76

¹ Price reported is packinghouse door fresh price
² Preliminary figures
Source: Various issues of "Agricultural Prices," Agricultural Statistics Board, NASS, USDA

harvesting to let the Chilean fruit clear the market. The Chilean avocados, however, were of considerably lower quality than avocados from Mexico or California. Reflecting both their superior quality and the waning supplies from Chile, California Hass avocado prices have increased steadily in the past month, from \$15.67 per lug in mid-February to \$21.54 as of March 10. Due to the moderating influence of increased imports, the price impacts of the freeze for avocados are much less dramatic than witnessed for crops without a significant trade component, as the next section demonstrates.

Price Impacts

Grower-shipper prices for most freeze-impacted commodities rose dramatically in the aftermath of the frost, mitigating the revenue losses due to reduced production and, no doubt, causing windfall profits for lucky or well-prepared growers whose crops escaped largely unscathed from the freeze. Table 3 provides average grower-shipper price information for California citrus for 2006 and 2007 for January and February, while Table 4 provides similar information for California fresh vegetables.

Table 3 demonstrates that price increases for January 2007 were moderate relative to 2006. There are two reasons—first, the freeze hit the state mid-month, and, second, sales in the post-freeze period were initially from stocks that had been harvested before the freeze, meaning that the market

disruption was initially small. Much more pronounced price effects are apparent for February, based upon preliminary data. The per box price for navel oranges rose from \$14.89 in January 2007 to \$27.19 in February, an 82.6 percent increase. February 2007 navel prices were 119 percent higher than in February 2006. Lemon prices tell a similar story. Price per box doubled from January to February of this year, and February 2007 prices were 179.2 percent higher than a year ago. Notably, price effects were much more moderate for grapefruit and tangerines, quite simply because California is a relatively minor producer of both crops. The supply disruption for these products, although of a similar percentage magnitude in California to the disruption for oranges and lemons, was much smaller on a national scale. In contrast, California annually supplies between 80-90 percent of domestically grown lemons and nearly all of the navel oranges grown for fresh consumption, so in a very real sense the California supply is the U.S. supply for these products.

Consider now the contrasting story for fresh vegetables told in Table 4. Because most of the freeze-impacted vegetables are highly perishable and cannot be stored, the immediate price impact was pronounced. Prices more than doubled for broccoli, lettuce, and onions in January 2007 compared to January 2006, and the price of celery more than tripled. By February, however, supplies and prices had stabilized for broccoli, cauliflower, and lettuce,

Table 4. Grower Prices for Fresh Vegetables

Commodity	January Price/cwt.		February Price/cwt.	
	2006	2007	2006	2007
Broccoli	32.50	70.00	23.80	23.90
Cauliflower	33.10	46.20	26.40	24.40
Celery	9.64	33.90	10.80	58.70
Lettuce	10.50	21.00	12.00	16.60
Onions	11.70	26.50	8.04	25.60

Source: Various issues of "Agricultural Prices," Agricultural Statistics Board, NASS, USDA
²Preliminary figures

with 2007 prices varying little from those in 2006. Celery and onion production, however, recovered much less quickly. Celery prices increased to \$58.70/cwt. in February 2007, five times the level from the previous year, while onion prices were fourfold higher. These average prices mask considerable price heterogeneity for fresh vegetables during these months, as a consequence of the freeze and the adverse impacts it had on produce quality.

Analysts studying the impacts of the freeze on producers make a considerable error if they fail to consider the price impacts caused by reduced supplies. Economists measure the impact of supply adjustments on price in terms of the price flexibility of demand. (The price flexibility is the inverse of the better-known price elasticity of demand.) We say that price is flexible (demand is inelastic) if a given percentage supply reduction causes a larger percentage price increase. For California commodities with inelastic demands or flexible prices, this means that sales revenues actually increase as a consequence of the freeze, meaning that producers as a group benefit from the supply disruption.

The elasticity of demand facing California growers depends upon the nature of the commodity being produced, including consumer loyalty, the extent of substitutes available, and the magnitude of competing supplies from elsewhere in the United States or from

imports. Commodities that are considered essential in diets and face little competition from other goods will have inelastic demands (flexible prices). Fresh vegetables represent this situation. Most consumers consider them to be essential and, as noted, California and western Arizona face little competition during the winter from outside competitors. One recent estimate of the price flexibility of demand for iceberg lettuce is -2.3, meaning that a 10 percent supply reduction would cause a 23 percent increase in price. Although we do not know the precise reductions in supply for the freeze-impacted vegetables, we see the evidence of the high flexibility of price for these commodities in terms of the sharply higher prices summarized in Table 4. The magnitude of the price increases that resulted as markets adjusted to the supply shock suggests that the adverse impact on growers was much less than predicted initially. In fact, many growers and some industries, on average, benefited from the freeze.

One statistical estimate is that the price flexibility for fresh navel oranges is 1.27. The evidence for navel oranges and lemons in the aftermath of the freeze is consistent with inelastic demands and flexible prices. Prices increased on average over January and February at a percentage rate well in excess of the percentage decrease in production caused by the freeze. Of course, these products will continue to

be marketed through the spring, so the complete story on the price effect is not yet fully known.

A conclusion that producers for some commodities benefited on average from the freeze does not obviate the fact that many growers were harmed by the freeze or suggest that disaster relief is not justified. Indeed, an important lesson from the freeze is that the impacts in terms of crop loss vary widely across growers and regions, but the price effects are mostly uniform, except for differentials due to quality. Thus, it is easy for winners and losers to emerge from a major crop disruption. Additional losses to growers that are less easily quantified include long-term damage to trees in the case of citrus and avocados. Low quality may also have long-term repercussions for an industry if it causes consumers to lose confidence in the product and reduce demand even after quality has returned to pre-freeze levels.

A final point to note relative to the overall impact of the freeze on California agriculture is the emerging evidence that production of several commodities may actually have benefited from the freeze. They include cherries and other stone fruits, tree nuts, and pears, all of which benefit from sub-freezing temperatures during their dormant state, and strawberries, whose root systems will have been strengthened by the frost.

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