Enhancement of the citrus industry forecasting model

David Pearce
Centre for International Economics

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REPORT

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Project description: In 2002, Horticulture Australia Ltd (HAL) commissioned the Centre for International Economics (CIE) to develop an economic model of the Australian orange and mandarin industry. In early 2005 HAL requested the CIE to update the model's data set and to further extend the model to allow foreign consumers to be identified by their country of residence, allowing the exports of citrus products by country of destination to be identified. Further, the model now allows for imports into Australia of both citrus and processed product, with the price of both foreign and domestic prices affecting the level of domestic consumption of both fresh fruit and processed product.

(6 September 2006)

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Contents

Boxes, charts and tables

Media summary

In 2002, HAL commissioned the Centre for International Economics (CIE) to develop an economic model of the Australian orange and mandarin industry. In early 2005 HAL requested the CIE to update the model's data set and to further extend the model.

Why a model?

Changes in world markets, new trade agreements, the introduction of new techniques and many other developments can have complex and significant effects on citrus growers. An economic model provides and consistent and rigorous framework to analyse these and other developments. By taking available data and combing it with economic theory and the collected wisdom of growers, the model provides a valuable tool for strategic analysis and for evaluating the impact of different research outcomes on the industry.

The enhancements for this project

The original model has been expanded to allow foreign consumers to be identified by their country of residence, allowing the exports of citrus products by country of destination to be identified. Further, the model now allows for imports into Australia of both citrus and processed product, with the price of both foreign and domestic prices affecting the level of domestic consumption of both fresh fruit and processed product.

Outcomes for the industry

The project has resulted in enhanced economic modelling capability for the industry and provides an excellent strategic planning tool for the industry, and a way of analysing the various trade-offs and challenges it will face in the future.

Technical summary

The citrus model further developed in this report is a partial equilibrium simulation model of core elements of the citrus value chain.

The model is implemented using GEMPACK simulation software. Using facilities within GEMPACK, the equations of the model are written in mixed levels and percentage change form.

Data for the model is taken from a mix of industry and published sources and core model parameters are derived through industry discussions. These parameters are generally not econometrically estimated, although published estimates where available are taken into account. Systematic sensitivity analysis (using techniques including Monte Carlo simulation and Gaussian Quadrature) is the main mechanism through which importance of various parameters are assessed.

1 Introduction

In 2002, Horticulture Australia Ltd (HAL) commissioned the Centre for International Economic (CIE) to develop an economic model of the Australian orange and mandarin industry, the Citrus model. In June 2005 HAL requested the CIE to update the models data set and extend the model to incorporate Australia's major citrus export destinations.

The Citrus model, like other economic models, describes the market interactions between the supply of citrus products and the demand for these products at all levels of the supply chain. The computerised models are used to calculate the impact upon product prices and quantities supplied and consumed. Consequentially, these models are a useful tool that can be used to analyse the impact of developments within the domestic and/or international markets or the industry.

This report summarises the key features and structure of the original Citrus model, and details the extensions and changes most recently made to it. Following on from this, some key simulation results are reported and explained which illustrate possible ways in which the model can be used for industry planning activities and responding to market situations.

2 *Model specification*

This section describes the theoretical structure of the model and the nature of relationships between the model variables and coefficients. The enhancements made to the model as part of this product are also specified.

Model enhancements

The original citrus model was built around a typical value chain economic model, which traces the production from the farm through to the final consumer (either a domestic or foreign consumer), with margins added through the way.

The enhancements to the citrus model do not change the underlying structure of the model; that is the model is still a value chain model. Rather, the model has been expanded to allow foreign consumers to be identified by their country of residence; in effect allowing the exports of citrus products by country of destination to be observed. Furthermore, the model now also allows for imports into Australia of both citrus and processed product, with the price of both foreign and domestic prices affecting the level of domestic consumption of both fresh fruit and processed product. Previously, only fresh citrus products could be imported into Australia.

In addition to the above changes, the model now models the domestic and foreign demand and domestic and foreign supply for navels, valencias, mandarins and processed product, with both navels and valencias having a high and low quality product to better reflect market realities. The original model only had eating oranges, oranges for the processing sector mandarins, and a processed product market.

The key steps in extending the existing citrus model were:

- analysing the existing model to determine which theoretical structures needed to be changed and/or extended;
- constructing a database based on the requirements from step 1;
- building the model around the structure and data;
- model checking and testing; and
- undertaking simulations of interest to the citrus industry to demonstrate the capability of the model.

The above five steps have been completed, with the structure of the model detailed below.

Model structure

The following discussion outlines the components that go into marking the citrus value chain model, and the relationships between domestic and foreign supply and demand for fresh and processed products.

Farm sector

At the farm level, the model distinguishes five citrus commodities:

- navel oranges – high quality;
- navel oranges – low quality;
- valencia oranges – high quality;
- valencia oranges – low quality; and
- mandarins.

The main reason for splitting oranges into high and low quality is to track and appropriately record the value of oranges that are sent for export by country as opposed to those that are sent to the processing industry. Mandarins were not split into high and low quality, as no mandarins are sent for processing.

Given that the majority of mandarin production occurs in Queensland while the majority of orange production occurs in the southern states, the model differentiates between farm production in Queensland and the Southern States. Thus, there are two representative 'farms' in the model, *Qld* and *Sth*. Production on both of these 'farms' is responsive to changes in the prices received by farmers for their product.

Foreign consumers of fresh product are specified by country of destination.

Processing sector

Once fresh produce has been sold to the processing industry, a number of inputs and factors of production (labour and capital) are combined to produce orange juice, which is sold to both domestic and foreign consumers.

Foreign consumers of processed product are specified by country of destination.

Foreign supply sector (imports)

Imports of fresh and processed product are not specified by country of origin. Rather, all imports are considered as coming from one external supplier, with Australia facing one uniform import price.

Both fresh and processed imported products compete against domestic fresh and processed products for domestic consumption by consumers or as use as an input into the processing sector.

Farm, retailing and processing and other margins

A number of margins are imposed on each commodity as they go through the value chain in the model, from the farm to the consumer.

For domestic consumption, after produce leaves the farm, there is the addition of a transportation margin, a packing margin, and a retail margin for domestic sales. Thirty per cent of fresh navel and mandarin produce destined for domestic consumption is assumed to be packed in 3kg bags with the remaining 70 per cent packed in cartons. One hundred per cent of fresh valencia production is assumed to be packed into cartons. For produce destined for external markets, all is assumed to be packed into cartons prior to shipping.

The transport and handling, and packing margins are commodity specific.

Domestic consumption

On the domestic market, consumer demand for farm product depends on income levels, the price of domestic and foreign product, as well as the price of any substitutes.

At the retail level, it is assumed that citrus fruit compete for the consumer dollar with other fruits. The degree of substitution depends on the fruit in question and consumer preferences. For ease of modelling, we have included a general price of *other fruit*, which can be easily changed to investigate the potential impact movements in the price of other fruits may have on the industry.

Demand for orange juice in the model is treated as a composite of demand for domestically produced orange juice and imported juice, which is generally imported in the form of frozen concentrate orange juice (FCOJ). Here, the demand for orange juice depends upon consumer income, the price of orange juice, which is a function of the domestic and foreign price, and the price of orange juice substitutes. Substitutes in this case are other fruit juices, carbonated drinks and flavoured milk that compete with orange juice at the retail level.

Foreign consumption (exports)

Australia's largest citrus export markets by value are individually identified within the model, which allows for a significantly broader range of market shocks to be simulated by the model. The specific markets are:

- New Zealand;
- Malaysia;
- Japan;
- Singapore;
- Hong Kong;
- Indonesia;
- Sri Lanka;

- United States of America;
- Canada;
- Taiwan; and
- European Union.

For exports, after produce leaves the farm, there is a domestic transport margin and packing for export margin bringing each commodity up to the 'free on dock' (FOB) point in Australia. After the FOB point, country and commodity specific shipping and tariff costs are added, brining the price up to the 'cost, insurance and freight' (CIF) point in the destination country.

Foreign demand for Australian citrus products is a function of the price and foreign, country specific incomes.

3 *Model database*

There are two broad steps in developing the database for the model:

- development of the input – output database (the data); and
- determining values for key elasticities (the parameters).

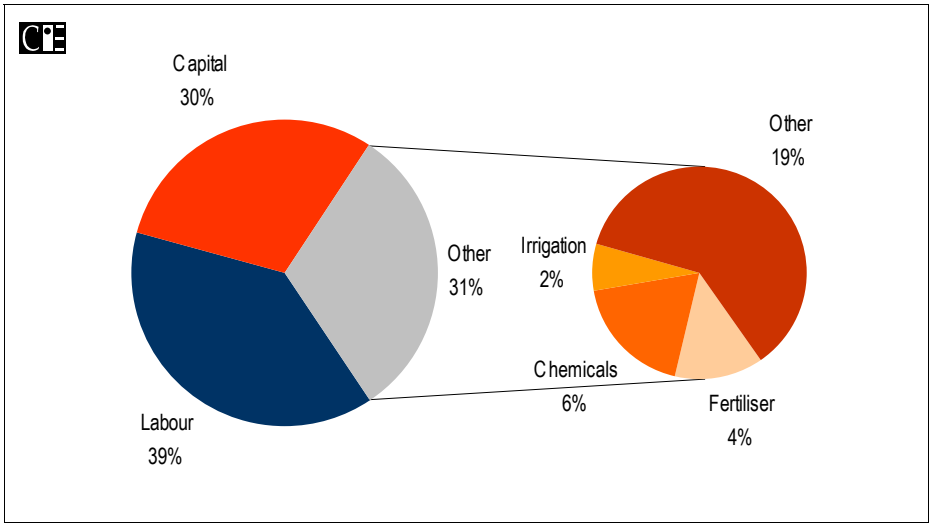
The input-output database

The input – output database describes all the key model flows, including:

- the use of inputs, including labour and capital on the farm and within the processing sector;
- flows of farm product to the domestic market, export markets and processing industry;
- the cost structure and margins of domestic and foreign transportation, retailing and packing; and
- any foreign economy import tariffs.

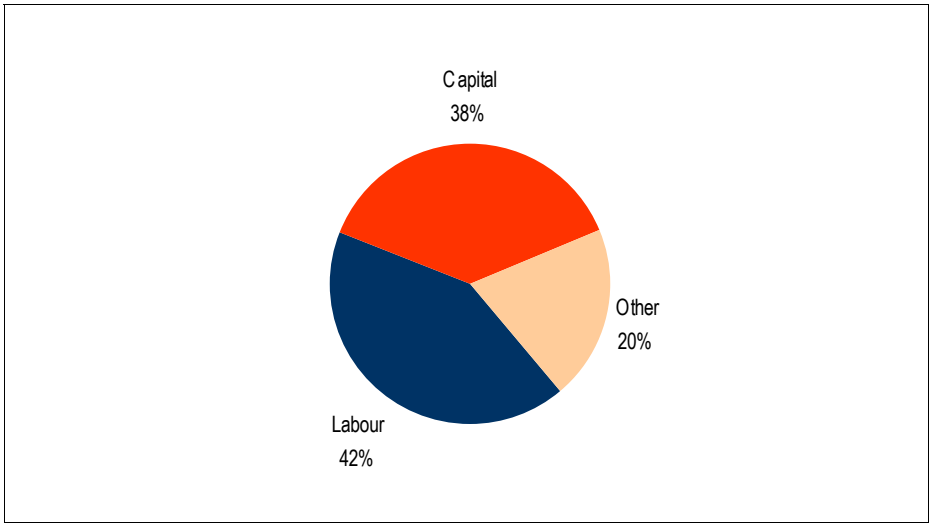
A first step in developing an input – output database is to determine the cost structures involved in producing the tradeable good. Charts 3.1 and 3.2 show the breakdown of farm and processing cost structures. Interestingly, almost 70 per cent of the farm cost structure and 80 per cent of the processing sectors cost structure is attributable to labour and capital costs. Other costs, such as fertiliser and chemicals for the farm sector and transport and energy usage in the processing sector, make up the final 31 per cent and 20 per cent respectively.

3.1 On farm cost structure of citrus production



Data source: McGuickian 2001.

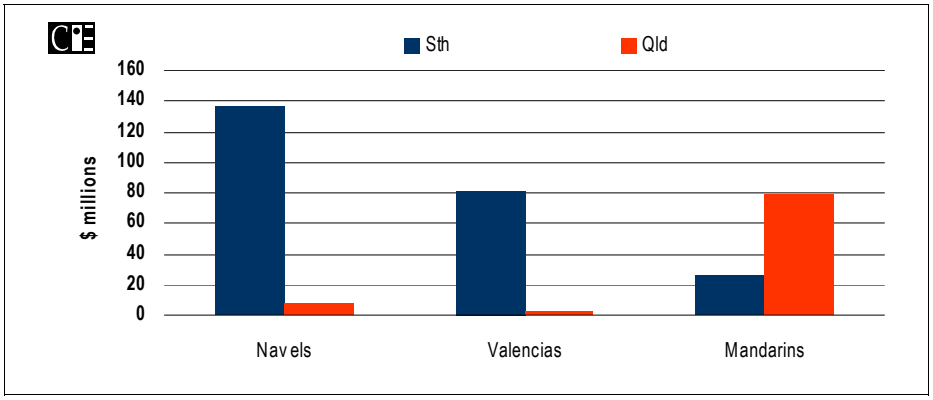
3.2 Processing sector cost structure



Data source: McGuickian 2001.

Following this, an accurate measure of the quantities of products being produced and the corresponding values by each region need to be developed. The latest Australian Bureau of Statistics data for the 2003–04 financial year has been used. See chart 3.3 for details.

3.3 **Value of farm output by region**

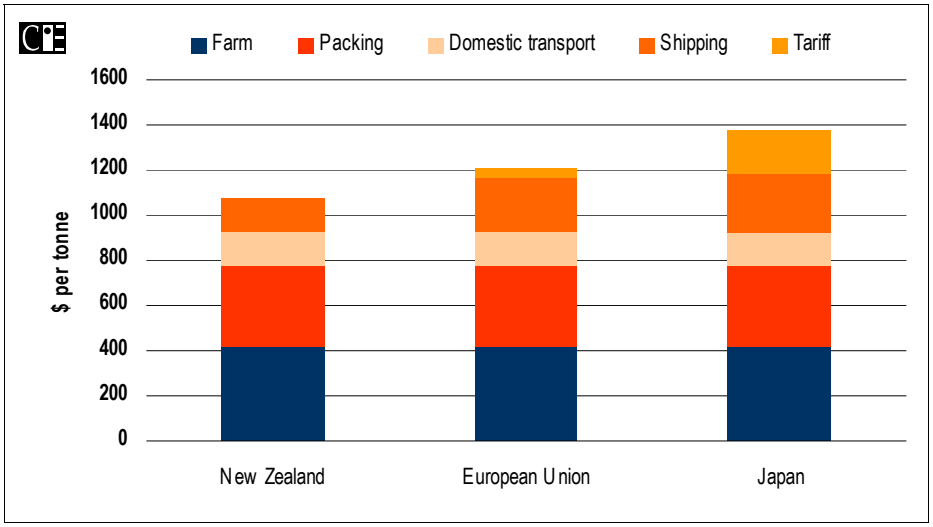


Data source: ABS 2004.

There are two components that make up the margins that go into supply external markets with Australian citrus products, and are detailed for three of Australia's export markets in chart 3.4. The first set of margin components, the *free on board* set, detail the margins are faced getting produce to the export point within Australia, and is uniform across a particular product regardless of the final destination. In the case of high quality navels, these amount to $925 per tonne.

The *cost, insurance and freight* set of margins, which sit on top of the FOB set, are country specific and measure the margins associated with product arriving on dock in the destination country post any tariffs being paid. The CIF tariff includes the specific shipping costs associated with moving produce from Australia to the port of destination, as well as the costs associated with any tariff barriers. In the case of Japan, the CIF margins are made up from $257 per tonne shipping cost and a $189 per tonne tariff. The specific tariffs for each destination country are detailed in table 3.5 below.

3.4 **Export margins for high quality navels**



Data source: Productivity Commission 2002.

3.5 **Import citrus product power tariffs in selected economies**

Export destination	*Navel tariff*	*Valencia tariff*	*Mandarin tariff*
Canada	1	1	1
European Union	1.032	1.032	1.16
Hong Kong	1	1	1
Indonesia	1.1	1.1	1.1
Japan	1.16	1.16	1.16
Malaysia	1	1	1.05
New Zealand	1	1	1
Singapore	1	1	1
Sri Lanka	1.28	1.28	1.28
Taiwan	1.4	1.4	1.4
USA	1	1	1

Source: Productivity Commission 2002.

The parameters data set

A large number of elasticities need to be determined in order to run the model effectively. These elasticities indicate the responsiveness of a particular variable to a change in another variable. For example, the 'own price elasticity of demand' measures the per cent change in quantity demanded given a one per cent change in the price level of the good. Another example is the 'cross price elasticity of demand', which measures the per cent change in the quantity demanded for good A given a one per cent change in the price of good B.

For the purposes of the citrus model, there are a number of categories of elasticities that need to be determined:

- supply side elasticities:
  - price elasticity of farm supply;
  - substitution between the production of high and low quality navels, high and low quality valencia and mandarins at the farm level; and
  - substitution between the two factors of production, labour and capital, within the processing industry.
- demand side elasticities:
  - own price elasticity of demand for each fresh and processed product in the domestic and eleven export markets;
  - import substitution elasticity for fresh and processed products;
  - substitution between fresh citrus and other fruits and the retail level;
  - substitution between processed orange juice and other beverages at the retail level; and
  - income elasticities of demand for each fresh and processed product in the domestic and eleven export markets.

Generally, elasticities are difficult to measure, as there is often very little applicable data that can be used. When estimated, studies make use of consumer and producer behaviour that attempt to measure the impact the desired element upon the quantity demanded or supplied, with results suitably adjusted to better reflect the particular conditions within a specific industry. Typically, it is extremely difficult to isolate the desired element's impact upon quantity over and above the impact of any other developments within the market.

Table 3.6 describes and shows the values of the elasticities used in the Citrus model. The name of the elasticities is the name used in the model. Each elasticity can be specified across a number of dimensions, including industry (ind) for the processing sector, commodity (com) such as high quality navels, region (reg) for example Queensland, factor of product (fact) such as capital, or across export markets (for) such as Sri Lanka.

3.6 **Parameter values**

Parameter	*Description*	*Name*	*Value*
Substitution between citrus in intermediate demand	% change in demand for a processing input due to a 1% change in the price of the other input	sig1(ind)	1
Substitution between factors of production in the processing industry	% change in demand for one factor due to a 1% increase in the price of another factor	sig2(ind)	0.5
Substitution to other fruits at the retail level for domestic demand	% change in demand for citrus products due to a 1% increase in the price of other (substitute) fruit	sig3	0.5
Substitution to other beverages at the retail level	% change in demand for orange juice due to a 1% increase in the price of other (substitute) drinks	sig4(ind)	0.5
Import substitution of processed product for domestic consumption	% change in demand for domestic orange juice due to a 1% increase in the price of imported orange juice	sig5(ind)	0.5
Import substitution of fresh product for domestic consumption	% change in demand for domestic fresh product due to a 1% increase in the price of imported fresh product	sig6(com)	0.5
Import substitution of fresh product for the processing sector	% change in demand for a processing input due to a 1% change in the price of the other input	sig7(com,ind)	1
Demand elasticity of processed product for domestic consumption	% change in domestic demand due to a 1% increase in the retail price of orange juice	eta1(ind)	-0.3
Demand elasticity of fresh product for domestic consumption	% change in domestic demand due to a 1% increase in the retail price of fresh product	eta2(com)	-0.3
Demand elasticity of fresh product for export consumption	% change in foreign demand due to a 1% increase in the price of fresh product	gamma1(com,for)	-10
Demand elasticity of processed product for export consumption	% change in foreign demand due to a 1% increase in the price of orange juice	gamma2(com,for)	-10
Farm supply substitution elasticity	% change in farm output of one commodity due to a 1% increase in the price of another commodity	alpha(com,reg)	5
Farm supply price expansion elasticity	% change in total farm output for a 1% increase in the general price level	tau(reg)	2
Income expenditure elasticity	% change in demand due to a 1% increase in domestic real income	eps	1

4 Simulations and results

An infinite number of simulations could be run on the enhanced Citrus model. Given the addition of export countries into the model, analysing potential shocks to these markets provides a useful starting point.

Effectively, markets can be affected by one of two shocks, a demand or supply side shock. In a demand side shock, the quantities demand at any given price level would either increase or decrease, with the sign and magnitude of change determined by the type of shock. An overall increase in income in one of the foreign would lead to an increase in the demand for citrus products to increase in that country, thereby increasing the price of the product. Alternatively, a decrease in import tariff rates would lead to fall in the price faced by consumers in the particular export market, leading to an increase in demand, and an increase of the price of citrus products in Australia.[1] The increase in price from both of these shocks would then have further ramifications across the domestic and other export markets.

The other type of shock that can be modelled is a supply side shock, in which the supply of fresh or processed product increases or decreases for any given price level. A widespread outbreak of Citrus Canker, for example, would lead to a fall in supply, driving up the price of citrus products, and then

Previously, as part of the first Citrus model, a number of simulations were modelled. These included a ten per cent increase in total export demand for all products, a five per cent increase in domestic demand for all products, a combination of the first two simulations, and a sensitivity analysis of the supply elasticity (CIE 2003).

Given that the current enhancements to the model have included expanding and detailing the export markets, it is appropriate to simulate specific shocks based on the expansion. Additionally, given the recent discovery of Citrus Canker in Queensland in June 2004, the model is able to simulate what would happen to the industry given a widespread outbreak of the disease. The above supply and demand shocks are simulated as follows:

1. a ten per cent increase in foreign demand in Malaysia, Indonesia and Sri Lanka in response to increases in income due to prosperity improvements in those three countries (demand side);
2. the complete removal of all import tariffs for all citrus products going to Australia's citrus export markets (demand side);

[1] Both these shocks assume that citrus products are normal goods, that is, as income increases, quantity demanded also increases. This assumption is made in the model, with the value for *eps*, the income expenditure elasticity, being positive (see table 3.6 for details).

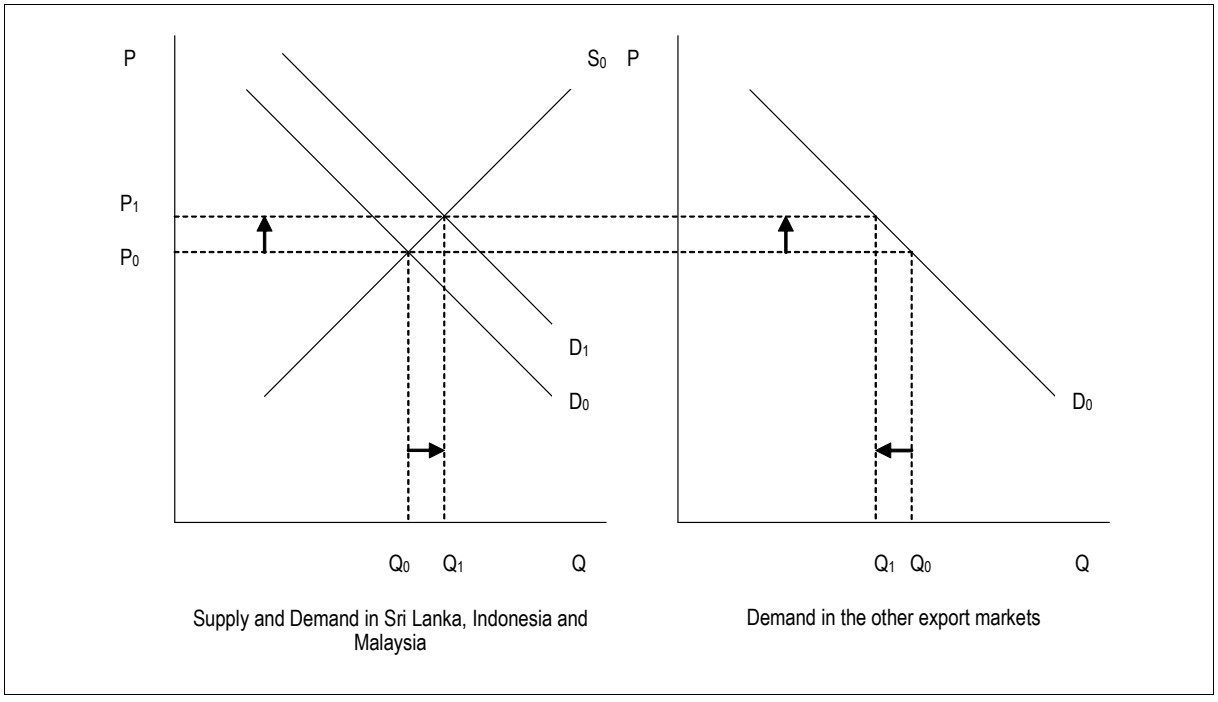
3. a fifty per cent reduction in output in Queensland due to an outbreak of Citrus Canker (supply side); and
4. a combination of the three simulations.

Simulation 1: a ten per cent increase in demand in Malaysia, Indonesia and Sri Lanka

With improvements in income in Sri Lanka, Malaysia and Indonesia associated with broad development improvements, the quantity of all products consumed in these three economies would be expected to increase, including citrus products. This would lead to an increase in the price of the citrus products in these economies, driving up the price of citrus products in Australia, and potentially leading to reductions in exports to the other export markets due to higher prices. The enhanced citrus model can be used to analyse this scenario. Chart 4.1 illustrates these impacts.

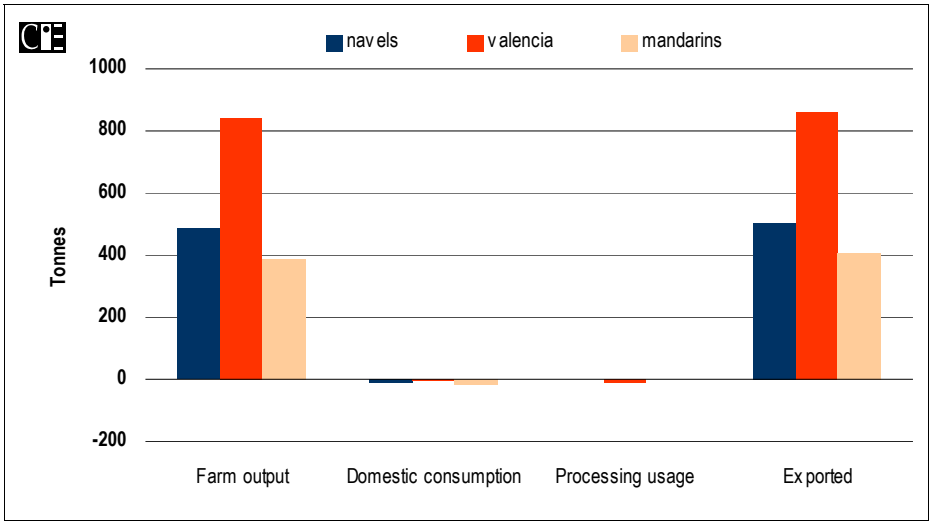
The initial change in demand in the three developing countries leads to a price increase for Australian citrus products, and thus returns to Australian citrus products. As a result, more citrus product is exported to these three countries, leading to a reduction in the quantity of citrus products supplied to both Australia and the other export markets. As this supply contracts, the prices paid increase in order to keep supply equal to demand.

4.1 **Simulation one: impact of an export demand shift in one market upon other export markets**



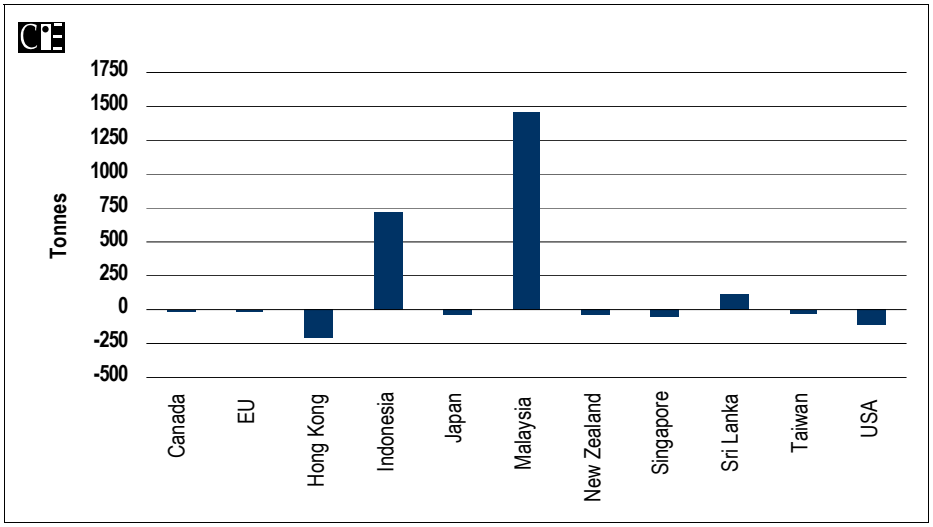
Charts 4.2, 4.3 and 4.4 present the results from the simulation.

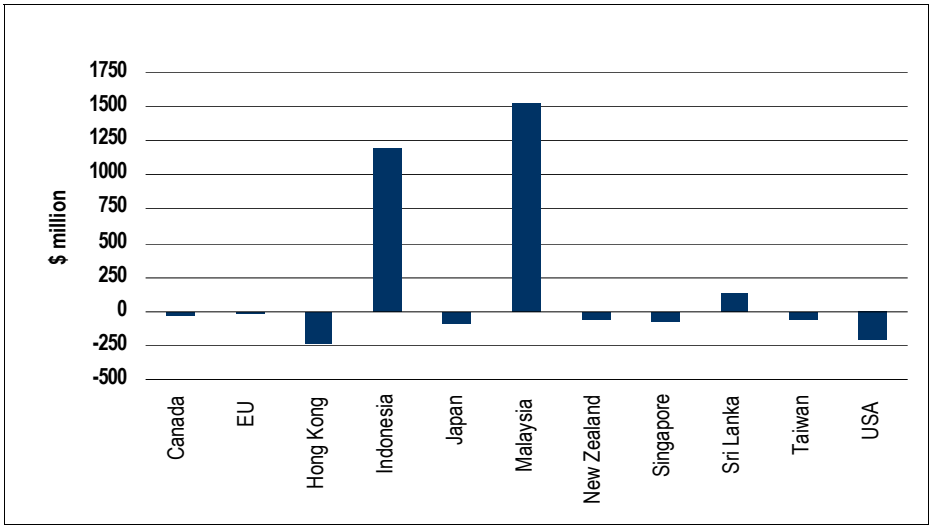
4.2 **Simulation one: change in the quantity of farm output, domestic consumption, processing sector usage and exports**



As is expected, the main impact of the increase in demand is to increase exports to Sri Lanka, Malaysia and Indonesia, while decreasing exports to the other eight economies. The value on farm price is in the order of 0.1 of a per cent, which is expected given a very small fraction of total farm output exported to the three shocked economies. The increase in farm prices results in an expected decrease in domestic consumption and use in the domestic processing sector, however, this decrease in the quantity and value of domestic demand is not enough to offset the increase in demand in the three economies. The increase in farm prices, however, also leads to farms increasing production in the longer term. Combined with the higher prices, the increase in supply increases value of the citrus sector by $73.21 million.

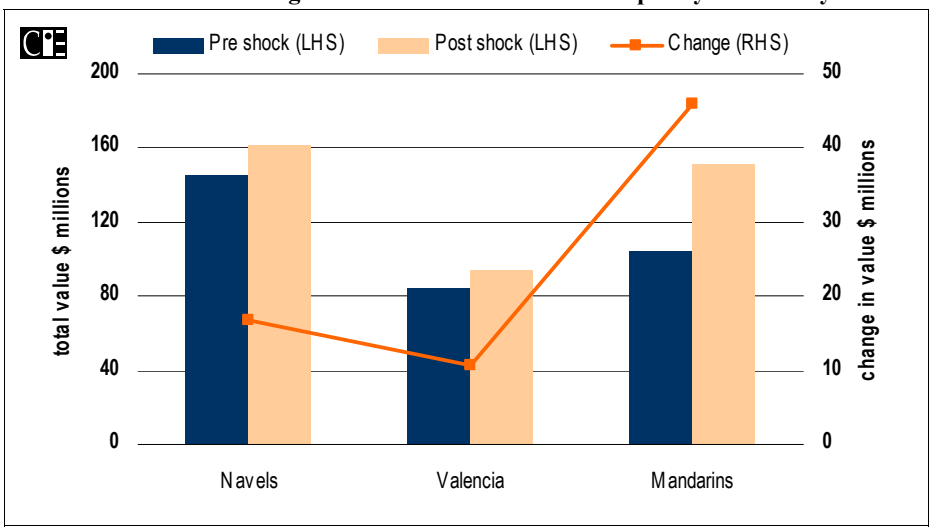
4.3 **Simulation one: change in the quantity and value of exports by destination**





The results of this simulation highlight the trade-offs between supplying one market over another. While supply to Indonesia, Malaysia and Sri Lanka expands, other exports as well as domestic consumer and processing consumption of fresh produce falls.

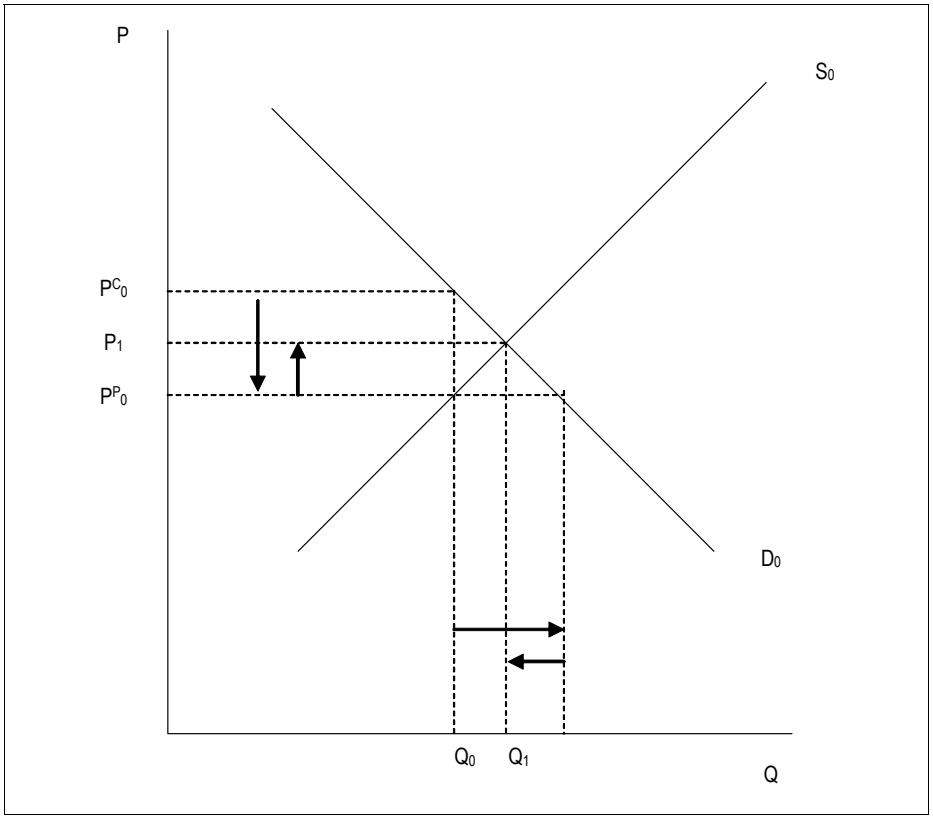
4.4 **Simulation one: change in the value of citrus farm output by commodity**



Simulation 2: the removal of import tariffs in Australia's export markets

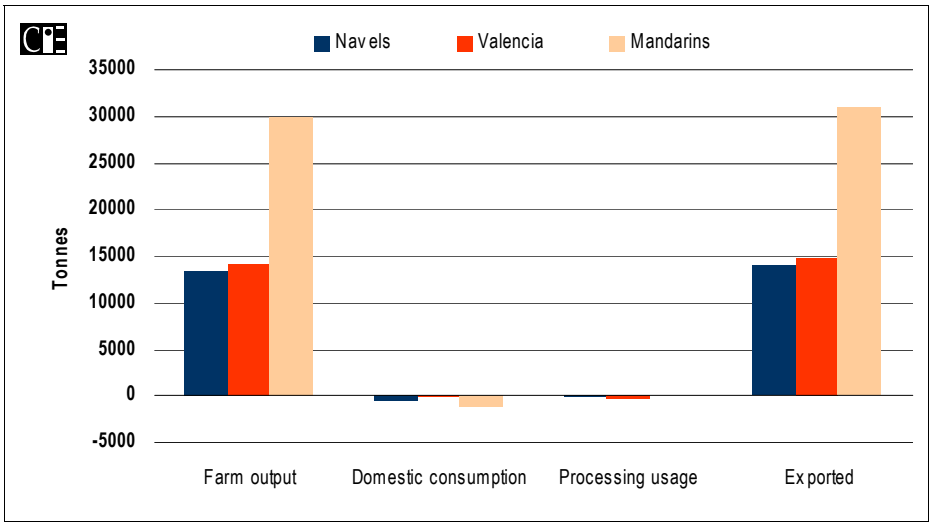
The following scenario is similar to the first in that it is an external demand shock, except that there is no explicit shift in the demand schedule; rather, across all export markets, import tariffs are reduced to zero. Chart 4.5 represents the removal diagrammatically. As can be seen, the removal of the tariff reduces the effective price that foreign consumers face for Australian citrus products from P^C_0 to P^P_0. At this new price, there is excess demand, so competition drives the price up, leading to an increase in the quantity supplied, from Q_0 to Q_1. The final price is P_1.

4.5 Simulation two: impact of the removal of an import tariff in a market



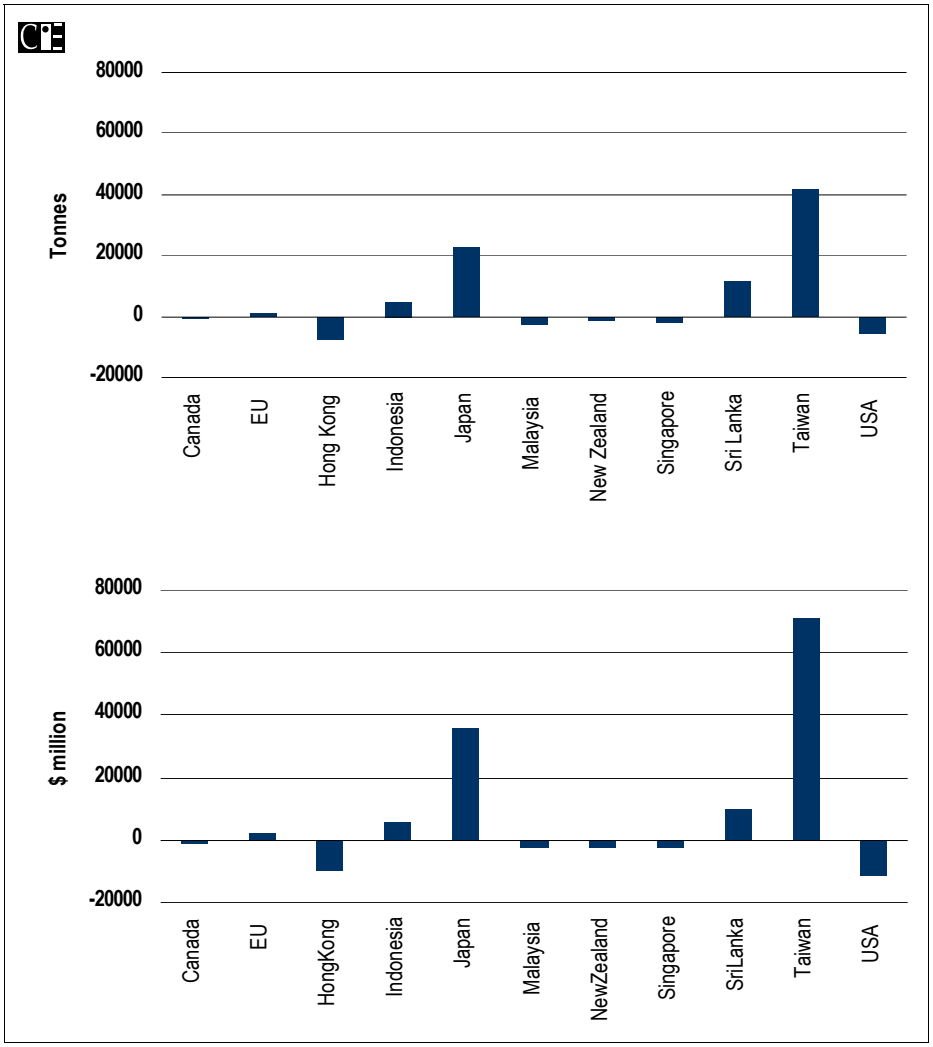
The results from this simulation are reported in charts 4.6, 4.7 and 4.8.

4.6 Simulation two: change in the quantity of farm output, domestic consumption, processing sector usage and exports



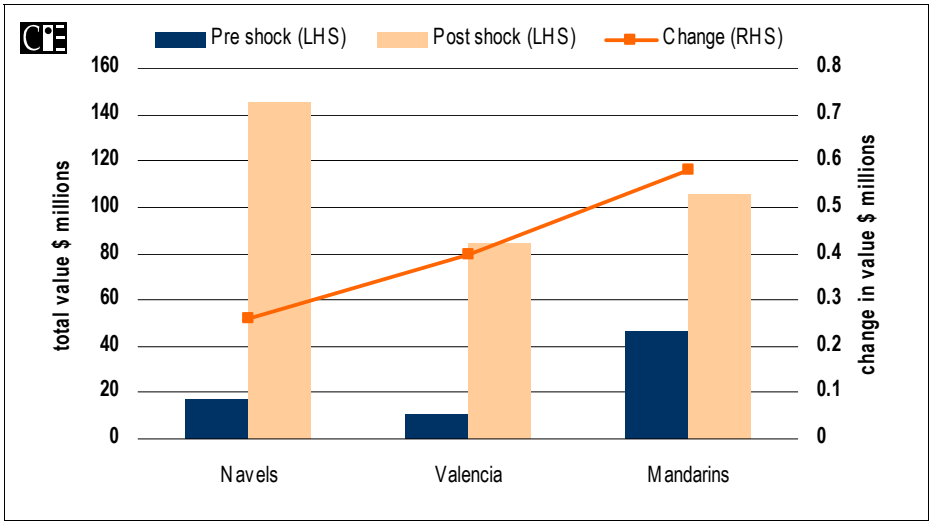
As expected, the quantity of produce produced increases to meet the increase in demand from the export markets. However, when examining the changes in quantities and values to each export market separately, six of the eleven markets experience a fall in exports with only five increasing. The largest increase in output is in Taiwan, where import barriers fell by the greatest per cent. As is shown in chart 4.5, the removal of the tariffs results in an overall increase in the export price of citrus products in those markets that previously had tariffs. This increase in the export price leads to an increase in the domestic Australian price, thus reducing domestic consumption. However, for those export markets that did not have any import barriers, the increase in the domestic price leads to an increase in the price for citrus products and thus a decrease in the quantity and value of exports to those markets.

4.7 **Simulation two: change in the quantity and value of exports by destination**



The end result for domestic citrus producers is that the removal of tariff barriers leads to an increase in the value of farm output of $1.24 million. Where tariff barriers currently more widespread, the benefit to the industry from their removal would be more significant.

4.8 **Simulation two: change in the value of citrus farm output by commodity**

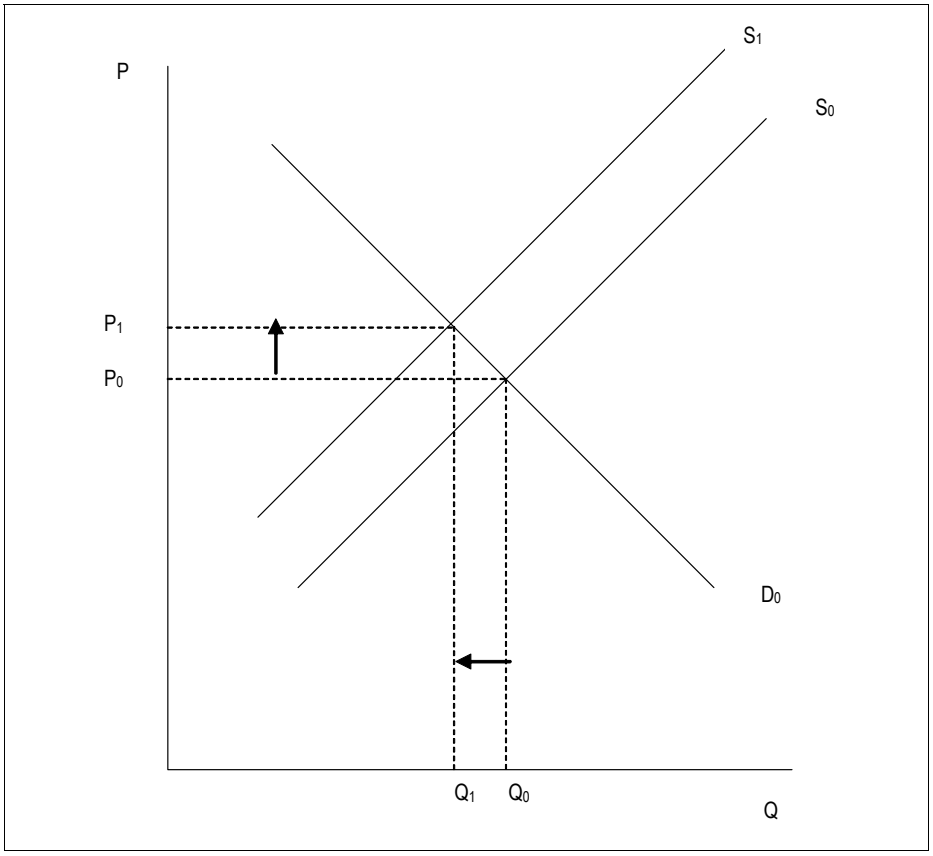


Simulation 3: a fifty per cent decrease in Queensland output due to an extended outbreak of Citrus Canker

Simulation three models the impact of a widespread outbreak of Citrus Canker across Queensland. Citrus canker is a highly contagious disease of citrus crops caused by the bacterium *Xanthomonas citri*. Severe infection can produce defoliation, dieback, severely blemished fruit and premature fruit drop. Diseased fruit cannot be sold.

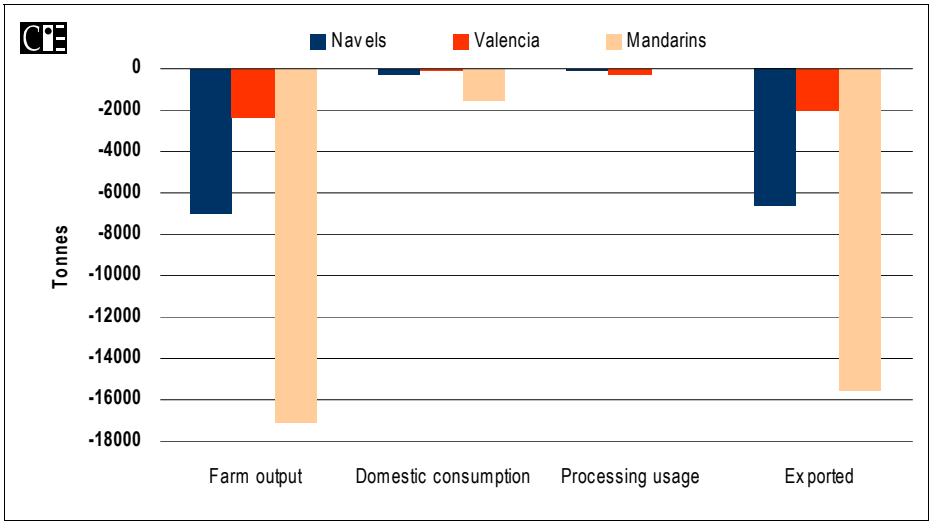
In this scenario, fifty per cent of current Queensland production, reducing total Queensland output by half. It should be noted, though, that this is a long term product scenario, in which unaffected Queensland farmers are able to switch their production from one type of citrus product to another in response to price movements. This is a supply side shock, in which the quantity of citrus products supplied at any given price level is reduced. Chart 4.9 graphically represents this.

4.9 **Simulation three: Citrus Canker reducing supply**



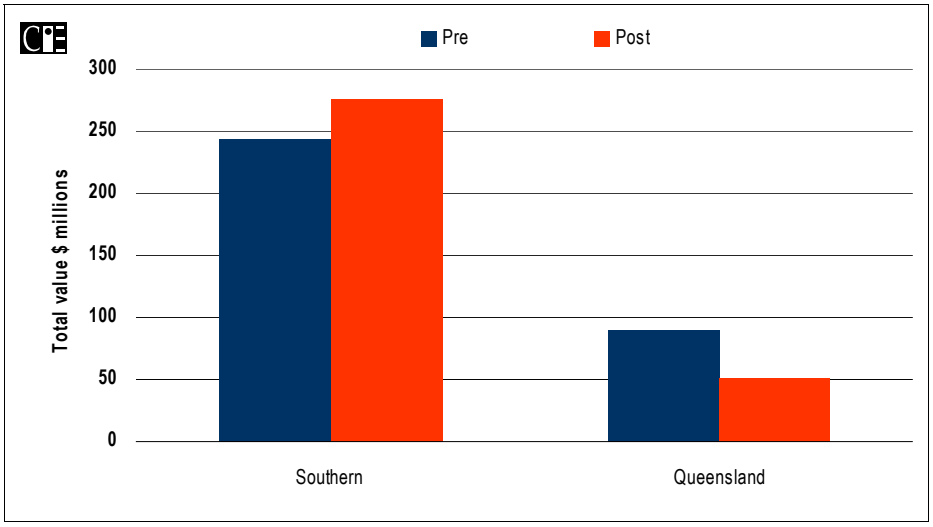
As can been, a reduction in supply would be expected to lead to an increase in the price, offsetting the reduction in revenue from reduced sales. For those farms unaffected by the outbreak, thus producing at their previous level, Citrus Canker would even have a beneficial impact on farm returns. Given the model's regional make-up between Queensland and the rest of Australia, the different in farm returns between those affected by the disease and those not can be observed. The results of the simulation are presented in charts 4.10, 4.11, 4.12 and 4.13.

4.10 **Simulation three: change in the quantity of farm output, domestic consumption, processing sector usage and exports**



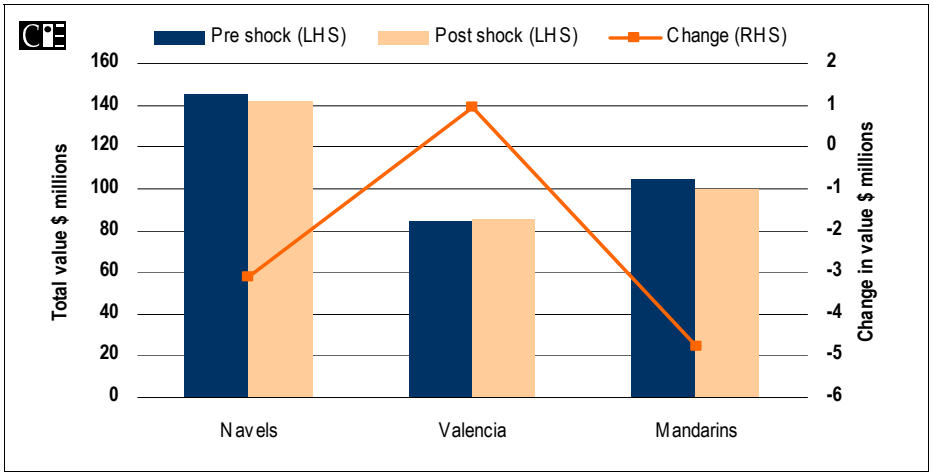
As is expected, total output falls, in this case by 26 406 tonnes, with the majority of this reduction made up by mandarins. Due to supply contraction, farm prices increase by between 2.3 and 2.7 per cent for navel and valencia production and 14.8 per cent. In response to the higher price, unaffected farms increase output, moving along their supply schedules. Overall, the value of output from the Queensland industry falls by $38.6 million, while the value of the southern states citrus output increases by $31.7 million, a 12.9% increase. Overall, the Citrus Canker outbreak in Queensland costs the Australian citrus industry $7.0 million.

4.11 **Simulation three: change in the value of production from by region**



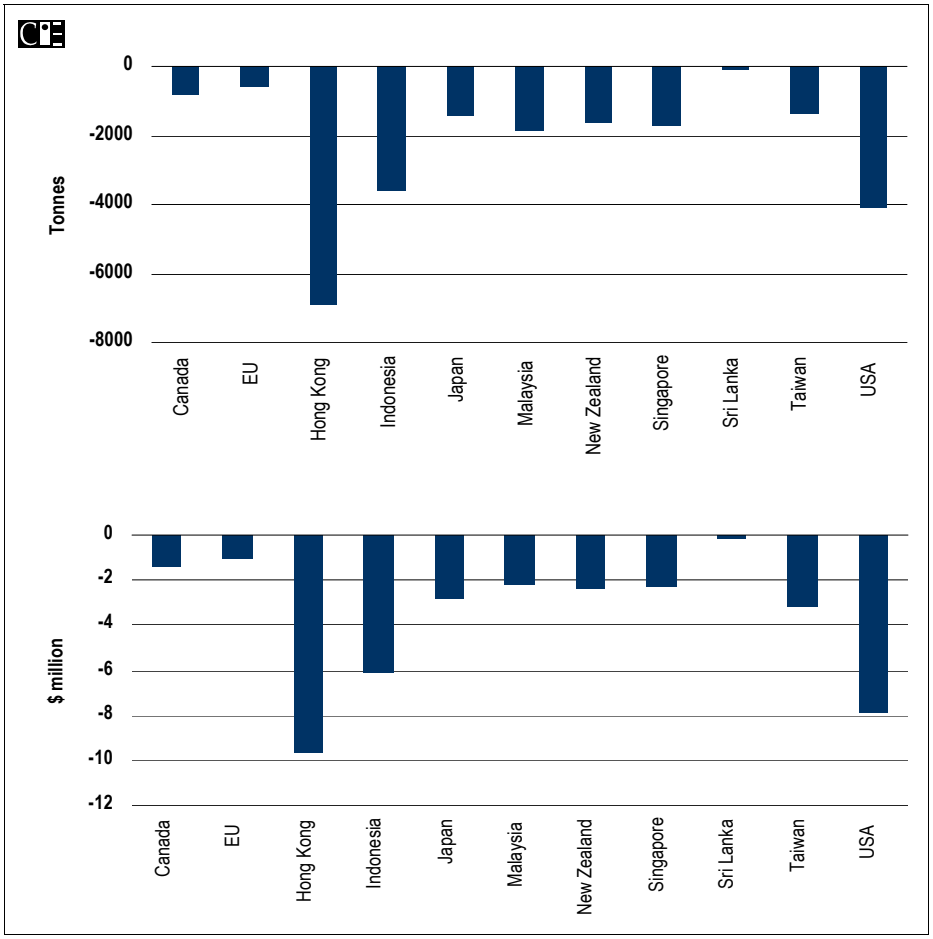
With Queensland producing only 3.0% of nation's valencia crop, the reduction in Queensland's valencia crop is outweighed by the increase in valencias produced by the southern states in response to the higher prices of all citrus products. Chart 4.12 presents this specific result.

4.12 **Simulation three: change in the value of citrus farm output by commodity**



The higher domestic price of citrus products also leads to a reduction in exports, as foreign markets switch away from Australia citrus products. Total exports fall by $39.0 million.

4.13 **Simulation three: change in the quantity and value of exports by destination**

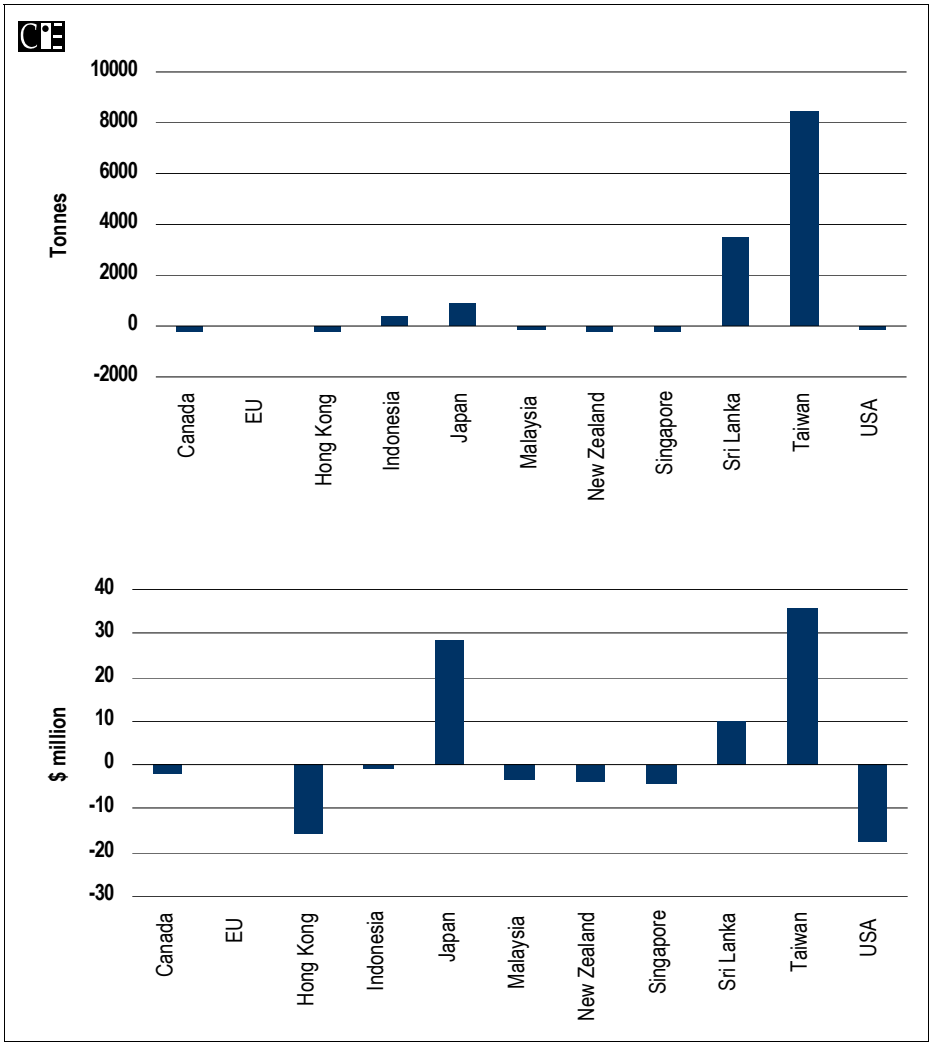


Simulation 4: a ten per cent increase in export demand in Malaysia, Indonesia and Sri Lanka

Simulation four is the combined combination of the above three simulations, incorporating two demand side impacts of regionalised increased demand and reduced tariffs and a supply side impact of reduced production. The results from this simulation are reported in charts 4.14, 4.15, 4.16 and 4.17.

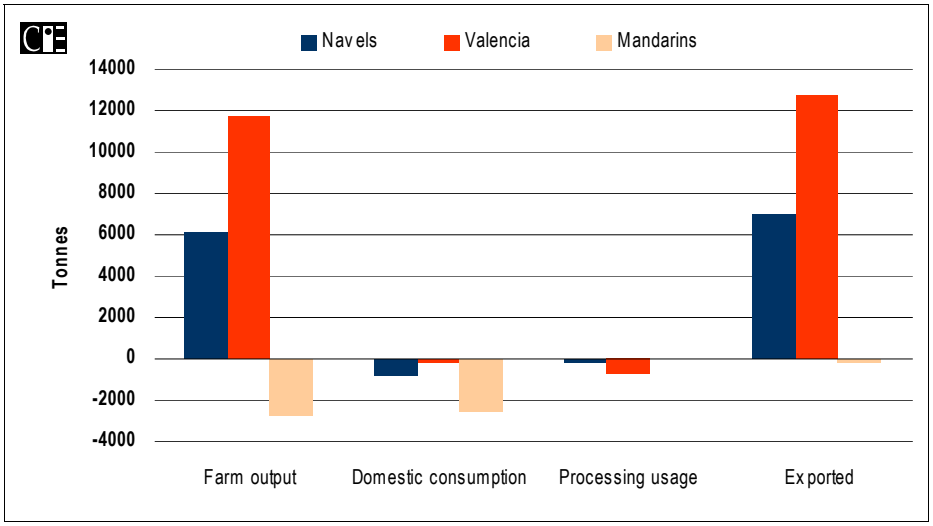
Similar to simulations one and two, the quantity and value of exports varies according to both the level of the previous level of tariff and whether or not the economy experienced a demand shock. Interestingly, the quantity and value of exports to Malaysia fell, even after their demand shock. After the reduction in supply of valencias in Queensland and the increase in demand for citrus products associated with the two demand shocks, the price increase of the citrus products leads to an overall decrease in the quantity of product consumed by Malaysia.

4.14 **Simulation four: change in the quantity and value of exports by destination**



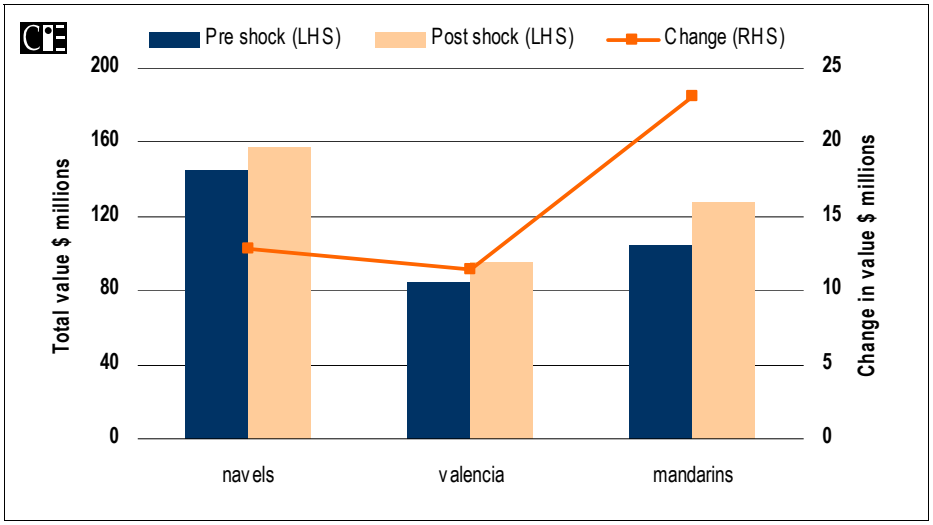
Similar to simulation three, the supply of mandarins falls due mainly to the influence of Citrus Canker. However, unlike simulation three, the output of navels and valencias increases as a result of the much larger increase in supply coming from the southern states as a result of the three shocks on the price level. Valencia production increases by 11 772.1 tonnes, due mainly to the limited output of valencias in Queensland prior to the outbreak of Citrus Canker.

4.15 **Simulation four: change in the quantity of farm output, domestic consumption, processing sector usage and exports**



The total value of output of all three products increases as a result of the three shocks, with the value of total industry output increasing by $47.3 million.

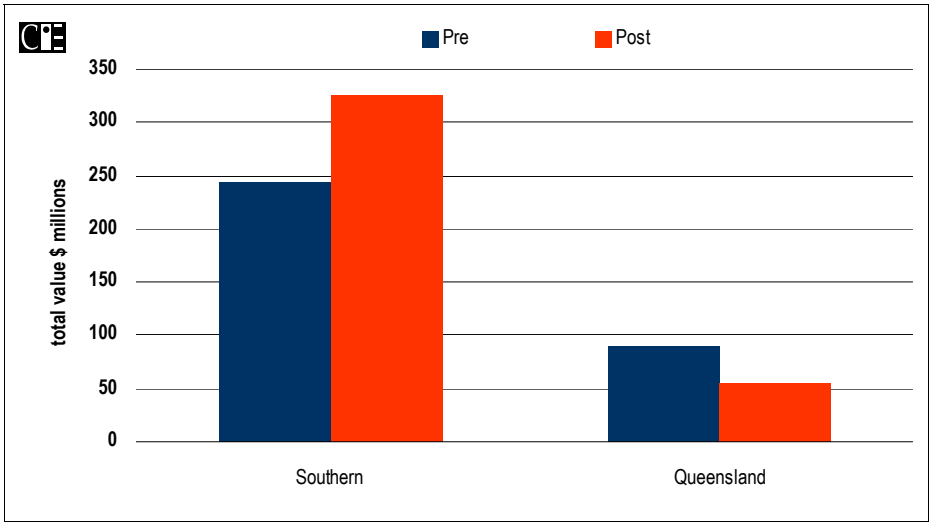
4.16 **Simulation four: change in the value of citrus farm output by commodity**



While the industry as a whole has benefited, the benefits are not evenly distributed across the producing regions, with Queensland still suffering a reduction in supply. However, the decrease in the value of output experienced in Queensland is

$34.1 million, $4.6 million less than under simulation three, due to the increase in prices from the demand and supply shocks.

4.17 **Simulation four: change in the value of production from by region**



5 *Points for discussion*

This report provides an ideal opportunity to get some industry feedback on the enhanced model. In particular, we would be looking for some input into:

- parameter values;
- the types of simulations required; and
- the export market construction of the model.

As was discussed previously, parameters are often difficult to estimate accurately; the overriding goal for this report has been to use generic values in order to run and test the model and illustrate simulation findings

Given the absence of any relevant studies into citrus consumption, generic values have been assigned for parameters in the model in most instances. Some exceptions are for export demand elasticises, which are generally accepted to be significantly higher than domestic demand elasticities.

Also, given the almost infinite number of simulations that can be run from the model, it is crucial that only simulations of interest to the industry are analysed. The industry itself would have the best ideas on how the model would be most beneficial. Importantly, it should be realised that the model is able to focus on the domestic, export and import sectors of the fresh and processed citrus industries.

Furthermore, given the enhancements to the citrus model made as part of this activity, it is important that the model accurately reflect industry realty in relation to the export of citrus products. An accurate picture of the exporting sector, particularly the transporting processes and cost structure would help ensure the models usefulness as an analytical tool.

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