The Impacts of the Proposed Carbon Price Mechanism on Australian Horticulture

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The impacts of the proposed carbon price mechanism on Australian horticulture

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Abbreviations

CFI	Carbon Farming Initiative
CIE	Centre for International Economics
CPRS	Carbon Pollution Reduction Scheme
GVA	Gross value added
GVP	Gross value of production
HAL	Horticulture Australia Limited

Summary

Horticulture Australia Limited (HAL) has commissioned the Centre for International Economics (CIE) to quantify the potential impacts of the Australian Government's Clean Energy Futures program on the Australian horticulture industries.

- This quantification was conducted using the *Hi-Link* model developed and maintained by the CIE on behalf of HAL.

The CIE adopts the carbon price trajectory and estimates of the potential impact on input prices outlined in Knudsen et al (2012).

- However, the policy environment around the carbon price mechanism remains highly uncertain as a result of recent and anticipated changes in the supporting legislation and administration of the scheme.
- In the headline analysis, the carbon price commences at $23 per tonne of emissions in 2012, increasing to $24.15 per tonne on 1 July 2013. It is projected to increase steadily to $30 per tonne by 2020. The CIE assumes that it remains stable at $30 per tonne from 2020 to 2025, although there is considerable uncertainty around carbon prices beyond 2020.
- However, in recognition of the strong possibility of moving towards an emissions trading scheme earlier than planned we have modelled a separate lower carbon price trajectory in the sensitivity analysis. In this alternative carbon pricing scenario we assume a flexible price mechanism in 2014 trading at $10 per tonne, increasing to $15 per tonne by 2020.

Overall, the carbon price reduces the competitiveness of Australian horticultural products in both domestic and export markets. While the value of the industry continues to grow over the period, the rate of growth is slower than without a carbon price.

- The carbon price may cause an annual reduction in gross value of production at the wholesale level of between 0.5 per cent and 1.0 per cent by 2020, depending on the price trajectory assumed. In gross value added (GVA) terms, sectoral value may reduce by 1.1 per cent to 2.2 per cent by 2020.
- In dollar terms, by 2020, the GVP of the sector at wholesale prices could be $135.6 million *less* under carbon pricing, although a smaller carbon price is expected to moderate this impact significantly.

1 This study

In 2011 the Australian Government announced the Clean Energy Futures program. As part of that announcement, estimates of the potential impacts of the carbon price mechanism on a number of agriculture industries were provided based on Treasury modelling. These estimates did not identify horticulture separately from the 'other agriculture' group.

Therefore, HAL commissioned Growcom to conduct two studies on the expected impact of the carbon price mechanism on Australian horticulture, and anticipated opportunities arising from the Carbon Farming Initiative (CFI). The studies demonstrated that there was very little immediate opportunity for horticulture in the Governments CFI program, however, the carbon price mechanism, which is now a tax, was expected to add a significant cost to production.

- As expected the real cost to each business was dependent on the business size, its operation, and exposure to increased costs of goods and services as a result of the tax.

The extent of the Growcom study was limited and the Across Industry Committee representing HAL's 42 industries directed HAL to engage with a service provider to explore the ramifications of the carbon arrangements on the industry.

The purpose of this report is to:

- develop scenarios and generate economic impacts using the *Hi-Link* model for horticulture industries at a national level which will then be translated to changes across a number of growing regions in different states of Australia
- run a number of different scenarios based on a different combinations of fixed and variable assumptions with reference to the carbon price (and associated policies)
- provide modelling results for the expected impact on the horticulture industry in the short term, and the medium to longer term (10-15 years).

Hi-Link model

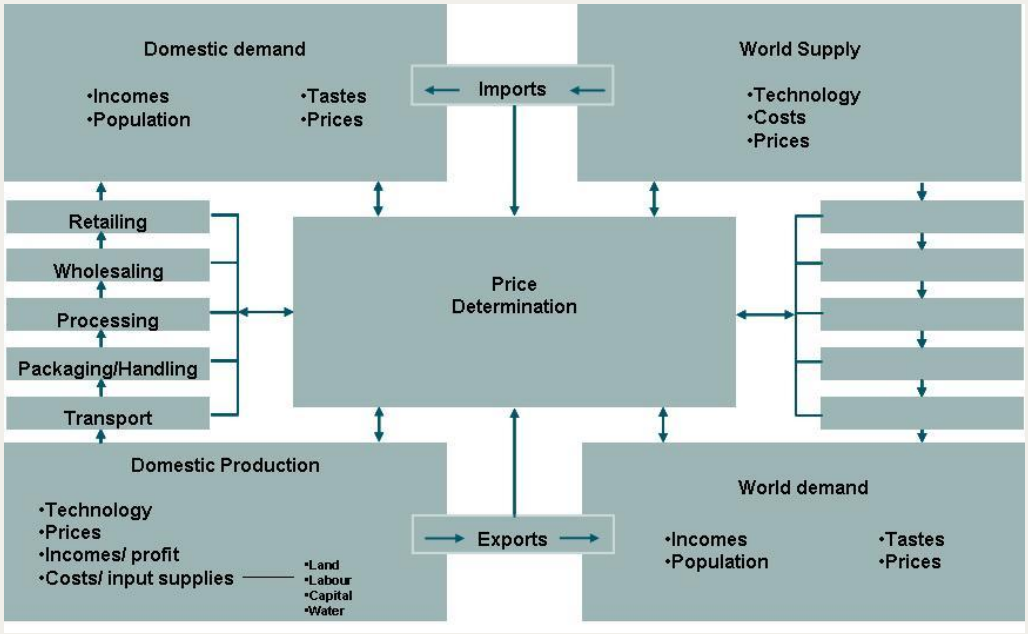
Quantification of the impacts of carbon pricing mechanisms was conducted using the *Hi-Link* model initially developed by the Centre for International Economics (CIE) for the HAL *FutureFocus* strategic planning process.

- The objective of the *FutureFocus* project was to prioritise and provide funding options for programs and projects that address significant cross-cutting issues across horticulture that currently are not funded or are not funded adequately.

The framework developed for *FutureFocus* was the Hi-Link model — a national model of horticulture — the structure and interactions of this model are shown in box 1.1.

1.1 The Hi-Link model

The *Hi-Link* model is an analytical tool that captures all of the main economic linkages between industries locally and globally, up and down the entire value chain. The model covers fresh, processed and amenity horticulture, domestic production and consumption, and exports and imports. The broad structure is shown in the following chart.



The *Hi-Link* model distinguishes 44 commodity groups but also produces results for aggregates such as fresh fruit, fresh vegetables, processed products and nuts as well as amenity horticulture. It is a powerful tool that can be used to analyse the repercussions and effects from 'what if' type experiments. It can be used to assess payoffs from strategies and actions and therefore allow the industry to focus on what is important for industry profitability. Its value is in the insights and understanding it adds to the knowledge base about the Australian horticulture industry and what the key drivers affecting the fortunes of the industry might be. The model is unique to the industry and the only one of its type for horticulture anywhere in the world.

Model details include 42 farm level commodities including fresh and processing industries. It identifies farm level sales to retail (supermarkets and other retail), food service and processing industries and export markets.

Imports are also accounted for. Another important ingredient of the model is detailed value chains from farm through to sales and representative cost structures of farm level and processing industries. The model also recognises the scope for substitution in consumption, which is particularly important for fruit.

2 The carbon price and the key economic drivers

The inputs required for the *Hi-Link* model comprises two parts:

- the carbon price arrangements in terms of the expected per tonne tax equivalent of the mechanism
- the impact of the tax equivalent on economywide costs, sectoral and macroeconomic performance
- the flow-on of these macro impacts to the horticulture sector.

Carbon price outcomes

The CIE adopts the carbon price trajectory and estimates of the potential impact on input prices outlined in the report titled *Opportunities for Australian horticulture in the Carbon Farming Initiative* prepared for HAL by Knudsen et al (2010). The expected carbon price trajectory is based on the legislation that was in place at the time of the commissioning of the report which includes a fixed price period for the first three years, followed by a flexible pricing period whereby a price floor and ceiling is set to avoid large price fluctuations.

The policy environment for the carbon price mechanism remains highly uncertain. This uncertainty is the result of how recent and anticipated changes in the legislation and administration of the scheme will affect the price setting arrangements and therefore, the carbon price.

- In August 2012, the government announced it would link the Australian emissions trading scheme with the European Union Emissions Trading System.
- Starting with an interim link to operate from 1 July 2015 which will allow Australian liable entities to use European allowances for compliance under the Australian scheme. A full two-way link, by means of the mutual recognition of carbon units between the two cap and trade systems, is to commence no later than 1 July 2018.
- As part of these announcements, the legislated floor price for carbon from the original legislation was abandoned.

The Australian government also expressed interest in bringing forward the emissions trading scheme which would expose the domestic market to significantly lower carbon prices in the immediate term.

Therefore, the assumptions concerning the carbon price going forward also rely on the expectations that the European Commission will tighten permit allocations as well as overall emissions targets in Europe.

- These actions would be necessary to stabilise and increase carbon prices in the European market from current low levels.
- The extent to which this is practically possible is limited by prevailing economic conditions in Europe where nearly half of the member countries are currently in recession.

The carbon price trajectory utilised in this study, taken from Growcom (2012), is provided in table 2.1. The assumptions are consistent with those reported across the literature, despite there being expectations of impending changes to the carbon pricing mechanism.

The carbon price commences at $23 per tonne of emissions in 2012, increasing to $24.15 per tonne on 1 July 2013. It is projected to increase steadily to $30 per tonne by 2020. The CIE assumes that it remains stable at $30 per tonne from 2020 to 2025, although there is considerable uncertainty around carbon prices beyond 2020.

2.1 Carbon price trajectory adopted in CIE's modelling in the headline analysis

	Carbon price
	$ per tonne
2009-12	0
2012	23.0
2013	24.1
2014	25.4
2015	24.1
2016	25.4
2017	26.6
2018	28.0
2019	29.3
2020	30.8
2021-2025	30.8

Source: Knudsen et al (2012) and CIE.

Given the commentary above concerning recent and likely changes to the carbon pricing mechanism, it would be safe to assume that the price outcomes in table 2.1 could be considered at the upper limit.

Impact of carbon price on farm and processing inputs

While the products of the horticultural sector are not taxed directly for emissions, the products are taxed indirectly through higher input costs. The key inputs expected to increase because of the carbon tax include electricity, fuel, freight, chemicals and packaging costs.

Knudsen et al (2012) estimate the potential change in input costs in percentage terms. By 2020, compared to without a carbon price:

- chemical costs, such as fertiliser, are expected to increase by 0.73 per cent
- electricity (power) costs are expected to increase by 13.1 per cent
- transport costs are expected to increase by 1.5 per cent
- other costs, such as packaging, are expected to increase by approximately 2 per cent.

In the CIE's *Hi-Link* model these inputs are increased proportionately to reflect the expectation that prices will be lower earlier in the period. For instance, in 2012 where the carbon price was $23 per tonne or 75 per cent of the price in 2020, we assume that 75 per cent of the input cost increases listed above are realised.

Table 2.2 shows the shocks to farm and processing inputs incorporated into the CIE's modelling. Input increases appear broadly consistent with ABARES expected increases in electricity and freight prices for 2012-13 and 2014-15.

- For instance, ABARES estimated that electricity (power) prices would increase by 9.7 per cent compared to estimates by Knudsen et al of 9.8 per cent in 2012-13.
- ABARES projected carbon pricing would increase freight prices in 2014-15 by 0.7 per cent while it was estimated an increase of 1.1 per cent for horticulture.
  - Liquid fuels are treated differently from other sources of emissions. An equivalent carbon price will be applied through reductions in the fuel tax credit rate for some sectors and /or activities. The Government intends to add the carbon price on fuel used for heavy on-road transport from 1 July2014.
  - Fuel costs were estimated to 20 per cent of freight costs to and from the farm. Therefore, the impact of the carbon price will affect 20 per cent of the freight cost, with this increase being delayed until July 2014.

2.2 Farm and processing input shocks - change from baseline

	Chemicals	Power	Transport	Other
	%	%	%	%
2009-12	0.00	0.00	0.00	0.00
2012	0.55	9.78	0.00	1.49
2013	0.57	10.27	0.00	1.57
2014	0.60	10.79	0.62	1.65
2015	0.57	10.27	1.18	1.57
2016	0.60	10.79	1.24	1.65
2017	0.63	11.33	1.30	1.73
2018	0.66	11.89	1.36	1.82
2019	0.70	12.48	1.43	1.91
2020	0.73	13.11	1.50	2.00
2021-25	0.73	13.11	1.50	2.00

Source: Growcom, 2012 and CIE.

Potential economywide impacts of the carbon mechanism

Other dimensions important to capture in the simulation of the carbon pricing impact on the horticultural sector are changes to the exchange rate, real wages and real consumption.

Exchange rate

It is well documented throughout the literature that the carbon price is projected to depreciate the exchange rate. Treasury modelling estimated that the pricing of fugitive emissions in coal and gas production would lower Australia's exchange rate making other trade-exposed industries such as agriculture more competitive (Whittle et al, 2011).

This is also documented through other non-government sources of modelling. In 2009, Frontier Economics projected the economic impact of the Carbon Pollution Reduction Scheme (CPRS). It suggested that the reduction in competitiveness of emissions-intensive trade-exposed industries products more than outweighed the currency depreciation of the exchange rate, resulting in declining exports in those sectors (Frontier Economics, 2009). However, other industries, which were less energy intensive, would benefit from the currency depreciation and expand as a result (Frontier Economics, 2009). Such industries broadly were expected to include agriculture.

The Frontier Economics report models the medium and long term impact of carbon pricing. The model results indicate that in the medium run, a depreciation in the exchange rate of 0.8 per cent from the baseline could be expected. In the longer run, the rate of depreciation would be higher.

This is consistent with other literature and as such, is employed in the CIE's modelling.

Impact on real wages

The labour intensity of most horticultural enterprises, especially in harvesting, means that wage levels are a critical issue. Real wages fall across the economy as the demand for and marginal value of labour in emissions-intensive trade-exposed industries falls. The result from the Frontier Economics report indicate that by 2020, the average level of real wages could *fall* by 1.63 per cent compared to the situation without the carbon price mechanism. This could provide a significant stimulus to many parts of horticulture as these changes are expected to translate to lower wages in full and part time employment in key horticultural regions. In line with the Frontier Economics research, we employ a negative shock to real wages of 1.63 per cent in the medium term by 2020.

Impact on real consumption

Another key parameter change is the level of household disposable income and consumption, which are expected to fall in the medium and long term. Due to the weaker terms of trade and lower household incomes, domestic consumption levels fall in the medium term by approximately 0.4 per cent (Frontier Economics, 2009).

3 Carbon mechanism impact on horticulture

The Treasury previously projected long run average growth in gross output across the agricultural sector of 1.2 per cent each year from 2009-10 to 2019-20 (Whittle et al, 2011). The primary drivers of this projected growth is a reduction in the exchange rate and lower wages, allowing for less emissions-intensive parts of the economy to grow more rapidly (Australian Government, 2011).

The CIE's projections detailed in this chapter also suggest that growth in the gross output of the horticulture sector will be positive over the decade from 2009-10 to 2019-20 despite the introduction of carbon pricing. In aggregate, farm gate GVP may grow on average by 0.66 per cent each year, compared to 0.76 per cent in the absence of the carbon price.

While the horticultural sector continues to grow over the period, the expected reduction in the exchange rate and real wages in the medium term is too modest to mitigate other economic changes induced by the carbon pricing mechanism. Agricultural producers are not able to pass on all additional input costs to consumers, and higher production costs make them less competitive in export markets which translates into a fall in the quantity of exports. Importantly, household demand falls across most categories due to a reduction in household income while substitute products are readily available from international markets. This is reflected in terms of lower domestic production and higher imports compared to without a carbon price. The processing sector, which is highly trade-exposed, is particularly affected by carbon pricing.

Carbon price impact on sectoral value

The modelling outputs are presented below for 2015 and 2020 in terms of the *change* in key economic parameters with the carbon price compared to the baseline or the without carbon pricing scenario. The results confirm that the implementation of the carbon price results in a modest fall in the value of the sector.

The 'without carbon price' baseline used in this analysis reflects the reality that the ratio of prices to costs of horticultural commodities has fallen over time, yet production has risen. This is due to two factors:

- increasing demand across and the horticulture category primarily as the result of population growth
- the impact of productivity across the industry.

An important assumption of this analysis is that horticulture industries ***do not*** respond to the introduction of carbon pricing mechanism through the adaptation of existing or new technologies to offset the cost increases.

- In practice, knowledge of how industries could potentially increase their productivity above current levels would be very difficult to assess.
- If these cost saving technologies are already available to them and are cost effective, they would have been adopted and be in the 'without' carbon pricing case.

Gross value of production

At the farm gate level, sectoral gross value of production (GVP) falls for product sent to both fresh and processed markets. In absolute terms, the impact is very similar for both the fresh and processing sector. In terms of the percentage change, however, the impact is more significant for producers sending product to processing markets (see table3.1).

- The value of 'amenity' horticultural production, comprised by turf, cut flowers and nursery products, also reduces in value by a modest amount.

3.1 Farm gate gross value of production

	Change in millions of dollars		Percentage change	
	2015	2020	2015	2020
Fresh	-25.4	-35.5	-0.6	-0.7
Processed	-25.3	-33.9	-2.2	-3.1
Amenity	-6.9	-11.9	-0.4	-0.6
Total	**-57.6**	**-81.3**	**-0.8**	**-1.0**

Source: CIE.

The combined impact in 2015 is a reduction in farm gate GVP of $57.6 million or 0.8 per cent. In 2020, as a result of a higher carbon price, farm gate GVP is projected to fall by $81.3 million or to 1.0 per cent.

Table 3.2 shows the magnitude of the impact on GVP across 19 sectors in terms of wholesale prices. Whereas table 3.1 shows just the change in farm gate GVP, table 3.2 incorporates farm gate GVP as well as handling, packing, transportation and wholesale margins. Subsequently, the impact to GVP measured at the wholesale level is greater than when measured at the farm gate level because of the reduction in output and associated reduction in post-farm gate activity.

In percentage terms, the sectors affected the most by the carbon pricing mechanism include juice, processed vegetables, processed fruit and nuts, citrus and stone fruit. In absolute terms, the largest impact is to other vegetables, juice, root vegetables and processed vegetables — reflecting both the size of the change in and the value of the sector.

These sectors are orientated towards and/or exposed to international markets. They generally have difficultly passing on higher costs to customers, which are sensitive to changes in prices.

3.2 Change in wholesale GVP by sector

	Change in millions of dollars		Percentage change	
	2015	2020	2015	2020
Pome fruit	-2.7	-3.6	-0.3	-0.4
Stone fruit	-3.0	-3.8	-0.9	-1.1
Berries	-1.7	-2.1	-0.3	-0.4
Kiwifruit	-0.1	-0.1	-1.2	-1.4
Citrus	-6.5	-7.9	-1.1	-1.3
Grapes	-1.9	-2.2	-0.8	-0.9
Other temperate fruit	0.0	-0.1	-0.2	-0.4
Tropical fruit	-6.2	-8.6	-0.6	-0.7
Olives	-4.0	-5.8	-0.7	-0.9
Nuts	-5.4	-7.2	-0.7	-0.9
Root vegetables	-11.4	-15.3	-0.7	-0.9
Other vegetables	-19.0	-24.3	-0.7	-0.9
Nursery	-6.2	-10.6	-0.4	-0.6
Turf	-0.9	-1.5	-0.6	-0.8
Cut flowers	-0.8	-1.5	-0.2	-0.4
Processed vegetables	-10.1	-12.7	-1.6	-2.0
Processed fruit and nuts	-3.9	-4.9	-1.4	-1.7
Juice	-16.1	-22.6	-3.6	-6.0
Olive oil	-0.4	-0.7	-0.8	-0.9
Total	**-100.4**	**-135.6**	**-0.8**	**-1.0**

Source: CIE.

Gross value added

Gross value added (GVA) provides a measure of horticulture's profitability and its contribution of value added to the economy. It is simply the difference between GVP and the costs of intermediate inputs used in production.

The carbon pricing mechanism causes GVA) to fall by ***more*** than the reduction in the gross value of production because horticulture cannot pass all of these costs onto consumers. Lower economic activity reduces income and wages, resulting in a reduction in the demand across all fresh commodities as well as nuts and processed vegetables. For this reason, and due to price sensitivity, higher inputs do not lead to higher prices received for horticulture (see further below).

The impact of carbon pricing on GVA is provided in table 3.3 for fresh, processed and other horticultural products.

In 2015, compared to the without carbon pricing scenario, the GVA of fresh horticultural products is 1.8 per cent less and the GVA of horticultural products for processed markets is 4.9 per cent less. Due to the relative size of the fresh sector, however, it experiences the greatest reduction in value in absolute terms. Across all sectors, the GVA of the

horticultural sector is expected to be $78.0 million or 1.9 per cent smaller with the carbon pricing arrangements in 2015 than without.

3.3 Change in gross value added

	Change in millions of dollars		Percentage change	
	2015	2020	2015	2020
Fresh	-49.1	-67.4	-1.8	-2.1
Processed	-14.2	-16.9	-4.9	-6.1
Amenity	-14.8	-22.2	-1.2	-1.5
Total	**-78.0**	**-106.5**	**-1.9**	**-2.2**

Source: CIE.

In 2020, compared to without the carbon price, total GVA is $106.5 million lower than the case without carbon pricing. In absolute terms, the impact on GVA is largest for fresh products which falls by $67.4 million or 2.1 per cent. In percentage terms, horticultural products for the processing sector may fall the most by 6.1 per cent or $16.9 million.

Table 3.4 shows the impact of carbon pricing on GVA by sector. The value of all sectors is lower in both the short and medium term.

3.4 Change in gross value added by sector

	Change in millions of dollars		Percentage change	
	2015	2020	2015	2020
Pome fruit	-3.1	-4.2	-1.1	-1.3
Stone fruit	-2.3	-2.9	-1.9	-2.3
Berries	-3.2	-4.2	-1.0	-1.2
Kiwifruit	-0.1	-0.1	-3.1	-3.4
Citrus	-4.9	-6.5	-2.7	-3.1
Grapes	-1.1	-1.5	-2.3	-2.6
Other temperate fruit	-0.2	-0.2	-1.6	-2.0
Tropical fruit	-7.5	-10.5	-2.1	-2.5
Olives	-1.3	-1.9	-2.0	-2.4
Nuts	-4.7	-6.6	-2.1	-2.6
Root vegetables	-9.2	-12.8	-2.0	-2.3
Other vegetables	-11.7	-16.0	-1.8	-2.2
Nursery	-10.4	-15.6	-1.2	-1.4
Turf	-1.5	-2.3	-1.2	-1.5
Cut flowers	-2.9	-4.2	-1.6	-1.9
Processed vegetables	-5.0	-6.0	-3.6	-4.5
Processed fruit and nuts	-2.4	-3.0	-3.7	-4.4
Juice	-6.7	-7.7	-8.0	-11.6
Olive oil	-0.1	-0.1	-2.0	-2.3
Total	**-78.0**	**-106.5**	**-1.9**	**-2.2**

Source: The CIE.

Competitiveness in domestic and export markets

The carbon price reduces the competitiveness of Australian horticultural products in both domestic and export markets as shown in table 3.5. The reduction in the exchange rate in the medium term is not sufficient to offset higher input costs attributed to the carbon pricing mechanism. In 2015, the carbon price induces a fall in exports of 2.0 per cent, or by $11.7 million, while imports increase by 0.6 per cent or $17.2 million.

The sectoral terms of trade worsens further in 2020, with $15.7 million of additional exports and $20.7 million less imports compared to the baseline scenario.

3.5 Change in exports and imports of horticultural products

	Change in millions of dollars		Percentage change	
	2015	2020	2015	2020
Exports	-11.7	-15.7	-2.0	-2.4
Imports	17.2	20.7	0.6	0.7

Source: CIE.

Price and quantity movements

Further detail is provided below on how carbon pricing impacts average prices and the quantity of output across different sectors of horticulture. Changes in prices and quantities are the result of adjustments to supply and demand due to economic changes attributed to carbon pricing identified in chapter 2.

Level of household demand

In the domestic market, household consumption decisions are impacted by a reduction in income and real wages (table 3.6). Overall demand for fresh fruit and vegetables, as well as the demand for nuts and processed vegetables, falls. The magnitude of this change is relatively small; nonetheless this indicates that households will consume less horticultural products than would otherwise be the case without a carbon price at any given price level (the demand curve shifts downwards). However, the demand for processed fruit increases considerably as consumers substitute fresh for processed fruit consumption.

3.6 Change in household demand

	2015	2020
	%	%
Fresh fruit	-0.14	-0.18
Fresh vegetables	-0.10	-0.13
Nuts	-0.12	-0.16
Processed fruit	0.12	0.15
Processed vegetables	-0.24	-0.30

Source: CIE.

Quantity of production

The quantity of production falls across the broad categories identified in table 3.7. These falls reflect the small reduction in domestic demand and a worsening of producer's cost price situation compared to the without carbon price scenario. That is, there is little scope to pass these additional costs on.

Importantly, the quantity of output falls more significantly for processed product markets due to the sensitivity of their customers and consumers to changes in the price paid. For other horticultural products, output is basically unchanged despite higher input costs.

3.7 Change in quantity of production

	2015	2020
	%	%
Fresh	-0.63	-0.73
Processed	-1.97	-2.91
Amenity	0.02	0.05

Source: CIE.

Table 3.8 shows the change in quantity of output by sector. The fall in the quantity of output is also relatively large (more than one per cent) for citrus, processed vegetables and processed fruit and nuts. All of these have significant trade exposure.

3.8 Change in quantity of output by sector

	2015	2020
	%	%
Pome fruit	-0.0	0.0
Stone fruit	-0.6	-0.8
Berries	0.0	0.2
Kiwifruit	-0.9	-0.9
Citrus	-1.3	-1.7
Grapes	-0.6	-0.6
Tropical fruit	- 0.4	-0.5
Olives	-0.2	-0.2
Nuts	-0.4	-0.5
Root vegetables	-0.5	-0.5
Other vegetables	-0.9	-1.1
Nursery	0.0	0.1
Turf	0.0	0.0
Cut flowers	-0.2	-0.1
Processed vegetables	-1.2	-1.6
Processed fruit and nuts	-1.0	-1.3
Juice	-3.6	-6.2
Olive oil	-0.2	-0.2

Source: CIE.

Price adjustments

In response to higher input costs, average prices remain broadly unchanged for fresh products at both the farm gate and wholesale level (see table3.9).

Small price improvements are received for citrus as well as 'other' vegetables (see table 3.10). However, the majority of individual categories actually experience small falls in price associated with a modest reduction in the demand for and consumption of fresh fruit and vegetables across all categories.

These results confirm that virtually all of the cost increases that result from the carbon price mechanism, are not passed onto consumers but born by producers in terms of lower profitability.

3.9 Change in farm gate prices

	Change in farm gate price - 2015	Change in farm gate price - 2020
	%	%
Fresh	0.04	-0.01
Processed	-0.20	-0.18
Amenity	-0.42	-0.64

Source: CIE.

3.10 Change in farm gate prices by sector

	Change in farm gate price - 2015	Change in farm gate price - 2020
	%	%
Pome fruit	-0.5	-0.7
Stone fruit	-0.4	-0.5
Berries	-0.4	-0.5
Kiwifruit	-0.5	-0.7
Citrus	0.2	0.4
Grapes	-0.5	-0.6
Tropical fruit	-0.2	-0.3
Olives	-0.7	-0.8
Nuts	-0.2	-0.3
Root vegetables	-0.3	-0.5
Other vegetables	0.6	0.7
Nursery	-0.5	-0.7
Turf	-0.6	-0.8
Cut flowers	-0.1	-0.3
Processed vegetables	-0.4	-0.4
Processed fruit and nuts	-0.4	-0.5
Juice	0.0	0.2
Olive oil	-0.6	-0.7

Source: CIE.

Adjustments in the quantity of exports and imports

For producers competing in export markets, the reduction in the exchange rate is not sufficient to offset the increase in input costs. This results in a reduction in the volume of exports across most categories. For the reasons, higher costs for the domestic sectors make imports more competitive compared to the without carbon pricing scenario.

Table 3.11 shows the impact to exports and imports by individual commodities, organised from the most impacted to least impacted. Note that the results in percentage changes do not reflect that traded volumes in some categories are quite small

3.11 Quantity of exports and imports by commodity

	Change in quantity - 2015		Change in quantity - 2020	
	Exports	Imports	Exports	Imports
	%	%	%	%
Other tropical fruit	-8.0	1.9	-9.3	2.3
Processing tomatoes	-5.9	**5.9**	-9.4	**9.5**
Lettuce	-4.2	4.5	-5.1	5.5
Fresh tomato	-3.6	3.6	-4.1	4.0
Mushrooms	-3.6	3.2	-4.2	3.8
Juice	-3.3	3.1	-4.8	3.4
Macadamia	-3.1	2.9	-3.8	2.5
Other vegetables	-3.1	0.2	-3.9	0.2
Broccoli	-3.1	3.0	-3.7	3.0
Melons	-3.0	3.0	-3.3	3.2
Pumpkins	-3.0	2.9	-3.3	3.0
Carrots	**-2.9**	2.8	**-3.0**	2.8
Cauliflower	-2.7	2.8	-2.9	3.0
Cut flowers	-2.7	1.0	-2.7	1.0
Mandarins	**-2.7**	2.3	**-3.0**	2.4
Capsicum	-2.7	2.3	-3.0	2.6
Pineapples	-2.7	1.9	-3.2	2.1
Sweet corn	-2.6	1.1	-2.9	1.2
Pears	-2.4	0.8	-2.8	0.7
Bananas	-2.3	1.1	-2.6	1.0
Canned tomato	-2.2	1.8	-3.0	2.1
Table grapes	-2.1	0.5	-2.5	0.5
Strawberries	-2.1	2.1	-2.3	2.4
Onions	-2.1	1.3	-2.2	1.5
Oranges	-2.1	1.1	-2.3	1.1
Garlic and herbs	-2.0	1.8	-2.1	1.9
Asparagus	-2.0	0.0	-2.3	0.0
Peas and beans	-1.8	1.6	-2.0	1.8
Mangos	-1.8	1.7	-1.8	1.7

	Change in quantity - 2015		Change in quantity - 2020	
	Exports	Imports	Exports	Imports
	%	%	%	%
Potatoes	-1.7	1.3	-1.7	1.2
Kiwifruit	-1.6	0.2	-1.8	0.2
Processed fruit and jams	-1.4	1.7	-1.7	1.8
Dried grapes	-1.4	0.4	-1.6	0.5
Summerfruit	-1.3	1.4	-1.5	1.4
Other processed vegetables	-1.2	0.8	-1.5	0.9
Avocados	-1.2	1.0	-1.3	1.1
Apples	-1.1	0.5	-1.2	-0.2
Almonds	-1.1	1.3	-1.2	1.4
Other citrus	-1.0	0.5	-1.1	0.5
Nursery	-0.9	0.4	-0.7	0.3
Frozen potatoes	-0.8	0.6	-1.0	0.6
Other nuts	-0.8	0.7	-0.9	0.9
Olives	-0.8	0.5	-1.0	0.6
Cherries	-0.8	-0.1	-0.8	-0.2
Olive oil	-0.5	0.5	-0.6	0.7
Turf	-0.3	0.1	0.2	0.0
Rubus	-0.1	0.1	0.0	0.1

Source: CIE.

4 Sensitivity analysis

The most uncertain parameter associated with the projected impact of the carbon arrangements is the carbon price itself. As previously mentioned, the Australian government is considering an earlier transition from the fixed carbon price to the emissions trading scheme. In order to be an emissions trading scheme which is linked to international markets, rather than a tax, the floor price would need to fall to accommodate the direction of current international prices. While the results presented in chapter 3 could be considered the upper bound impact, the altered carbon price trajectory based on an earlier transition to emissions trading could be considered the lower bound.

Alternative carbon price trajectory

Recently, the international carbon price has been trading a very low levels. Over the counter prices for EU credits have maintained around 5 euros per ton. An obvious alternate scenario to that used in chapter 3 could involve a price of less than A$10 per ton depending on the exchange rate.

However, European prices are expected to increase over time as authorities take action to withhold the release of permits with the objective of propping up carbon prices.[1] We have therefore assumed, that the carbon price reaches A$10 per tonne by the end of 2014 as shown in table 4.1. By 2020, the carbon price increases to $15 per tonne, or roughly half of the price modelled in the results discussed above.

4.1 Alternative price trajectory

Year	Carbon price
	$ per tonne
2009-12	0
2012	23.0
2013	24.1
2014	10.0
2015	10.7
2016	11.4
2017	12.3
2018	13.1
2019	14.0

1 http://www.businessspectator.com.au/news/2014/1/29/carbon-markets/eu-carbon-rises-fast-track-supply-cut-hopes

Year	Carbon price
2020	15.0
2021-25	15.0

Source: CIE.

A lower carbon price trajectory would be associated with lower input cost pressure, as well as softer macroeconomic effects to the exchange rate and household income. In the lower bound scenario, we have scaled the input cost increases and macroeconomic effects proportionately to the reduction in carbon price trajectory.

Range of expected values

The results of the modelling presented in tables 4.2 and 4.3 show the potential range of economic outcomes that could be expected from the introduction of carbon pricing. It shows that an annual reduction in farm gate GVP of between 0.4 per cent and 0.8 per cent may be expected by 2015, and a 0.5 to 1.0 per cent reduction by 2020. By 2020, the value of the sector could be $81.3 million less under carbon pricing, although a smaller carbon price is expected to moderate this impact significantly.

4.2 Change in farm gate GVP

	2015		2020	
	Lower carbon price trajectory	Upper carbon price trajectory	Lower carbon price trajectory	Upper carbon price trajectory
Change in farm gate GVP – percentage terms				
Fresh	-0.3	-0.6	-0.4	-0.7
Processed	-1.0	-2.2	-1.5	-3.1
Other	-0.2	-0.4	-0.3	-0.6
Total	**-0.4**	**-0.8**	**-0.5**	**-1.0**
Change in farm gate GVP – $millions				
Fresh	-11.3	-25.4	-17.3	-35.5
Processed	-11.1	-25.3	-16.4	-33.9
Other	-3.1	-6.9	-5.7	-11.9
Total	**-25.5**	**-57.6**	**-39.4**	**-81.3**

Source: CIE.

In value added terms, the sectoral value may be worth up to $106.5 million less each year as a result of the carbon price (see table 4.3).

4.3 Change in gross value added

Key output	2015		2020	
	Lower carbon price trajectory	Upper carbon price trajectory	Lower carbon price trajectory	Upper carbon price trajectory
	%	%	%	%
Change in GVA – percentage terms				
Fresh	-0.8	-1.8	-1.0	-2.1
Processed	-2.2	-4.9	-3.0	-6.1
Other	-0.6	-1.2	-0.7	-2.5
Total	**-0.8**	**-1.9**	**-1.1**	**-2.2**
Change in GVA – $millions				
Fresh	-21.9	-49.1	-32.9	-67.4
Processed	-6.3	-14.2	-8.3	-16.9
Other	-6.6	-14.8	-10.8	-22.2
Total	**-34.8**	**-78.0**	**-52.0**	**-106.5**

Source: CIE.

Table 4.4 illustrates the potential impact of carbon pricing on export and import values. The annual value of net exports may fall by up to $18.9 million in the short term (by 2015) and $20.7 million in the medium term (by 2020).

4.4 Change in the value of exports and imports

Key output	2015		2020	
	Lower carbon price trajectory	Upper carbon price trajectory	Lower carbon price trajectory	Upper carbon price trajectory
Percentage change				
Exports	-0.9	-2.0	-1.2	-2.4
Imports	0.3	0.6	0.3	0.7
Absolute change ($million)				
Exports	-5.2	-11.7	-7.7	-15.7
Imports	7.5	17.2	10.2	20.7

Source: CIE.

Accumulative impact over time

Table 4.5 shows how the impacts of carbon pricing in millions of dollars accumulate over time. The accumulative impact of the carbon price is presented for the period 2012-20. A lower carbon price trajectory may reduce the loss in gross value added to the horticulture sectors by $425 million or 1.1 per cent of the business as usual outcomes for GVA. This loss could be as high as $762 million or 2 per cent of GVA under the upper carbon price trajectory.

4.5 Cumulative impact of carbon price on horticultural GVA (2012-20)[a]

Key output	Business as usual	Lower carbon price trajectory[a]	Upper carbon price trajectory[a]
	$ million	$ million	$ million
Fresh	25 074	-266.9	-480.9
Processed	2 584	-74.6	-132.4
Other	11 231	-83.3	-150.9
Total	**38 889**	**-424.8**	**-764.2**

[a] Simply addition of nominal values over the period 2012-20. [b] Change from baseline or business as usual GVA outcomes for the horticulture industry.

Source: CIE.

5 Regional analysis

The potential impact of the carbon arrangements on individual regions within the Australian horticulture industry depends on a range of factors:

- the relative energy intensity of each horticultural industry in each region and the intensity of individual businesses relative to the national average
  - For example, we know that some industries and even regions are more energy intensive than others to the increased use of cold storage (critical in the case of apples and many vegetables such as sweet corn) and more generally associated with irrigation.
- the mix of horticultural industries in regions (predominantly fruit or vegetable growing and the presence of amenity horticulture)
  - Many Australia regions have distinct profiles across each of the sectors. For example, the Lockyer Valley, Bundaberg and Bowen are predominantly vegetable growing areas servicing the fresh market along the east coast.
- the level of international trade exposure of industries and regions directly through the export or import of fresh product and indirectly through imports of processed fruit and vegetable products
  - Regions supplying fruit and vegetables for processing such as Murray Goulburn and Tasmania may be disproportionately impacted by higher input costs.

As identified earlier, the *Hi-Link* model is national model and as such has a representative cost structure (including chemicals, energy and transport) that spans:

- businesses of different sizes and levels of integration with packing across each of the production regions
- different production technologies especially outdoor versus indoor which is important for tomatoes, capsicums, cucumbers and lettuce.

At this point, the required data to distinguish businesses with different cost structures, especially for energy intensity, is simply not available. Solving this data gap would require a targeted cost benchmarking process between businesses.

We understand that the energy costs for greenhouse operations are significantly higher than for outdoors, but this is offset by higher yields per megalitre of irrigation for each hectare under cover. Energy use in storage is difficult to categorise across significant users such as the apple industry where product can be held both on-farm and off-farm at packing sheds.

In addition, it is difficult to quantify how producers react to the higher input costs which make prompt a switch to other energy sources (such as exempt fuels at a farm level) or taking energy efficiency initiatives in other cases.

Of the factors identified, the *Hi-Link* model and the analysis presented in this report are better equipped to capture:

- the regional or state production profiles across each of the model categories based on ABS production and gross value of production data (the second factor)
- the exposure of each industry to different market segments including international markets which determine what share of the additional costs can be passed onto customers (the third factor).

In line with the headline results, the overall impact on horticulture businesses at the state level, as shown in table 5.1 are reasonably modest. Increases in costs for energy related inputs are (partially) offset by a falling exchange rate and lower labour costs.

By 2020, the impact of the headline analysis in dollar terms is spread evenly between businesses producing fruit, vegetables and amenity horticulture. By state, the impacts are somewhat different as a result of the relative size and composition of each regioanl industry:

- businesses in Victoria and Queensland account for just over half of the fall in farm incomes on a national basis
  - Amenity horticulture is not only significant in terms of its absolute size but is distributed regionally in proportion to population.
- the most significant losers in dollar terms are Queensland vegetable producers but this largely reflects the contribution of this region to national production
- no attempt was made to allocate processing activities back to individual states because of their characteristic of importing ingredients from other regions. For example, virtually all vegetables grown in northern Tasmania are processed in Victoria.

5.1 Change in value added by region

		NSW	VIC	QLD	SA	WA	Tas	NT	ACT	Australia
		$m	$m	$m	$m	$m	$m	$m	$m	$m
Change in value added by region										
Fruit	$m	-6.2	-9.5	-10.0	-3.1	-3.2	-0.6	-1.1	0.0	-33.6
Nuts	$m	-1.5	-3.3	-0.7	-1.5	0.0	0.0	0.0	0.0	-7.1
Vegetables	$m	-3.3	-6.8	-9.9	-6.5	-3.5	-2.6	0.0	0.0	-32.7
Amenity	$m	-5.2	-7.5	-4.8	-0.9	-2.1	0.0	-0.1	0.0	-20.6
Farm level	$m	-16.2	-27.1	-25.4	-12.0	-8.8	-3.2	-1.3	0.0	-93.9
Processing level	$m									-23.3
Change in value added by region										
Fruit	%	-2.0	-1.9	-2.3	-2.6	-2.4	-1.1	-2.7	0.00	-2.1
Nuts	%	-3.5	-2.4	-6.0	-2.4	-2.4	-2.0	0.0	0.00	-2.7
Vegetables	%	-2.5	-2.5	-2.4	-2.6	-2.6	-2.6	-2.3	0.00	-2.5
Amenity	%	-1.5	-1.5	-1.4	-1.4	-1.5	0.0	-1.5	0.00	-1.4
Farm level	%	-1.9	-1.9	-2.1	-2.4	-2.1	-2.1	-2.4	0.00	-2.0
Processing level										-8.4

Source: CIE.

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