



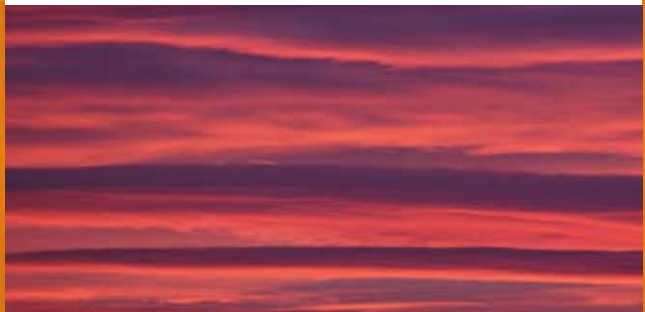
# *issues* insights

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*Effects of the Carbon  
Pollution Reduction Scheme  
on the economic value  
of farm production*

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# Effects of the Carbon Pollution Reduction Scheme on the economic value of farm production

## Introduction

As part of ABARE's ongoing analysis of issues around the inclusion of agriculture in the Carbon Pollution Reduction Scheme (CPRS), this paper assesses the effects of the recently announced changes to the CPRS on the economic value of farm production. The economic value of farm production is a measure of net farm cash income (defined as total cash receipts minus total cash costs) after accounting for the value of any change in stocks over the period.

Given the limitations of the estimation methodology used, the estimates presented in the paper should be treated as indicative of the likely initial policy effects. The aim of this analysis is to contribute to the existing body of knowledge about the potential impacts of the CPRS made by the industry and other agencies, as well as to highlight that the overall effects of the CPRS on agriculture must include the subsequent round of adjustment effects that can be expected to occur following the introduction of the scheme.

The CPRS is an emissions trading scheme which will commence in 2011, according to the most recent announcement by the Australian Government. According to the revised CPRS, the emission price in the first year will be fixed at \$10 a tonne of carbon dioxide equivalent (t CO<sub>2</sub>-e). A global recession buffer for five years will be added to the existing Emissions Intensive Trade Exposed (EITE) assistance, and there will be a conditional 2020 emissions reduction target of 25 per cent below 2000 levels. The White Paper indicates that the government is disposed to include agriculture in the scheme by 2015.

Like all sectors of the economy, agriculture will face higher input costs because of the CPRS from 2011. This is a direct result of placing a price on non agricultural greenhouse gas emissions. There may also be a CPRS related cost-price pass-through from downstream processors to farmers that lowers the prices farmers receive for their produce. Understanding the likely implications of the CPRS, including both the extent of possible on-farm input cost increases and farm-gate price changes, is important to assist the sector in preparing for the scheme's introduction and for agriculture's possible inclusion in the scheme from 2015.

## The analytical framework

The robustness of any estimate of the likely effects of the CPRS on any part of the economy is driven largely by the application of an appropriate analytical framework which allows for the possible uptake of abatement technologies and activities, possible changes to management

practices, scale of operations, input and output mixes, and likely changes to consumer preferences, in response to an emissions price. The strength of estimates also depends on how accurately the actual design features of the CPRS, including its transitional assistance measures (fuel tax arrangements, EITE assistance), are accounted for.

The appropriate framework for assessing the effects of the CPRS is a computable general equilibrium (CGE) framework, which incorporates important interactions between various parts of the economy, possible changes in production and consumption decisions in response to changes in policies and prices, and accounts for any direct and flow-on effects of the CPRS on the economy and any sector of interest. The CGE analysis usually involves a complex system of equations to represent various interactions in the economy and requires extensive real-world data sets.

Recently, ABARE has published its analysis of the likely long-term CPRS effects on agriculture, focusing on the possible effects in 2020 and 2030, using its dynamic global CGE model, GTEM (Ford et al. 2009). The results of this analysis show an estimated production increase of grains of around 5 per cent in 2030 relative to the baseline case (no CPRS) and production decline of around 8 per cent for beef cattle and sheep meat.

In the short run (e.g. in 2011), unlike in the long run, market participants may not be able to adjust fully and flexibly to changes in policies and prices. Therefore, to assess the short-term effects of a policy such as the CPRS, substantial refinements to ABARE's GTEM framework, where parameter values and economic environments (in technical terms, model closures) are currently set for long-term policy simulations, would be required. Work on such refinements is currently in progress. In the meantime, an initial impact analysis has been undertaken for assessing the potential immediate effects of the CPRS at the farm level in 2011 and 2015. Given the nature of the estimation methodology, the results presented in this paper should be viewed as upper bounds of possible effects as these do not (at this point) include any changes in production and consumption activity in response to policy and price changes. Some of the likely future responses to price changes (particularly beyond 2011) include:

- changes in input and output mixes by farmers in response to changes in relative prices of inputs, products and profitability
- changes in technologies or management practices which reduce emissions in response to the introduction of an emissions price
- changes in consumption and associated effects on prices and production levels which would occur as consumers switch from more emissions intensive to less emissions intensive substitutes (e.g. from red meat to grains) in response to changes in the relative prices of commodities under the CPRS.

This analysis assumes that only the prices of the major energy/emission intensive inputs (electricity, fuel and freight) are to increase because of the introduction of the CPRS. It is expected that the price of other inputs may increase because of the emission price being applied across the economy. However, these price changes have been omitted from this analysis. This initial impact analysis also does not allow for economy-wide changes in the cost of labour and capital and any resultant reallocations of these factors of production which are likely to occur because of any contraction of the economy under the CPRS.

# The likely effects of the CPRS on the economic value of farm production

## The farm financial model

Even if the agriculture sector is not a covered sector under the CPRS, agricultural producers will face increased input costs associated with the use of electricity, fuels and freight and may face lower farm-gate prices for their goods from downstream processors. These will have implications for the economic value of farm production.

The major energy intensive inputs used by agricultural producers and processors which are identified and analysed in this paper include electricity, fuel and freight. As outlined in the White Paper and in draft legislation, agricultural producers will receive a CPRS fuel credit for the first three years of the CPRS to offset the increased cost of fuel as a result of the CPRS (DCC 2008). Heavy on-road transport will also receive a fuel credit for the first year of the scheme.

The production of fertiliser and chemicals is an energy intensive process, therefore, domestic fertiliser and chemical producers will face significantly higher input costs. If producers could pass on their increased input costs then the price of these goods would increase. However, the scenarios analysed in this paper assume no increase in the price of fertiliser or chemicals to reflect that these are highly traded products. International producers which export to Australia are assumed not to face the same increase in input costs and therefore, international competition will mean domestic producers are unlikely to be able to drive up the price of fertiliser and chemicals in Australia.

The agricultural (food and fibre) processing sector will be included in the CPRS from the commencement of the scheme in 2011. Therefore, agricultural processors with emissions of more than 25 kilotonnes of carbon dioxide equivalent (kt CO<sub>2</sub>-e) will be required to purchase permits for their emissions and will face increased costs for their inputs. These emissions and costs will mostly be associated with wastewater management, transport and electricity usage. The processing sector is highly trade exposed and so it is expected that the full extent of increased costs will not be passed on to consumers. It is likely that some of these increased costs to the processor will be passed on to agricultural producers in the form of lower prices paid for the inputs to the processing sector such as wool, livestock and milk, etc. The extent of the cost-price pass-through depends on a range of complex interrelated factors, and is purely an empirical issue.

Determining the extent to which prices paid to farmers will decline is a difficult task for a number of reasons including:

- not all processors will be above the 25 kt CO<sub>2</sub>-e emissions threshold
- there is limited information about the emissions and cost structure of processors
- there is limited understanding of the degree of cost-price pass-through downstream to wholesalers and consumers and upstream to agricultural producers. Understanding the degree of cost-price pass-through requires extensive data analysis and econometric estimates of supply and demand.

## Scenarios

Given the lack of empirical estimates and analyses on the rate of cost-price pass-through in agricultural industries, a sensitivity around the potential effects of the CPRS has been undertaken assuming different rates of cost-price pass-through: 0, 20, 60 and 100 per cent. For example, in the case of 100 per cent cost-price pass-through, it is assumed that agricultural processors pass all of the additional costs associated with the CPRS back to agricultural producers through lower prices for agricultural inputs purchased. As it is unlikely that 100 per cent cost-price pass-through will occur, other things being the same, this represents an upper bound of the effects of the CPRS on agricultural producers.

The 60 per cent cost-price pass-through scenario roughly represents a situation where processors export the majority of their production taking prices set in the international markets as given, but have some control over prices charged for domestic sales. As processors are unable to adjust the price to international consumers for the majority of their production, approximately 60 per cent of the production cost increases associated with the CPRS is assumed to pass back to farmers supplying key commodity inputs to processors.

For each assumed cost-price pass-through rate, a set of three CPRS scenarios are analysed (table 1). The three CPRS scenarios are consistent with the government's most recent policy announcement, and have been considered to examine the likely effects of the CPRS in:

- 2011 when agriculture is not included in the scheme
- 2015 when agriculture is not included in the scheme
- 2015 when agriculture is included in the scheme.

## On-farm input costs

The analysis uses ABARE's farm survey data on average input costs for the years 2003-04 to 2007-08 for six industries: wheat and other crops; mixed livestock-crops; sheep; beef; sheep-beef; and dairy. For a definition of these industries see Hooper et al. (2008). The input costs for fuel, freight, electricity and other costs were averaged for the five years for each industry. In table 2, the relative cost shares of each input for each agricultural industry are shown. For most of the agricultural industries, the highest share of input costs is fertilisers and fuels; electricity represents only a small proportion of farm input costs.

## Estimated increases in on-farm input costs under the CPRS

The government has stated that the emission price in 2011 will be capped at \$10 per tonne of carbon dioxide equivalent (t CO<sub>2</sub>-e). The price of emissions after 2011 will be determined by the domestic permit market (as well as rules around access to international markets) and will not be known until after the scheme commences. Therefore, for simplicity, the analysis undertaken here assumes an emission price equal to that projected by the Treasury (Australian Government 2008): a price of \$20/t CO<sub>2</sub>-e in 2010 (in 2005 dollars) increasing on average at 4 per cent a year. The financial information from ABARE's farm survey data is recorded in 2007-08 dollars; therefore, to ensure consistency between the historical costs and the assumed emission price, the emission price was converted into 2007-08 dollar terms when the analysis was conducted.

The increase in the price of fuel in 2015 was calculated to be 10.4 per cent. This estimation was based on the carbon content of diesel fuel of 2694 grams of carbon dioxide equivalent per litre (NGGI 2007) and an average diesel price of 72.04 cents a litre for 2003-04 to 2007-08 (in 2005 dollars; ABARE 2008a). The increased price of freight is assumed to be equal to the increase in fuel prices, multiplied by the share of fuel in total inputs for the freight industry and is 1.9 per cent in 2015. The increase in the price of electricity, estimated to be 6.9 per cent in 2011 and 24 per cent in 2015, is based on an estimated average emission intensity of 834 grams of carbon dioxide equivalent per kilowatt hour and an average retail electricity price of around 10 cents a kilowatt hour (ABARE 2008b).

## 1 Key features of scenarios <sup>a</sup>

feature	2011 agriculture not covered	2015 agriculture not covered	2015 agriculture covered
<b>Coverage of the scheme</b>	Agricultural emissions not covered	Agricultural emissions not covered	Agricultural emissions covered
<b>Transitional assistance</b>	None	None	Livestock and rice producers receive 89.7 per cent of permits free to cover emissions associated with on-farm production and increased cost of electricity
<b>Increased costs to agricultural producers</b>	Electricity	Electricity, fuel and freight	Electricity, fuel, freight and emissions
<b>Increased costs to agricultural processors</b>	Electricity and own emissions	Electricity, fuel, freight and own emissions	Electricity, fuel, freight and own emissions
<b>Emissions price <sup>b</sup></b> (A\$/t CO <sub>2</sub> -e)	10	28	28

<sup>a</sup> No allowance was made for the scale of operation, flow-on effects of increased costs of inputs other than those discussed or any price interactions between the inputs. <sup>b</sup> The emissions prices are reported in 2011 dollars for the 2011 emission price (\$10) and 2005 dollars for the 2015 emission price (\$28).

## 2 Per cent share of inputs to total farm costs average over 2003-04 to 2007-08

	all broadacre industries	wheat and other crops	mixed livestock- crops	sheep	beef	sheep- beef	dairy
Electricity	0.8	0.7	0.8	1.1	0.8	1.0	2.6
Freight	3.2	4.5	3.2	2.3	2.7	2.4	1.1
Chemicals	6.0	12.4	7.6	2.9	0.9	2.0	0.6
Fertiliser	9.5	15.3	12.0	8.2	3.1	6.9	7.4
Fuel	7.6	9.8	8.8	6.9	5.5	5.4	3.7
Other costs <sup>a</sup>	72.8	57.3	67.7	78.5	87.0	82.4	84.6

<sup>a</sup> Other costs includes cash costs for labour and equipment.

The assumed increase in the prices of inputs was applied to the average input costs over the period 2003-04 to 2007-08. As discussed earlier, it is assumed that agricultural producers do not change behaviour in response to changed input costs.

## Emission costs in agriculture at 2015

The agriculture sector may be required to participate directly in the CPRS from 2015 (the decision is to be made in 2013). Whilst the effects of coverage under the CPRS from 2015 have been modelled and compared with those under non-coverage, it is important to note that, according to the government's policy statement, if agriculture is not included in the CPRS, the sector will face alternative measures which impose an equivalent carbon cost. The point of policy obligation has not been decided. However, in this analysis it is assumed that if agriculture participates in the scheme, agricultural producers will be required to purchase emission permits to account for the emissions which occur on-farm. The cost of these emission permits has been estimated using activity levels and average emission factors. In the context of the analysis undertaken here, the point of policy obligation will not affect the change in the economic value of farm production if it is assumed that the full cost of permits for on-farm production are passed to the farmer.

The activity levels have been determined using farm survey data averaged for the years 2003-04 to 2007-08. The activity level (e.g. the number of cattle and sheep held) was multiplied by the emissions factor for the activity (table 3) to determine the level of emissions associated with each activity for an average farm in each industry. It is expected that some agricultural activities will be eligible for emissions intensive, trade exposed assistance. In particular, it is expected that beef cattle, sheep, dairy and rice will receive the higher rate of transitional assistance. The high rate of assistance in 2015 will be 89.7 per cent. This rate of assistance includes the global recession buffer announced by the government in May 2009.

To determine the cost associated with purchasing required emission permits, the calculated emissions for each industry were multiplied by the permit price in 2015. The emission cost associated with beef cattle, sheep, dairy and rice was then adjusted by the percentage of permits which will be provided free as transitional assistance, to find the net emission cost. This was added to the emission costs associated with cropping, to find the total emission cost for the average farm in each industry. Finally, the emission cost was added to the total input costs for each average farm. The final estimated increase in input costs is the per cent difference between this final input cost and the initial input cost without the CPRS.

### 3 National emission factors

	emissions kg CO <sub>2</sub> -e/head/year		emissions kg CO <sub>2</sub> -e/ha/year
Dairy cattle	3 212	Rice	4 725
Grazing beef cattle	1 657	Soil disturbance	22
Sheep	170	Fertiliser	5.3 (kg CO <sub>2</sub> -e/kt fertiliser)

Source: DCC (pers. comm.).

## Estimating the change in farm receipts because of increased processing sector costs

Under the CPRS, processors are required to purchase permits associated with methane emissions from their on-site wastewater treatment if they exceed the 25 kilotonne of carbon dioxide equivalent threshold. Together with the increased costs of energy and transport, it is likely that some of these CPRS costs will be passed on to agricultural producers, resulting in lower cash receipts for Australian farmers.

To estimate the increased costs of energy and transport in the agricultural processing sectors, the input-output details in the Australian Input-Output Table (ABS 2008b), which presents the flows of goods and services between industries/sectors in a typical year, is used in the absence of more recent and detailed industry level information. In table 4, the cost shares of major inputs for each processing sector are presented. Similar to on-farm input cost shares, electricity constitutes a small proportion of total input costs for processing sectors.

Wastewater emissions for each processing sector are provided in the National Greenhouse Gas Inventory (NGGI 2007). The cost is the product of wastewater emissions and the estimated emission price.

The increase in costs to the meat processing sector associated with the CPRS was allocated between beef, sheep, pigs and poultry, based on the share of inputs the processing sector sources from each industry. This distributed share was then divided by the number of animals slaughtered to determine the additional cost of processing on a per head basis. The costs to the dairy and grain processing sectors were divided by the volume produced by each sector, to determine the additional cost of processing per litre of milk and tonne of grain produced (table 5).

The cost per unit of production was multiplied by activity levels (averaged over 2003-04 to 2007-08) for each farm to determine the decrease in receipts for an average farm in each industry. The activity levels for beef and sheep were divided by the average life span of an animal to account for the fact that the decline in receipts is only realised at the time of slaughter.

### 4 Per cent share of input costs in agricultural processing sectors, 2004-05 <sup>a</sup>

	meat processing	dairy processing	grains processing
<b>Inputs</b>			
Livestock	57.2	0	0
Dairy cattle	0	34.7	0
Grains	0	0	9.9
Electricity	1.1	1.4	1.1
Fuel	0.1	0.4	0.4
Transport <b>b</b>	6.2	4.1	4.9
Other costs <b>b</b>	35.4	59.5	83.8

<sup>a</sup> The share estimates are based on the most recent input-output tables published by the ABS. Unlike the cost shares presented in table 2, the shares in this table are not based on data over the past five years. Also, the definitions of inputs in tables 2 and 4 differ and, therefore, are not directly compared. <sup>b</sup> Transport includes freight and other costs includes chemicals and labour.

Source: ABS 2008b.

It should be noted that only the primary effects of increased costs of energy and transport because of the CPRS are included in this analysis. It is possible that other suppliers may pass on their increased energy and transport costs to the processing sector. Ignoring the secondary effects of increased energy and transport costs may underestimate the effect on agricultural processors.

## 5 Estimated increase in the cost associated with processing on a per unit basis accounting for increased input costs and the purchase of emission permits

Sector	units (in 2007-08 dollars)	additional cost per unit of production	
		2011	2015
Beef processing	\$/head	1.83	7.60
Sheep processing	\$/head	0.17	0.72
Grains processing	\$/tonne	0.61	2.34
Dairy processing	\$/L	0.001	0.005

*Note:* The costs in 2015 apply to both the agriculture covered and the agriculture not covered scenarios. The difference between the 2011 and 2015 costs are because of the higher emission price in 2015 and the removal of shielding for freight and fuel.

It is also important to recognise that this methodology assumes that all processing points exceed the 25 kilotonne of carbon dioxide equivalent threshold and hence provides the upper bound on the total effects on the agricultural industry. Detailed information on the exact number of processing points which will fall under the 25 kilotonne threshold is not available. However, some estimates suggest that it may only be the largest five to 10 processors in each industry. Importantly, in most processing sectors, the largest processors are responsible for the majority of throughput.

## Estimated changes in the economic value of farm production because of the CPRS

The economic value of farm production is defined as farm cash income (total cash receipts minus total cash costs), adjusted for the economic value of the buildup in trading stocks. Buildup in trading stocks is the imputed value of all changes in the inventories of trading stocks during the financial year. It includes the value of any change in herd or flock size or in the stocks of wool, fruit and grains held on-farm. It is negative if stocks are run down. Farm cash incomes under the CPRS were calculated by determining cash costs and the cash receipts under the CPRS, based on the results obtained as outlined above, and subtracting the costs from receipts. Estimates of the likely changes to the buildup in trading stocks because of the introduction of the CPRS are not available and, hence, are assumed to remain unchanged in this analysis.

### The results

#### Increases in on-farm input costs in response to the CPRS

In table 6 the estimated increase in on-farm input costs because of the introduction of the CPRS are shown. This estimate was formed based on the input cost shares summarised in table 2, and the methodology and assumptions described earlier in this paper. Despite the estimated increase in electricity, fuel and freight prices, the increase in input costs because of the CPRS is relatively small because of the small contribution of these energy/emission intensive inputs in total farm costs and the receipt of transitional assistance in livestock in the 2015, agriculture covered scenario.

#### 6 Per cent increase in total on-farm input costs because of the CPRS relative to the average over 2003-04 to 2007-08 <sup>a</sup>

scheme coverage	agriculture not covered 2011	agriculture not covered 2015	agriculture covered 2015
accounting for increased price of:	electricity	electricity, freight and fuel	electricity, freight, fuel and cost of emissions (net of assistance)
<b>Emissions price</b> (A\$/t CO <sub>2</sub> -e) <sup>b</sup>	10	28	28
<b>Industry</b>			
All broadacre industries	0.06	1.0	1.9
Wheat and other crops	0.05	1.3	1.5
Mixed livestock-crops	0.05	1.2	1.7
Sheep	0.07	1.0	1.8
Beef	0.05	0.8	2.4
Sheep-beef	0.07	0.8	2.0
Dairy	0.18	1.0	1.5

<sup>a</sup> Calculations based on the cost structure in table 2 and the assumptions outlined in the methodology section. <sup>b</sup> The \$10 emission price for 2011 is in 2011 nominal dollars, the price of \$28 in 2015 is in 2005 dollars. To be consistent with the measure of the economic value of farm production, all these emissions prices have been converted to 2008 dollars.

## Decrease in farm receipts because of the CPRS as a result of increased processing sector costs

In table 7, the potential percentage change in farm receipts in 2011 and 2015 is shown. The estimates are based on the input cost shares summarised in table 4 and the methodology and assumptions described earlier in this paper. The change in farm receipts is expected to be the same in 2015 whether the agriculture sector is included in the scheme or not. This is because the change in receipts is driven by the effects of the scheme on the processing sector. These effects on the processing sector are expected to be the same whether agriculture is included in the scheme or not.

### 7 Per cent decrease in total average farm receipts because of the CPRS as a result of increased costs in the processing sector, relative to the average over 2003-04 to 2007-08 <sup>a</sup>

accounting for increased price of:	2011		2015
	electricity	electricity, freight, fuel and cost of emissions	
<b>Emissions price</b>			
(A\$/t CO <sub>2</sub> -e) <sup>b</sup>	10		28
<b>Industry</b>			
All broadacre industries	0.3		0.9
Wheat and other crops	0.2		0.8
Mixed livestock–crops	0.3		0.8
Sheep	0.3		0.6
Beef	0.3		1.4
Sheep-beef	0.3		0.9
Dairy	0.3		1.2

<sup>a</sup> This assumes 100 per cent cost-price pass-through from processors to producers. Calculations are based on the cost structure of the processing sector in table 4 and assumptions outlined in the methodology section. The costs in 2015 apply to both the agriculture covered and the agriculture not covered scenarios. <sup>b</sup> The \$10 emission price for 2011 is in 2011 nominal dollars, the price of \$28 in 2015 is in 2005 dollars. To be consistent with the measure of the economic value of farm production, all these emissions prices have been converted to 2008 dollars.

## Change in the economic value of farm production because of the CPRS

The net effects of the CPRS on the economic value of farm production as a result of the projected change in input costs and receipts are shown in tables 8, 9, 10, 11 and 12. The definition of economic value of farm production, as described in the methodology section of this paper, is the farm cash income (cash receipts less cash costs) adjusted for the economic value of the buildup in trading stocks. Each table corresponds to a different assumed rate of cost-price pass-through. The scenario assuming processors pass 100 per cent of their CPRS-associated costs back to agricultural producers is a worst-case scenario for farmers because in reality it is unlikely that processors will be able to pass back 100 per cent of their cost increases to agricultural producers. The extent to which processors will pass their costs on is driven by a range of complex and interacting factors including: level of agricultural market power; elasticity of final demand; market structure of the industry and the international competitiveness of Australian production on world markets.

## 8 Economic value of farm production <sup>a</sup>, and its per cent and absolute change under the CPRS, selected years, no cost-price pass-through from processors to farmers <sup>b</sup>

economic value of production of an average farm with no CPRS (average over 2003-04 to 2007-08)	scheme coverage						
	agriculture not covered	agriculture not covered	agriculture covered	agriculture not covered	agriculture not covered	agriculture covered	
	2011	2015	2015	2011	2015	2015	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	
<b>Emissions price</b> (A\$/t CO <sub>2</sub> -e) <sup>c</sup>	na	10	28	28	10	28	28
\$	% change relative to production value in column 1			absolute (\$) change relative to production value in column 1			
<b>Industry</b>							
All broadacre industries	61 600	-0.3	-5.1	-9.1	-200	-3 100	-5 600
Wheat and other crops	116 000	-0.2	-4.8	-5.6	-200	-5 500	-6 500
Mixed livestock	62 300	-0.3	-5.9	-8.7	-200	-3 700	-5 400
Sheep	27 400	-0.5	-7.1	-12.7	-100	-2 000	-3 500
Beef	50 800	-0.3	-4.5	-13.0	-100	-2 300	-6 600
Sheep-beef	46 900	-0.4	-4.5	-11.0	-200	-2 100	-5 200
Dairy	97 100	-0.7	-3.7	-5.4	-600	-3 600	-5 200

<sup>a</sup> The economic value of production is farm cash income (total cash receipts less total cash costs) adjusted for the economic value of the build-up in trading stocks. <sup>b</sup> This assumes a 0 per cent rate of cost-price pass-through from processors to farmers. Under this scenario the estimated economic value of farm production is determined by changes in farm input costs only. <sup>c</sup> The \$10 emission price for 2011 is in 2011 nominal dollars, the price of \$28 in 2015 is in 2005 dollars. To be consistent with the measure of the economic value of farm production, all these emissions prices have been converted to 2008 dollars.

## 9 Economic value of farm production <sup>a</sup>, and its per cent and absolute change under the CPRS, selected years, 20 per cent cost-price pass-through from processors to farmers <sup>b</sup>

economic value of production of an average farm with no CPRS (average over 2003-04 to 2007-08)	scheme coverage						
	agriculture not covered	agriculture not covered	agriculture covered	agriculture not covered	agriculture not covered	agriculture covered	
	2011	2015	2015	2011	2015	2015	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	
<b>Emissions price</b> (A\$/t CO <sub>2</sub> -e) <sup>c</sup>		10	28	28	10	28	28
\$	% change relative to production value in column 1			absolute (\$) change relative to production value in column 1			
<b>Industry</b>							
All broadacre industries	61 600	-0.6	-6.2	-10.2	-400	-3 800	-6 300
Wheat and other crops	116 000	-0.4	-5.5	-6.3	-400	-6 300	-7 300
Mixed livestock	62 300	-0.6	-6.8	-9.6	-400	-4 300	-6 000
Sheep	27 400	-1.0	-8.1	-13.6	-300	-2 200	-3 700
Beef	50 800	-0.7	-6.2	-14.7	-400	-3 200	-7 500
Sheep-beef	46 900	-0.8	-5.7	-12.2	-400	-2 700	-5 700
Dairy	97 100	-0.9	-4.8	-6.4	-900	-4 700	-6 200

<sup>a</sup> The economic value of production is farm cash income (total cash receipts less total cash costs) adjusted for the economic value of the build-up in trading stocks. <sup>b</sup> This assumes a 20 per cent rate of cost-price pass-through from processors to farmers. That is, processors are assumed to pass 20 per cent of their costs associated with the CPRS on to farmers. Under this scenario the economic value of farm production is affected by changes in farm input costs as well as changes in receipts from processors. <sup>c</sup> The \$10 emission price for 2011 is in 2011 nominal dollars, the price of \$28 in 2015 is in 2005 dollars. To be consistent with the measure of the economic value of farm production, all these emissions prices have been converted to 2008 dollars.

# 10 Economic value of farm production <sup>a</sup>, and its per cent and absolute change under the CPRS, selected years, 60 per cent cost-price pass-through from processors to farmers <sup>b</sup>

economic value of production of an average farm with no CPRS (average over 2003-04 to 2007-08)	scheme coverage						
	agriculture not covered	agriculture not covered	agriculture covered	agriculture not covered	agriculture not covered	agriculture covered	
	2011	2015	2015	2011	2015	2015	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	
<b>Emissions price</b> (A\$/t CO <sub>2</sub> -e) <sup>c</sup>	10	28	28	10	28	28	
\$	% change relative to production value in column 1			absolute (\$) change relative to production value in column 1			
<b>Industry</b>							
All broadacre industries	61 600	-1.2	-8.3	-12.3	-800	-5 100	-7 600
Wheat and other crops	116 000	-0.8	-6.9	-7.7	-900	-8 000	-8 900
Mixed livestock	62 300	-1.2	-8.7	-11.4	-700	-5 400	-7 100
Sheep	27 400	-1.9	-9.9	-15.5	-500	-2 700	-4 200
Beef	50 800	-1.6	-9.7	-18.2	-800	-4 900	-9 300
Sheep-beef	46 900	-1.6	-8.0	-14.5	-700	-3 700	-6 800
Dairy	97 100	-1.4	-6.9	-8.6	-1 300	-6 700	-8 300

<sup>a</sup> The economic value of production is farm cash income (total cash receipts less total cash costs) adjusted for the economic value of the build-up in trading stocks. <sup>b</sup> This assumes a 60 per cent rate of cost-price pass-through from processors to farmers. That is, processors are assumed to pass 60 per cent of their costs associated with the CPRS on to farmers. Under this scenario the economic value of farm production is affected by changes in farm input costs as well as changes in receipts from processors. <sup>c</sup> The \$10 emission price for 2011 is in 2011 nominal dollars, the price of \$28 in 2015 is in 2005 dollars. In order to be consistent with the measure of the economic value of farm production, all these emissions prices have been converted in terms of 2008 dollars.

# 11 Economic value of farm production <sup>a</sup>, and its per cent and absolute change under the CPRS, selected years, 100 per cent cost-price pass-through from processors to farmers <sup>b</sup>

economic value of production of an average farm with no CPRS (average over 2003-04 to 2007-08)	scheme coverage						
	agriculture not covered	agriculture not covered	agriculture covered	agriculture not covered	agriculture not covered	agriculture covered	
	2011	2015	2015	2011	2015	2015	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	
<b>Emissions price</b> (A\$/t CO <sub>2</sub> -e) <sup>c</sup>	10	28	28	10	28	28	
\$	% change relative to production value in column 1			absolute (\$) change relative to production value in column 1			
<b>Industry</b>							
All broadacre industries	61 600	-1.9	-10.5	-14.5	-1 100	-6 400	-8 900
Wheat and other crops	116 000	-1.2	-8.3	-9.1	-1 400	-9 700	-10 600
Mixed livestock	62 300	-1.8	-10.5	-13.3	-1 100	-6 500	-8 300
Sheep	27 400	-2.9	-11.8	-17.3	-800	-3 200	-4 800
Beef	50 800	-2.4	-13.2	-21.7	-1 200	-6 700	-11 100
Sheep-beef	46 900	-2.4	-10.3	-16.8	-1 100	-4 800	-7 900
Dairy	97 100	-1.9	-9.1	-10.7	-1 800	-8 800	-10 400

<sup>a</sup> The economic value of production is farm cash income (total cash receipts less total cash costs) adjusted for the economic value of the build-up in trading stocks. <sup>b</sup> This assumes a 100 per cent rate of cost-price pass-through from processors to farmers. That is, processors are assumed to pass 100 per cent of their costs associated with the CPRS on to farmers and nothing on to wholesalers or consumers. Under this scenario the economic value of farm production is affected by changes in farm input costs as well as changes in receipts from processors. <sup>c</sup> The \$10 emission price for 2011 is in 2011 nominal dollars, the price of \$28 in 2015 is in 2005 dollars. In order to be consistent with the measure of the economic value of farm production, all these emissions prices have been converted in terms of 2008 dollars.

## 12 Estimated effects of the CPRS on farmers (including on-farm input cost increase and processing costs pass-through) on a per unit basis, 2011

		varying rates of cost-price pass-through from the processor to the farmer			
		0%	20%	60%	100%
Cattle	\$/head	0.14	0.51	1.24	1.96
Sheep	\$/head	0.03	0.06	0.13	0.21
Crops	\$/tonne	0.09	0.21	0.46	0.69
Dairy	\$/head	1.87	2.61	4.09	5.57
Dairy	\$/average farm	600	900	1 300	1 800

### Comparison with literature and industry views

ABARE's estimates are similar to the estimates by industry assuming a 100 per cent pass-through rate (in particular the Murray Goulburn Cooperative and Teys Brothers, [table 13](#)), but it is important to note that these estimates represent the upper bound. Compared with the Centre for International Economics (CIE) report for the Rural Industries Research and Development Corporation (RIRDC), ABARE estimates of input costs are similar. However, the estimates for changes in receipts are different. The CIE used international models to determine the extent to which costs would be passed up or down the production chain. Their estimates show that farm receipts would increase under the CPRS. The net result is that the CIE estimates show farm cash income decreasing by a smaller amount than the ABARE analysis.

### Comparison with CIE work for RIRDC

The Centre for International Economics (CIE) was commissioned by the Rural Industries Research and Development Corporation (RIRDC) to assess the effect of the CPRS on the agriculture sector. The CIE reported changes in net farm cash income. Farm cash income differs from the economic value of farm production, used in the ABARE analysis above, by the buildup in trading stocks. The buildup in trading stocks was negative on average over the period considered (2003-04 to 2007-08) for the average mixed livestock-crops, sheep and sheep-beef farms. The economic value of farm production provides a more complete picture of the economic viability of a farm.

The CIE used a general equilibrium model to determine the extent to which input prices would change because of the introduction of the CPRS. Partial equilibrium commodity models were used to determine the extent to which agricultural commodity prices would increase on international markets.

The framework used by the CIE differs to that used by ABARE in that it incorporates a greater range of input and output price changes. These price changes incorporate the flow-on effects of the CPRS on all sectors of the economy. However, the CIE analysis is not a general equilibrium analysis because the estimated effects on the agriculture sector assume that farmers do not change their input or output mixes, or their farm management practices, in response to the price changes seen in the economy.

## 13 Published industry views on potential effects of the CPRS on agricultural processors <sup>a</sup>

source	variable	permitted price (t CO <sub>2</sub> -e)	industry estimated effect	ABARE estimate, 2011 <sup>b</sup>	ABARE estimate, 2015 <sup>b</sup>
<b>Murray Goulburn Cooperative</b> (AFI conference)	Increased cost per dairy farmer per year	\$25	\$5 000-10 000	\$1 200	\$5 000
<b>Murray Goulburn Cooperative</b> (Senate Select Committee on agriculture)	Increased cost per dairy farmer per year	\$23-40	\$5 000-9 000	\$1 200	\$5 000
<b>Dairy Australia and ADIC</b> (Senate Select Committee on Climate Policy)	Increased cost per dairy farmer per year	not reported	\$6 000-9 000	\$1 200	\$5 000
<b>Teys Brothers</b> (AFI conference)	Increased cost per animal processed	not reported	\$8-10	\$1.83 (cattle) \$0.17 (sheep)	\$7.60 (cattle) \$0.72 (sheep)
<b>Teys Brothers</b> (Senate Select Committee on Climate Policy)	Increased cost per animal processed	not reported	\$4.6	\$1.83 (cattle) \$0.17 (sheep)	\$7.60 (cattle) \$0.72 (sheep)
<b>Mick Keogh</b> (Senate Select Committee on Climate Policy)	Increased cost per animal processed	not reported	\$5	\$1.83 (cattle) \$0.17 (sheep)	\$7.60 (cattle) \$0.72 (sheep)

<sup>a</sup> This assumes a 100 per cent rate of cost-price pass-through from processors to farmers. <sup>b</sup> The \$10 emission price for 2011 is in 2011 nominal dollars, the price of \$28 in 2015 is in 2005 dollars.

The CIE projected that farmer receipts would increase by between 0.05 and 0.24 per cent for broadacre industries, and decrease by 0.08 per cent for dairy under a situation where agriculture was not covered (between 0.04 and 0.61 per cent increase in receipts when agriculture was covered). By contrast, ABARE estimates reported above were based on the assumption that farmer receipts would decrease by between 0 and 1.4 per cent because of the cost-price pass-through from processors to agriculture producers. Accordingly, a further set of ABARE estimates for the likely initial effects of the CPRS on farm cash income were prepared, assuming the same changes in farm receipts as assumed by the CIE.

In tables 14 and 15, the CIE estimates are presented together with ABARE estimates. To be comparable with the CIE estimates, all ABARE estimates in tables 14 and 15 are reported for changes in farm cash incomes rather than changes in the economic value of farm production. ABARE estimates for the 0 and 100 per cent cost-price pass-through scenarios in tables 14 and 15 are consistent with the results presented earlier in tables 8 and 11.

## 14 Per cent change in farm cash income because of CPRS, agriculture not covered

	CIE estimates for RIRDC (90% scenario) unknown	ABARE 100% pass- through 2015	ABARE 0% pass- through 2015	ABARE, using CIE's change in receipts 2015
<b>Emissions price</b>				
(A\$/t CO <sub>2</sub> -e ) a	\$25	\$28	\$28	\$28
Wheat and other crops	-6.8	-8.5	-4.8	-4.6
Mixed livestock-crops	-6.6	-10.3	-5.8	-5.1
Sheep	-5.8	-11.4	-6.9	-5.9
Beef	-2.7	-13.6	-4.6	-3.0
Sheep-beef	-4.0	-9.7	-4.3	-3.1
Dairy	-5.5	-10.2	-4.2	-4.6

a The ABARE analysis uses an emissions price of \$28 in 2015, denominated in 2005 dollars. It is not known what units the CIE emissions price is reported in.

## 15 Per cent change in farm cash income because of CPRS, agriculture covered

	CIE estimates for RIRDC (90% scenario) unknown	ABARE 100% pass- through 2015	ABARE 0% pass- through 2015	ABARE, using CIE's change in receipts 2015
<b>Emissions price</b>				
(A\$/t CO <sub>2</sub> -e ) a	\$25	\$28	\$28	\$28
Wheat and other crops	-8.2	-9.3	-5.7	-4.9
Mixed livestock-crops	-8.0	-13.0	-8.5	-6.2
Sheep	-9.2	-16.7	-12.2	-7.8
Beef	-14.1	-22.4	-13.3	-9.7
Sheep-beef	-4.9	-15.9	-10.4	-6.7
Dairy	-10.5	-12.0	-6.0	-5.8

a The ABARE analysis uses an emissions price of \$28 in 2015, denominated in 2005 dollars. It is not known what units the CIE emissions price is reported in.

Source: CIE (2009) tables 7, 11, 15, 19, 23 and 27.

## Conclusion

The analysis above is intended only to be illustrative of the approximate degree to which the agriculture industry may be affected by the introduction of the CPRS. As stated earlier this analysis is based on historical shares of input costs and activity levels. The introduction of the CPRS and the resulting changes in input costs, receipts and value of production is expected to lead to agricultural producers changing their input and output mixes in response to the changes in prices. Furthermore, this analysis does not assess the degree to which other input costs may increase because of the increased cost of emissions, electricity and fuel in the economy in general.

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