"The impact of the Carbon Pollution Reduction Scheme on Australian Agriculture"

Mick Keogh, Executive Director, Australian Farm Institute.

Abstract.

Three separate modelling analyses have been carried out of the potential impacts of the Australian Government's proposed Carbon Pollution Reduction Scheme (CPRS) on Australian agriculture. These analyses were conducted by ABARE (Ford et. al. 2009), The Centre for International Economics (The CIE, 2008), and the Australian Farm Institute (Keogh and Thompson, 2008). The ABARE and CIE modelling involved the use of dynamic computerised general equilibrium models of the entire economy and different sub-sectors of agriculture, while the AFI modelling involved relatively static farm-level financial modelling.

The results of these modelling analyses differed substantially. The ABARE analysis projected that the impact of the CPRS on agricultural production by 2020 would vary between +3% (grains) and -1.6% (other livestock), and by 2030 would vary between +5.3% (grains) and -8% (beef and sheepmeats), relative to a business-as-usual scenario.

Modelling by the CIE projected that the impact of the CPRS on agricultural production by 2020 would vary between approximately -1% (grains) and -9.1% (beef), and by 2030 would vary between -2% (grains) and -28.2% (beef) relative to a business as usual scenario.

The AFI modelling examined the impact of projected CPRS costs at the individual farm level, finding impacts of up to an 18% reduction in farm cash margins by 2020 relative to a business-as-usual scenario, assuming a relative passive reaction to the CPRS by farm managers.

It is apparent that the majority of the differences between the results of the ABARE modelling, on the one hand, and the CIE and AFI modelling on the other hand, arise from the assumption used in the ABARE modelling of equivalent international agricultural emission policies being implemented simultaneously with the Australian CPRS timetable in both developed and developing nations that compete with Australian agriculture in international markets. This, in combination with an emission price scenario that is inconsistent with the government's White Paper, appears to be the main reason for the differences in results. Other differences in results are likely to arise from assumptions in the ABARE modelling about the extent of development of carbon-sink forest plantations.

This difference in outcomes arising from these modelling analyses highlights the potentially large negative impact on Australian agriculture of the inclusion of the sector within the CPRS, as is currently proposed post-2015, if that occurs in advance of similar policies being adopted by major international competitors in both developed and developing nations.

Introduction.

The Australian Government has announced an intention to introduce policies to reduce the amount of greenhouse gases produced in Australia each year. The principal policy measure that is proposed to achieve this objective is an emissions trading scheme, called the Carbon Pollution Reduction Scheme (CPRS). This scheme will result in progressively higher costs being imposed on activities that produce greenhouse gases. The Australian agriculture sector is the source of significant greenhouse emissions, with these predominantly arising from the digestive processes of sheep and cattle. As a result, the proposed introduction of the CPRS presents a major, long-term challenge to the agriculture sector in Australia.

The Australian Government released its Carbon Pollution Reduction Scheme (CPRS) White Paper (Australian Government, 2008) on December 15th, 2008. It detailed the Government's preferred design for an Australian greenhouse emissions trading scheme. The Government has stated that this scheme is the main policy instrument that will be employed to achieve its 2050 objective of reducing annual greenhouse emissions by 60%, relative to emissions produced in 2000.

As an interim target, the Government has also committed to reduce Australian greenhouse emissions by between 5% and 15% of 2000 emission levels by 2020, with the higher target dependent on a comprehensive international agreement to limit greenhouse emissions. Australia's estimated total anthropogenic greenhouse emissions in 2000 were 552.8 million tonnes of carbon dioxide equivalent[1] (Mt CO_2-e) which by 2006 had increased to 576 Mt CO_2-e, an increase of 4.2%. Agriculture was the economic sector with the second highest level of emissions, and was estimated to have produced 90.1 Mt CO_2-e emissions, or 15.6% of net national emissions in 2006 (Department of Climate Change, 2008).

The CPRS is scheduled to commence in July, 2010. Approximately 1,000 organisations that produce direct annual emissions in excess of 25,000 tonnes CO_2-e and which are in CPRS-covered sectors of the economy (stationary energy, transport, fugitive emissions from coal mining and oil and natural gas refining, industrial processes and waste) will be required to submit annual greenhouse emission returns to the government based on Kyoto Protocol emission calculation methodologies, and to annually surrender a number of government-issued permits equivalent to the net tonnes of CO_2-e emissions the organisation has generated. Included in this group will be bulk fuel distributors, which will be made responsible for the emissions estimated to be produced when the fuel they sell is combusted.

The Government will release for sale a capped and gradually declining volume of tradable emission permits each year, and activities such as forestry, which sequester carbon from the atmosphere, will also be able to generate emission permits. For those organisations that are involved in activities that are classified as emissions-intensive and trade exposed (EITE), up to 90% of required emission permits will initially be available free-of-charge, with the volume of free emission permits declining each year. The criteria proposed to determine eligibility for these free emission permits includes that the activity is trade exposed (the value of either exports or imports relative to total production exceeds 10%), and that the activity is also emissions intensive. Emissions intensity is determined by the volume of emissions per million dollars of output. Those activities producing more than 2,000 tonnes CO_2-e of emissions will initially be allocated 90% of required permits for free, and those activities producing between 1,000 and 2,000 tonnes CO_2-e of emissions per million dollars of output will initially receive 60% of required emission permits for free. These thresholds are significant for agriculture if the sector eventually becomes a CPRS covered sector, in that beef, sheep, dairy and rice would all be eligible for the highest level of free permits, but cereal and other crop production would not be eligible for any free permits.

Agriculture (meaning farm businesses) will not be a covered sector under the CPRS until 2015 at the earliest. The White Paper states "*Initially, the scheme will not cover emissions from agriculture. The agriculture sector is characterised by thousands of small emitters and the calculations of emissions is complex, so it would not be*

[1] Each of the different greenhouse gases is estimated to have a different warming effect when present in the atmosphere. The combined warming effect of different gases is often expressed in terms of the amount of carbon dioxide required to create the same amount of warming, hence the term carbon dioxide equivalent. Methane has a warming potential 21 times that of carbon dioxide, while nitrous oxide has a warming potential 310 times that of carbon dioxide.

practical at this stage to cover those emissions directly. However, agriculture's eventual inclusion in the scheme is desirable, if it can be cost-effectively achieved.

The White paper further states "*Stakeholders outside the agriculture sector supported inclusion of the agriculture sector at the earliest opportunity, noting that this would reduce the overall costs of achieving Australia's mitigation targets and hence the burden on other sectors of the economy."*

The White Paper further explains "*If the Government decides in 2013 not to cover agriculture emissions in the Scheme, it will consider alternative mitigation measures. … …. To ensure that the agriculture sector makes an equivalent contribution to other sectors, the Government is disposed to apply mitigation measures that result in costs similar to those under the Scheme. For example, if the carbon price was $25 per tonne of CO_2-e, the Government would seek to mandate the use of mitigation technologies or practices in the agriculture sector with the intention of achieving a cost of around $25 per tonne CO_2-e.*

There are two broad sets of consequences for Australian farm businesses. The first arise from the indirect impact of the CPRS as sectors upstream and downstream of the farm sector pass on higher costs to farmers. The second arise from the likely future imposition of an emission cost on farm commodity production which results in the direct production of greenhouse emissions.

A number of economic modelling studies have been carried out to attempt to gain a better understanding of the potential impacts of the CPRS on agriculture. These include industry-wide and commodity sector level studies by ABARE (Ford et. al. 2009), and The CIE (TheCIE, 2009) and farm-level impacts research by the Australian Farm Institute (AFI) (Keogh and Thompson, 2008).

In each case, these studies first involved the development of a baseline scenario of future growth of the agriculture sector or farm business over the period to 2030. The results of those scenarios were then compared with the results of scenarios which include the impacts of the CPRS. The modelling results are then expressed as the difference between projected output under the business-as-usual scenario, and projected output under the various CPRS scenarios. In most cases, the impact of the CPRS is a slowing in the rate of growth of the agriculture sector, relative to what would have otherwise been the case. A negative percentage result therefore indicates a projected reduction in the rate of growth of the sector or business relative to business-as-usual, not an absolute decline in output from the sector or business. Figure 1 illustrates this point.

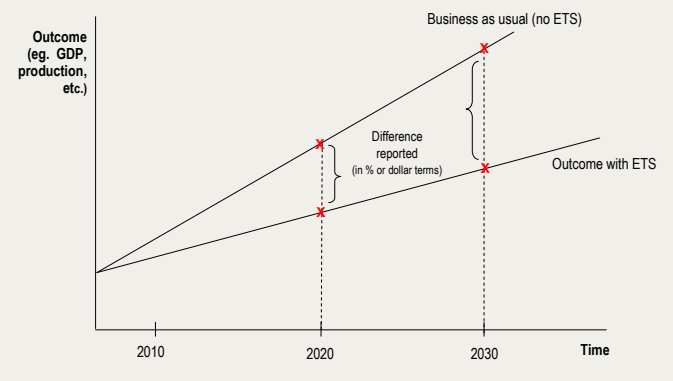

Figure 1. Method of expressing CPRS modelling results.
(Source: TheCIE, 2009)

Modelling assumptions

Before comparing the results of the different modelling exercises, it is important to understand that modelling results are not forecasts of future outcomes, but are projections of future outcomes based on the assumptions that have been incorporated in the models. Incorporating different assumptions in any modelling exercise will produce different results. The extent to which the incorporated assumptions are likely to be realised in the future will determine how closely the modelled outcomes actually predict future outcomes. As a result, there are no 'right' or 'wrong'

modelling outcomes, and each result should be considered in the light of the assumptions that underlie it. Table 1 provides a summary of the main assumptions underlying each of the three modelling exercises.

Table 1. A summary of the major assumptions used in different studies to project the potential impact of the CPRS on Australian agriculture.

	ABARE, 2009	**The CIE, 2009**	**AFI, 2008**
Subject	Agriculture, some commodity sub-sectors, processing sector.CGE modelling simulating dynamic sectoral change.	Agriculture, most commodity sub-sectors. CGE modelling assuming dynamic sectoral change.	A range of typical broadacre and horticulture farm businesses, based on ABARE survey data. Largely static modelling of farm profitability.
Emissions price	2010 - $A 20 2020 - $A 35 2030 - $A 52	2010 - $A5 - $A10 2020 - $A 50 2030 - $A 92.60 (conservative scenario)	2010 - $A 20 2020 - $A 35 2030 - $A 62 (Low emission price scenario)
Agricultural coverage within CPRS	From 2015	After 2015	After 2015
Transitional assistance for agriculture (EITE status)	• Sheep, cattle, dairy - 84% free permits in .2015, ceasing by 2025 • Other animals – 51% free permits 2015 ceasing by 2025. • Crops – zero free permits	100% free permits 2016, declining to zero free permits by 2026 (all commodities)	90% free emission permits from 2015, continuing at that level until 2030 for EITE commodities (mainly livestock). No free permits for grains sector.
International mitigation activities specific to agriculture	• Developed nations commit to the same reduction in emissions as Australia from 2010. • China, South Africa and OPEC implement emissions restrictions from 2015. India, Indonesia and other SE Asia commence in 2020.	Assumes no equivalent international coverage of agriculture within national ETS	Assumes no equivalent international coverage of agriculture within national ETS
Impacts measured	Changes in farm input costs and production, relative to a business-as-usual scenario.	Changes in gross value of production by sub-sector, relative to a business-as-usual scenario.	Changes in farm cash margins for individual farm businesses, relative to business-as-usual for those farm models.
Productivity in the agriculture sector.	Assumes historical rates of sectoral productivity growth are maintained into the future.	Assumes historical rates of sectoral productivity growth are maintained into the future.	Assumes historical rates of sectoral productivity growth are maintained into the future.

A comparison of modelling results.

Each of the modelling exercises included an examination of a number of different scenarios, meaning that a range of outcomes arose from each. Not all scenarios are comparable due to assumed differences in emission prices. The following analysis attempts to compare what are largely similar scenarios extracted from each modelling study to better understand the differences in the results arising from them.

Indirect impacts of the CPRS.

In the initial stages of CPRS implementation between 2010 and 2015, even though agriculture will not be a covered sector and farm businesses will not incur a liability for direct farm emissions, the sector will experience the indirect effects of the CPRS as fuel and energy price increases flow through the economy.

Farm businesses are largely price-takers in markets where prices are set internationally, meaning that the prices that Australian farmers receive for their produce are unlikely to rise as a result of the CPRS, and farm businesses will largely be required to absorb the additional costs. To moderate these impacts in the initial years of the CPRS, the Government has announced that fuel price increases will be offset by a reduction in fuel excise rates for the first three years, and that off-road fuel rebates will also be adjusted over the same period to offset CPRS-induced diesel price increases. Heavy-vehicle fuel prices will also be offset, but only for the first twelve months of the scheme.

As a result, the impacts of the CPRS in the first three years on farm businesses will be minimal, except for businesses in sub-sectors such as dairy and intensive livestock which may be significant users of electricity. From 2013 onwards, however, it is assumed that the full impact of CPRS-induced fuel and energy price increases will be passed on to farm businesses both directly and indirectly through the embedded energy costs incorporated in most farm inputs and services.

By 2015, the ABARE analysis projects that these indirect impacts of the CPRS will result in an average increase in broadacre and dairy farm costs of 1.1%, with cropping businesses experiencing increases of 1.3% in production costs relative to average costs over the 2004/5 to 2006/7 , and livestock specialist experiencing a 0.9% increases in production costs. This analysis assumes an emission price of $28, resulting in electricity costs increasing by 24%, freight costs increasing by 1.8%, and fuel costs increasing by 11%. The ABARE analysis also assumes that fertiliser and chemical manufacturers will be eligible for EITE assistance, and that the prices of these farm inputs will remain largely unaffected. ABARE noted that this analysis did not make any assumptions about farm businesses changing the mix of inputs used as costs increase. The ABARE analysis also only included direct farm production costs associated with electricity, freight and fuel, and did not include increased farm production costs arising from the indirect impact of increased energy prices on the cost of other farm inputs.

The CIE analysis did not separately examine the indirect impacts of the CPRS on farm businesses in the period prior to agriculture's assumed coverage within the CPRS in 2015. The CIE analysis did, however, provide projections of increases in various farm input costs as a result of the CPRS by 2015, using a dynamic modelling approach. These projected increases included a 4% increase in petrol prices, a 3% increase in chemical prices, a 2% increase in transport costs, and a 10% increase in electricity costs. The projections were developed prior to the Government announcement about excise reductions to offset fuel cost increases over initial periods of the CPRS, and the authors noted that the result would be an over-statement of costs impacts during the first three years, although the initial fuel cost offset will make little difference in the longer term. These cost increases projected by TheCIE modelling would result in a smaller increase in overall farm production costs than is projected by ABARE, given that energy and energy-related inputs are only a proportion of total farm input costs.

The AFI analysis involved development of model budgets of average farms, based on ABARE farm survey data. These model farms were segregated based on scale (utilising farm gross turnover categories) and enterprise mix, enabling a comparison of CPRS impacts on different farm sizes and types. Categories of farm input costs likely to increase as a result of fuel and energy cost increases were identified, and estimates made of the proportion these costs may increase relative to fuel and energy cost increases. The analysis enabled a linkage to be established between emission prices, fuel and electricity prices, and farm input costs for items such as freight, crop contracting, fertilisers, chemicals, and farm fuel and electricity costs. Importantly, the AFI modelling did not incorporate any

changes in the mix of farm inputs as their prices changed. As such, the results reflect the pressure to adjust that farmers will face, rather than a forecast of actual farm business outcomes.

Utilising the AFI Low emission price scenario (the scenario most closely reflecting the CPRS-5 emission price trajectory developed in Treasury modelling), the AFI modelling projected decreases in annual farm cash margins of between 3.6 and 3.9% by 2015 for average broadacre farms. Projected farm cash margin decreases were slightly higher for cropping specialists (between 4.4 and 5.7%), and slightly lower for livestock specialists (between 2.4 and 4.6%), and also lower for horticulture and vegetable businesses (between 2.0 and 3.2%).

ABARE's results were expressed in terms of increases in production costs, while the AFI results were expressed in terms of changes in farm cash margins, meaning the results are not directly comparable. To express the ABARE results as changes in farm cash margins, the data used for the AFI analysis was analysed to estimate the average farm cash margin (ie the ratio of revenue to expenses) for the model farms used in the AFI study. For the larger-scale farms, the farm cash margins reported were typically approximately 30% of total farm costs.

Therefore, to express ABARE's production cost increases in terms of changes in farm cash margins, a reasonable approximation is to multiply the ABARE results by 3. That is, a 2% increase in production costs (all other things being equal) will reduce farm cash margins by approximately 3 times that amount - that is by 6%. Using this approximation, it is apparent that that ABARE and AFI estimates of the indirect impacts of the CPRS on farm businesses in the period up to 2015 are quite similar, with the AFI results being slightly higher.

This is not surprising, as the AFI projections included a wider range of farm input costs that are likely to increase, given the probable impact of fuel costs on the cost of any farm inputs that have freight included as part of the total cost. The AFI analysis also assumed fertiliser and chemical costs would increase due to the CPRS, while the ABARE analysis assumed that these industries would be allocated EITE status (therefore receiving most of their required emission permits at no cost) and that therefore these costs would not increase as a consequence of the CPRS.

A factor not included in any of the three modelling analyses of the indirect impacts of the CPRS on farm businesses is the cost implications for meat, dairy and food processors which, as a consequence of having direct greenhouse emissions in excess of 25,000 tonnes of CO_2-e per annum, will be required to be direct participants in the CPRS from 2010. It is understood that a significant number of major processors have direct emissions in excess of the 25,000 tonne threshold, and that these businesses will not be eligible for EITE assistance in the form of free emission permits. As these businesses are subject to international competition, they have already stated that in order to remain competitive these added costs will need to be passed back to farmers in the form of lower prices or higher processing charges. Factoring in these costs would result in higher indirect impacts of the CPRS on agriculture, especially for meat and dairy producers.

Direct impacts of the CPRS.

The more significant potential impacts of the CPRS on Australian agriculture are likely to emerge post-2015, when the Government has proposed that farm businesses would become liable for an emission cost associated with the direct greenhouse emissions generated by the activities undertaken on that farm.

As noted earlier, a decision has not yet been made about how agricultural emissions would incur a cost, although models under consideration include direct farm level annual emission returns, an 'upstream-downstream' model whereby farm input suppliers and purchasers of farm products incur a liability for the emissions associated with farm production, and a hybrid combination of these under which the 'upstream-downstream' model would be the default, and larger farm businesses would be able to opt to become direct CPRS participants.

The method of agricultural engagement with the CPRS does not matter greatly for the purposes of modelling financial impacts, although it becomes important in relation to the ability of farm businesses to adopt, and gain recognition for emission mitigation. Under the 'upstream-downstream' model, for example, even if farms adopt emission mitigation strategies these will not easily be able to be recognised within the system, and farmers are therefore unlikely to receive recognition for these actions.

The CIE modelling analysis projected the impacts of the CPRS on Australian agriculture over the period to 2050, with the main focus being on the period to 2030. This analysis utilised dynamic modelling, incorporating

assumptions about demand and supply changes and product substitution as relative prices change. It also incorporated international interactions, an important assumption being that international competitors in agricultural markets would not adopt similar policies for their agriculture sectors for the period under study. The 'conservative' scenario modelled in the CIE research (agriculture becoming a covered sector by 2016, with businesses initially receiving 100% free permits, and the volume of free permits reducing to zero over the ten years to 2026) is closest to the CPRS design announced by the Government, and is therefore relevant for the purposes of comparing different modelling results. The following Table shows the results of the CIE modelling for 2020 and 2030.

Table 2 Percent changes in the gross value of production (net of emission permit costs) based on the conservative scenario, relative to business as usual. (CIE modelling.)

Commodity	2020	2030
Beef	-9.12%	-28.16%
Wool	-6.81%	-27.48%
Sheep meat	-5.75%	-21.02%
Dairy	-2.66%	-8.08%
Wheat	-0.86%	-2.29%
Pork	-3.94%	-10.44%
Poultry	-3.22%	-8.41%
Other coarse grains	-0.82%	-2.11%
Barley	-0.58%	-2.05%
Cotton	-0.85%	-1.42%

The modelling carried out by ABARE incorporated a range of different assumptions, most notably that assuming equivalent multilateral action by both developed and developing nations in emission reduction policies, including for agriculture sectors. The results of that modelling are shown in Table 3.

Table 3 Percent change in production by agricultural sectors under the CPRS, relative to the reference case. (ABARE modelling).

Commodity	2020	2030
Grains	3.3	5.3
Other crops	-0.6	0.0
Beef and sheep meats	0.1	-8.0
Other animals	-1.6	-1.1
Dairy cattle	0.4	-3.0
Wool	-1.4	-2.1
Total agriculture	0.1	-1.0
Processed meat	0.0	-5.8
Processed other food	0.0	0.6
Processed milk	0.5	-2.8

As noted earlier, the AFI modelling of the impacts of the CPRS on agriculture utilised a 'bottom up' approach, developing financial models of a range of different farm businesses, and then imposing both the direct and indirect impacts of the CPRS on those farm businesses to produce projections of potential impacts, all other things being equal. No assumptions were made about dynamic changes that farmers might make in response to the added costs imposed by the CPRS, and it was assumed to international competitors in global agriculture markets will not adopt equivalent emission policies within the timeframe in question. Importantly, the AFI modelling provided information about CPRS impacts on farm businesses on a year-by-year basis, highlighting some important short-term impacts requiring consideration.

The AFI modelling assumed that broadacre livestock industries would receive the equivalent of 90% free emission permits after 2015 when it was assumed the sector would become CPRS-covered, and that this level of free permits would continue indefinitely. The White Paper has subsequently proposed that the level of free permits allocated to

EITE activities would decline by approximately 1.5% per annum. As a result of this, the AFI modelling understates the impact of the CPRS on livestock industries over the longer term as free permit allocations decline.

The AFI modelling provides an indication of the impacts of the CPRS in the early years of the scheme before farm businesses have an opportunity to adjust to the changes, but the longer-term results reflect the pressure farmers will face to change, rather than the likely outcome of any dynamic changes that will undoubtedly occur.

Table 4 Percent change in farm cash margins for farm businesses under the CPRS, relative to the reference case, for farm businesses in the $200,000 to $400,000 annual turnover category. (AFI modelling).

Commodity	2016	2020	2030
Cropping $100-$200k)	-17.0%	-17.8%	-19.9%
Cropping $200-$400k)	-18.0%	-16.3%	-14.0%
*Beef-Sheep ($100-$200k)	-17.0%	-17.8%	-19.9%
*Beef-Sheep ($200-$400k)	-10.3%	-11.0%	-12.9%
*Large Beef ($400k+)	-5.8%	-5.9%	-5.9%
*Mixed broadacre ($100k-$200k)	-10.0%	-9.7%	-9.5%
*Mixed broadacre ($200k-$400k)	-8.2%	-8.1%	-8.1%
*Dairy	-6.7%	-6.8%	-7.1%
Horticulture	-2.5%	-2.4%	-2.2%
Vegetables	-3.3%	-3.3	-3.3%

* Beef-sheep, Large Beef, Mixed Broadacre and Dairy farm businesses are assumed to be eligible for EITE status, and receive 90% of required emission permits free-of-charge. All other farms are assumed to be liable for 100% of emissions from 2015. No reduction in free emission permits was assumed over the period to 2030.

The first point to note in comparing these results is that while the CIE and ABARE results are expressed in terms of changes in farm sector production, the AFI results are expressed in terms of changes in farm cash margins of individual farm businesses. These two measures of farm output are not comparable, as noted earlier. Changes in production (as modelled by ABARE and the CIE) will arise due to dynamic changes in markets as particular commodities increase in price, and also due to enterprise substitution decisions that will be made by farmers. The AFI modelling aimed to project the potential impact of the CPRS assuming that farm businesses continued operating as they have in the past and do not switch enterprises or the mix of inputs used in the farm business.

The most significant difference in comparable modelling outcomes is the differences between the ABARE and the CIE modelling. ABARE has projected maximum reductions in output of 8% for beef by 2030, whereas the CIE modelling projected reductions in beef and sheepmeats output of between 21 and 28%. This three-fold difference in results seems likely to have arisen from some major differences in assumptions about international climate change policy cooperation, some differences in emission price assumptions, and from other issues such as the extent of carbon-sink forestry development that is likely. These issues are considered further in the discussion section of this paper.

A further point of major difference in modelling outcomes is the projected 2016 impact for crop producers evident from the AFI modelling, but not in either of the other two modelling analyses. The AFI modelling projects a 17-18% fall in farm cash margins in 2016 for cropping specialists, a much bigger impact than for all other farm businesses at that time. The reason for this is that the government has indicated that crop production will not be an activity eligible for EITE assistance based on the criteria that have been proposed, which means that crop producers will have to pay for 100% of their emissions in 2016, while livestock producers are assumed to be eligible for 90% free emission permits in 2016, and therefore only incur the cost of 10% of estimated farm emissions.

In the AFI modelling, the two cropping farms had estimated emissions (based on National Greenhouse Gas Inventory calculation methodology) of 320 and 460 tonnes CO_2-e respectively, while the two sheep-beef farms had emissions of 1,750 and 2,330 tonnes CO_2-e. Based on the criteria applicable for EITE concessions, the crop producers receive no free permits and are assumed to be liable for the cost of all farm emissions (320 or 460 tonnes) after 2015, while the livestock farms are assumed to only be liable for 10% of their emissions (175 or 233 tonnes), and therefore face a much smaller emission cost in the initial years. Importantly, the sudden imposition of this cost

in 2016 would mean crop producers have little opportunity to adjust to the new cost through productivity gains over time.

The AFI projections underestimate impacts on livestock, broadacre and dairy farm businesses after 2015, to the extent that the assumption used was that the 90% free permit allocation would continue indefinitely, or until other nations adopted similar emission reduction policies. The Government's white paper has since clarified that free emission allocations to EITE-eligible businesses will decline by approximately 1.5% per year, meaning that free permit allocation for broadacre livestock farm businesses in 2015 will be for 84.4% of emissions rather than 90%, and this level will continue to decline each year.

All three analyses also assumed a continuation of historical rates of productivity growth in agriculture over the period to 2030. This assumption is quite significant, as in effect it means that it is assumed that the sector progressively becomes less emissions intensive (i.e. the quantity of emissions per unit of final production progressively declines). In the CIE modelling, for example, the emissions intensity of beef, dairy and grains is assumed to decline by up to 33% between 2006 and 2030. In the AFI modelling, emissions are assumed to remain constant while the unit value of output increases annually by the historical rate of productivity growth. In the ABARE modelling, there is an assumption of continued productivity growth in the sector (a 35% increase in annual output between 2005 and 2030) and also that emission mitigations and abatement technologies result in emission reductions of between 10 and 25%, depending on emission prices. No costs are assumed to be associated with these technologies in the ABARE modelling.

Discussion and conclusions.

The three analyses of the potential impact of the CPRS on Australian agriculture that have been carried out appear at first glance to have resulted in very different projections of the potential CPRS impacts on the agriculture sector. These different projections have arisen as a result of the assumptions utilised in each modelling exercise, and in the case of the AFI modelling, the fact that it projected changes in farm cash incomes rather than changes in agricultural production.

The ABARE modelling assumed equivalent international agricultural emission policies will be adopted by all developed nations in 2010, and progressively by developing nations after 2015. There appears to be a great deal of uncertainty surrounding this assumption, given that at this stage only New Zealand of the developed nations has proposed equivalent emissions policies for agriculture. The European Union has not proposed imposing a cost on agricultural emissions under its ETS, arguing that payments to farmers to reduce agricultural production over recent years have also reduced agricultural emissions. In any event, European agriculture also enjoys a high level of trade protection, insulating farmers there from increased the international competition that would arise as the ETS impacts on European fuel and energy costs. Some Canadian provinces have proposed that voluntary emission offset programs will be implemented for agriculture under which farmers voluntarily undertaking recognised sequestration activities will be paid incentives, but there has not been a proposal to require farmers to pay for farm emissions. The USA is even less advanced in terms of national emissions policy development, and the only policies applicable to agriculture are incentive payments for recognised sequestration activities within voluntary carbon markets. No developing nations (in particular major competitors for Australian farmers in South America, Asia and Eastern Europe) have proposed implementing national emissions trading schemes – let alone for their agricultural sectors, and would seem unlikely to implement such policies within the next decade.

Both the CIE and the AFI modelling assumed international agricultural competitors will not face equivalent emission constraints within the period under consideration. This major difference in assumptions about international agricultural emissions policies undoubtedly explains a large proportion of the difference between the two sets of results, but also at the same time highlights the potential impact on Australian agriculture of proceeding to implement the CPRS for agricultural emissions in advance of equivalent policies being adopted by most major competitor nations.

A significant point to note in comparing modelling outcomes is the different emission price scenarios that were used, which will obviously effect the projected scale of CPRS impacts. As can be observed from Table 1, the CIE modelling assumed a lower initial price for emissions, but a more rapid increase in emission prices over time than

was the case for either of the ABARE or AFI modelling. This difference could be expected to have some impact on modelling outcomes.

The differences in emission price projections also highlights an inconsistency in the modelling assumptions associated with the ABARE research, and the proposals outlined in the government's White Paper. In the Australian Government CPRS White Paper that details the design of the CPRS, the Australian Government stated that it would commit to a minimum emission reduction target of 5% by 2020 irrespective of international actions to limit emissions, and further would commit to reduce emissions by up to 15% in the event *major economies agree to substantially restrain carbon pollution and advanced economies take on reductions comparable to Australia*.

In the Australian Government Treasury modelling underpinning the White Paper, emission price projections for four different emission reduction scenarios were generated. These related to Australian emission reduction targets of 5% (the CPRS-5 scenario), 10% (Garnaut-10), 15% (CPRS-15) and 25% (Garnaut-25) by 2020, relative to 2000 emissions. The emission price trajectories developed for each of these four scenarios are shown in Figure 2.

To be consistent with the White Paper proposals, modelling assumptions therefore should either be that the 5% emission permit price projection applies as it is assumed that few overseas nations adopt similar policies, or that the 15% emission permit price projection applies because it is assumed most overseas nations adopt similar policies, and the Government will fulfill its commitment to seek a 15% reduction in emissions by 2020. However, the ABARE modelling has utilised the 5% emission price projections, but has also assumed that most overseas nations adopt similar emission reduction strategies. Using these two assumptions in combination is not consistent with the governments White Paper proposals.

Modelling that uses the CPRS-5 emission price projection in combination with an assumption of synchronized international emission action (as is the case in the ABARE modelling) will result in CPRS impacts being understated, due to the lower emission prices being utilised. For example, by 2020 emission permit prices are projected to be $35.20 under the CPRS-5 scenario, but $49.90 under the CPRS-15 emission scenario, (as can be seen in Figure 2) and this difference increases in later years.

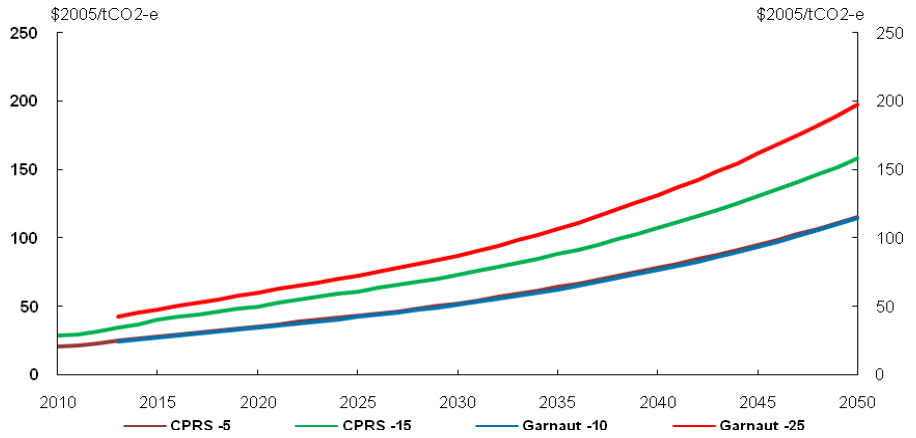

Figure 2. Emission permit prices projected for four different emission trajectories.
Source: Australian Treasury Modelling.

Modelling that utilises an assumption of common global agricultural emissions policies will also project reduced CPRS impacts on Australian agriculture because of the implicit assumption that all Australia's competitors in international agricultural markets face the same production cost increases. Given that some of Australia's biggest international competitors in international markets (South American nations in beef markets, Asian and South American nations in horticultural markets, and Eastern european and South American nations in grains and oilseed markets) are developing nations that do not have binding emission reduction targets under the Kyoto Protocol and are unlikely to have such targets in any post-Kyoto agreement, an assumption that agriculture sectors in these nations will face the same emission constraints as are proposed for Australian agriculture from 2010 and 2015 seems difficult to justify.

The CIE and the AFI modelling assumed no equivalent international emission policies in the period to 2030, and it could be argued that this is unrealistic given global developments in relation to climate change policy. However, from an agricultural perspective the issue is not whether other nations adopt national emissions policies, but whether they also include agriculture within their policies in a similar manner to that proposed by Australia and New Zealand. There is no evidence of other nations contemplating such policies at the present time.

A further point of difference between the ABARE and the CIE modelling is the assumption in the ABARE modelling that the development of carbon-sink forests will result in the conversion of some land currently used for agricultural production to permanent plantations. Interestingly, the ABARE modelling report is somewhat coy about the extent of plantation development projected, stating only that '*In this analysis some agricultural land is assumed to be converted to forestry in response to changes in relative profitability associated with the introduction of an emissions price. The conversion of agricultural land to forestry differs across agriculture industries. The majority of agricultural land converted to forestry is from the grazing industries."*

Earlier Treasury modelling released in advance of the government's White Paper included projections of the extent of agricultural land that would be converted to forestry, which had arisen from modelling that had previously been conducted by ABARE. That modelling projected there would be 1.7 million hectares of additional plantations by 2020, and 3.3 million hectares of additional plantations by 2030 under a scenario where the Australian emissions target was a 5% reduction in emissions by 2020. Under a 15% national emissions reduction target by 2020, additional plantation areas were projected to be 7 million hectares by 2020, and 14 million hectares by 2030.

Whether these projections are still applicable is unclear, as a more recent report by ABARE (Burns et. al, 2009) on the potential development of forestry plantations under the CPRS stated (in relation to these earlier projections) "*Some environmental, policy and market constraints which may limit the potential for afforestation in Australia were not fully accounted for in the (*earlier) *ABARE analysis because of inherent complex interactions between biophysical conditions and market and policy realities, and, in the case of water inception, the regional specificity."* The report concluded that "*Given the modelling framework and assumptions, ABARE's(*earlier) *projections should be considered an upper bound for afforestation potential."*

It is not apparent that the Treasury emission price projections have subsequently been adjusted upwards to reflect this more limited area of plantation forestry development that is now projected.

Leaving aside the uncertainty about the extent of projected afforestation arising from the CPRS, the inclusion of afforestation in modelling would be expected to result in a lower projected emission price than would otherwise be the case, and would therefore be expected to result in lower projected CPRS impacts for the national economy. Whether this would be the case for agriculture is uncertain, as it will depend on the nature of the agricultural land that is diverted to forestry uses. Converting highly productive high rainfall land to plantations (as the earlier ABARE modelling indicated would be the case) would be expected to reduce agricultural output as a result of the diversion of both land and water from agricultural use, but would also reduce emission prices and therefore reduce the impact of the CPRS on the profitability of farm businesses.

Taking all these factors into consideration, it is unclear the extent to which these assumptions about forestry development would reduce projected CPRS impacts on agriculture, but it seems likely to only account for a small proportions of the differences observed in the three modelling exercises under consideration.

In conclusion, the differences observed in modelling outcomes between the CIE and ABARE research has highlighted the potentially large impact on the competitiveness of Australian agriculture of the implementation of the CPRS, and in particular the coverage of agriculture such that farmers incur a cost for direct farm emissions, in the absence of equivalent policies being adopted by major competitors to Australian agriculture in international markets. This is hardly a surprising result, given that the Australian agriculture sector is one of the least subsidised or trade-protected agriculture sectors globally, and also has a high dependency on export markets, with approximately two thirds of annual output exported each year. The AFI modelling has also highlighted the potentially large and perverse shock that the sudden implementation of a new and major input cost would have on the agriculture sector in 2016, and has highlighted the urgent need for more sophisticated and informed policymaking on this issue.

References.

Australian Government 2008. *Carbon Pollution Reduction Scheme. Australia's Low Pollution Future.* Australian Government White Paper. December 2008.

Australian Government, Department of Treasury, 2008. *Australia's Low Pollution Future: The Economics of Climate Change Mitigation.* Australian Government, Canberra, October, 2008.

Burns K, Vedi J, Heyhoe, E and Ahammad H, 2009. *Opportunities for forestry under the Carbon Pollution Reduction Scheme (CPRS): an examination of some key factors.* ABARE Report 09.1, March 2009. Australian Bureau of Agriculture and Resource Economics. Canberra.

Department of Climate Change, 2008. *National Greenhouse Gas Inventory, 2006: Accounting for the Kyoto Target.* Australian Government Department of Climate Change. Canberra. June 2008.

Ford M, Gurney A, Tulloh C, McInnes T, Mi R, Ahammad H, 2009. *Agriculture and the Carbon Pollution Reduction Scheme (CPRS): economic issues and implications.* ABARE Report 09.2, March 2009. Australian Bureau of Agriculture and Resource Economics. Canberra.

Keogh M and Thompson A, 2008. *Preliminary Modelling of the Farm-Level Impacts of the Australian Greenhouse Emissions Trading Scheme.* Research Report. Australian Farm Institute, September 2008.

Lawson K, Burns K, Low K, Heyhoe E, Ahammad H, 2008. *Analysing the economic potential of forestry for carbon sequestration under alternative carbon price paths.* Modelling conducted as part of the Australian Treasury analysis of the economic implications of an Emissions Trading Scheme for the Australian Economy. Australian Bureau of Agriculture and Resource Economics. Canberra.

TheCIE, 2009. *Some Impacts on Australian Agriculture of an Australian Emissions Trading Scheme.* Research Report, Australian Farm Institute. February, 2009.