Question 1

Senator CAMERON: *Does your modelling indicate there will still be strong job growth?*

Mr Skelton: *The modelling we have had done indicates that there will be jobs growth, although it will be less than it otherwise would have been in some areas.*

Senator CAMERON: *Of course, but how much less?*

Mr Skelton: *For example, in the area where we live, which is the Hunter Valley, what has been a reasonable level of employment growth will potentially shrink to being relatively static. The difficulty is that that modelling was done a couple of years ago, when the CPRS was being discussed.*

Senator CAMERON: *This is your modelling?*

Mr Skelton: *It is modelling that we had done by Frontier Economics.*

Senator CAMERON: *Frontier Economics. There you go.*

Mr Skelton: *We do not have the capability of doing that, obviously.*

Senator CAMERON: *Can you provide the inputs that Frontier used to determine these outcomes?*

Mr Skelton: *My understanding is—and if you are interested we can make a copy of the report available to you—*

Senator CAMERON: *I am happy for you to table the report, but I am also keen for you to provide access to the actual modelling details.*

Mr Skelton: *All I know is what they have given us in the report. They describe in that report the assumptions that they made, and my understanding is that those assumptions were largely the same as the assumptions made by Federal Treasury modelling at the time.*

Mr Skelton: *We have participated in some research on that, but I would have to take it on notice to find out how much and when.*

Answer

The Frontier Economics Report, *Structural Adjustment and the CPRS – Final Report*, June 2009, is attached.

I note that you have requested the "inputs" that Frontier Economics used to determine the outcomes of the report. These were not provided to Macquarie Generation. We have sought these inputs from Frontier Economics, however Frontier's representative, Mr Danny Price, has indicated that he is unwilling to provide this information at this time.

Structural adjustment and the CPRS

FINAL REPORT

June 2009

Structural adjustment and the CPRS

Contents

Structural adjustment and the CPRS

Executive summary

Even taking into account the Government's proposed shielding and compensation measures we find that the costs of introducing the so called Carbon Pollution Reduction Scheme (CPRS) will be unevenly distributed across the Australian community. In particular, sectors and regions that rely on using large amounts of energy and produce large amounts of greenhouses gases will bear the majority of the burden of reducing Australia's greenhouse gas emissions intensity. It is important to recognise that if these industries weren't adversely affected the Government's policy of reducing greenhouse gases would simply not work, so the adverse effects on these sectors and regions is a design feature of the Government's policy. The effects on these sectors and regions are more dramatic than the overall negative effect on the economy. For this reason the Federal Government has preferred to emphasise the overall economic effects of the proposed CPRS rather than the regional and sectoral effects.

This report seeks to examine the regional and sectoral effects of the CPRS. It is important to understand these regional and sectoral effects so the Australian community can be confident that policy decisions are being made on an informed basis. In particular, given that the burden of the CPRS will inevitably fall on a few sectors and regions it is important for the community to understand what policies will be put in place to manage the transition of adversely affected communities. Mismanaging or ignoring these transitional issues will undermine the community's confidence in the merit of introducing greenhouse gas reduction policies in Australia and, perhaps, more widely.

It is important to acknowledge that introducing policies to reduce greenhouse gases will inevitably result in a loss to the economy if the environmental benefits of introducing such policies are ignored. The results of this study and of similar ones should be used to determine whether society considers that the (unmeasured) environmental benefits are likely to outweigh the costs of these policies, which often reflect foregone opportunities to enhance public welfare.

Overview

The Australian Government is committed to implementing an emissions trading scheme (Carbon Pollution Reduction Scheme, CPRS) to reduce greenhouse gas emissions. The fact that implementing a policy to reduce greenhouse-gas emissions will entail extensive structural change for Australians does not provide a reason to avoid making decisions in favour of the environment. If the costs of not reducing emissions are greater than the costs of implementing the emissions-reduction policy, then society ought to choose to reduce emissions. To assist this decision making process it is important to understand what these costs are likely to be, and how they are distributed, so that policies are made in an informed environment.

Thus far, most studies have focussed on the aggregate long-run costs of introducing emissions trading. There has been minimal discussion regarding: (a)

the medium-term consequences, particularly in light of new information regarding the global financial crisis and (b) the distribution of costs across sectors and regions, since some sectors and regions will bear a disproportionate burden of the overall economic costs. This study seeks to address these issues.

This modelling exercise

Frontier Economics has been commissioned by Macquarie Generation to conduct an economic modelling exercise similar to those undertaken by the Commonwealth Government for its *Australia's Low Pollution Future* White Paper and by the Garnaut Climate Change Review, albeit with considerably fewer resources. Frontier Economics used the same model of the Australian economy that the Commonwealth used (MMRF-GREEN). We examine some of the structural-adjustment pressures that adoption of the CPRS would impose on the Australian economy. In doing so, we accept that a modelling system such as was used by the Commonwealth and by the Garnaut Review is an appropriate analytical vehicle. We use the modelling system to simulate the effects of adopting a scheme with the same specifications as the CPRS-5 scheme proposed in the *White Paper*, including up-to-date compensation and shielding arrangements.

We assess structural adjustment pressures by examining the medium-run (to 2020) effects of the CPRS on the economic prospects of sectors and regions relative to the base-case prospects that they are likely to face if the CPRS is not introduced. The underlying idea is that a structural adjustment problem is most likely to arise when the adoption of the CPRS has adverse effects in a sector or region that would already face poor prospects even if the CPRS were not introduced. This is reflected in the structural adjustment framework in Table 1.

Table 1: Structural adjustment framework

Effect of CPRS	Base case prospects (output or employment)	
	Declining	Growing
Stimulatory	CPRS reduces or offsets underlying decline	CPRS may exacerbate growth pressures
Contractionary	**Problem: CPRS exacerbates decline** Certainly face absolute reductions	May or may not face absolute reductions CPRS may even alleviate growth pressures

Source: Frontier Economics

The columns of Table 1 reflect sector or regional prospects in the absence of the CPRS (declining or growing) and the rows reflect the impact of the CPRS (stimulatory or contractionary). Hence, there are four possibilities:

- Sectors or regions in the upper-left quadrant would face shrinking output or employment in the absence of the CPRS but their growth prospects would be improved by the introduction of the scheme.

- Sectors or regions in the upper-right quadrant would face growth of output or employment in the absence of the CPRS and even stronger growth prospects following introduction of the scheme.

- Sectors or regions in the lower-right quadrant would face growth of output or employment in the absence of the CPRS but weaker growth prospects following introduction of the scheme. For some sectors or regions in this quadrant, the negative effects of the CPRS could be strong enough to mean that with the scheme in place they would face shrinking output or employment and hence experience structural-adjustment problems.

- Sectors or regions in the lower-left quadrant would face shrinking output or employment in the absence of the CPRS and even poorer growth prospects after introduction of the scheme. Structural adjustment problems arise most obviously for sectors or regions that lie in this quadrant of the framework.

The structural-adjustment focus was not emphasised in the modelling results reported by the Garnaut Review or in the White Paper or subsequently by the Federal Government. These reports emphasised the long-run macro-economic effects of the CPRS. The base-case projections underlying those earlier results excluded any consideration of the global financial and economic crisis that has emerged in the last 12-18 months. The long-run effects of the CPRS are unlikely to be very sensitive to short-run base-case assumptions but these assumptions are potentially important for assessing structural-adjustment problems. The potential significance of the global financial crisis is that it could shift sectors and regions from the "Growing" base-case scenario (right hand column of Table 1) into the "Declining" scenario (left hand column). This would exacerbate the structural adjustment problems associated with the CPRS.

We have included assumptions about the global financial and economic crisis in our base case but we find that they have only a limited effect on our results. The reason is that the sources that we used assume a relatively quick macroeconomic recovery from the crisis. If this quick recovery does not emerge as predicted by these sources, then the global financial crisis will have a more profound affect than indicated in this analysis.

Summary of findings

Our macroeconomic results are consistent with the conclusions of the Garnaut Review and the White Paper that the effects of the policy on real GDP and aggregate employment are likely to be modestly, but not negligibly, adverse.

The policy reduces total growth in GDP over the period 2007-20 by *1 percentage point* (from *43.2% in the base case to 42.2% under the CPRS*). In dollar terms, this represents an *$11.05B* reduction in 2020 GDP (2007 prices), even with shielding and compensation arrangements in place. In previous longer term modelling, reported elsewhere, these GDP impacts are far greater because industry shielding is removed.

The CPRS was found to reduce total growth in aggregate employment by *0.3 percentage points* (from *19.9% to 19.6%*). This represents a reduction of about 28,500 in persons employed in 2020 compared with base-case employment level. However, the immediate impact on aggregate employment is a relative reduction (compared with BaU) of 25,000 persons in 2010 rising to 40,200 persons in 2013. These immediate employment impacts diminish in the medium term as wages respond with a lag to prevent the policy from increasing unemployment permanently.

Two factors limit the extent to which the CPRS policy generates adverse macroeconomic effects. First, our simulation period ends in 2020, before the shielding of trade-exposed industries that is included in the proposed CPRS policy package are removed. Secondly, like the earlier studies, we assume a high degree of macro-economic flexibility. In particular, we assume that real wage rates are sufficiently flexible to prevent the policy shock from generating an increase in aggregate unemployment except in the short run. In our results, the CPRS reduces growth in real wages over the period 2007-20 by *2.3 percentage points* (from *19.7% to 17.4%*). In other words, the aggregate employment result is largely a consequence of an input assumption – that wages will fall to ensure full employment is maintained. If this is not the case, then the CPRS would generate more serious declines in aggregate employment and GDP.

This *aggregate* employment result masks the underlying structural adjustment, which requires employment to flow between sectors and/or regions. To a degree, the creation of new jobs in some sectors and regions is outweighed by the reduction in jobs in other sectors and regions. However, the *change* in regional and sectoral results – which are not reflected in the aggregate numbers – is also significant for assessing transitional costs. Given that aggregate employment is unlikely to change significantly in the long run (by assumption), the cost of any policy can be evaluated according to the size of the structural shift in employment from one sector (or region) to another. Our results indicate that there are 15 sectors and 7 regions that are already expected to decline and are expected to contract further as a result of the proposed CPRS.

The CPRS would have more dramatically adverse macroeconomic effects if it led to a sharper reduction in primary-factor usage. One possibility is that uncertainty about the policy could lead investors to demand sharply higher rates of return on capital than would have been the case in the absence of the policy. This is especially likely if investors regard the details of the policy package as likely to be manipulated for political reasons. The results in this report do not include this scenario. Another possibility is that the labour market is insufficiently flexible to prevent the negative shock from causing reductions in employment beyond the short run.

Our primary focus is the effects of the policy on output and employment in the 58 sectors and 57 sub-state regions that are distinguished in our modelling system. The macroeconomic results mask the underlying structural adjustment, which requires employment to flow between these sectors and regions.

In contrast to the macroeconomic effects, the effects of the CPRS in particular sectors and regions can be quite dramatic. For sectors, the key factors are the emissions intensities (direct and indirect) of their production processes and the extent to which they are able to pass on emissions charges to their customers. For regions, what is crucial is the exposure of the regional economies to the sectors most adversely affected by the CPRS. While the share of the six most adversely affected sectors in GDP is only 5.3%, their shares in regions' gross products range up to 50 %. Similarly, the six sectors account for only 1.6% of aggregate national employment but for 35% of employment in the most heavily exposed region. Hence, it should come as no surprise that the effects of the CPRS on some regional economies are much more severe than its effects on the national economy.

According to our results, over the period 2007-20 the CPRS policy generates changes in sector-specific output growth ranging from *–15.4 percentage points +171 percentage points*. Of the 45 adversely affected sectors, there are three for which output is projected to shrink if the CPRS policy is introduced. Of these, two have shrinking output in the no-CPRS base case. It generates changes in sector-specific employment growth ranging from *-12 percentage points* to *+116 percentage points*. In terms of numbers employed, the range is *-16,248 +11,485*. Of the 29 adversely affected sectors, there are 15 for which employment is projected to shrink if the CPRS policy is introduced. All of these have shrinking employment levels in the no-CPRS base case. (See Table 2.)

Table 2: Structural adjustment results: sectors

Effect of CPRS	Base Case prospects			
	Declining		Growing	
	Output	Employment	Output	Employment
Stimulatory	0	14	10	9
Contractionary	**2**	**15**	43	14

Source: Frontier Economics

The proposed CPRS generates changes in region-specific gross product growth ranging from *-6 percentage points +6* percentage Of the 39 adversely affected regions, there are none for which gross product is projected to shrink if the CPRS policy is introduced. It generates changes in region-specific employment growth ranging from *–4.7 percentage points +4.7 percentage points*. In terms of numbers employed, the range is *-13,440* to *+6,877*. Of the 34 adversely affected regions, there are 14 for which employment is projected to shrink if the CPRS policy is introduced. Of these 7 have shrinking employment levels in the no-CPRS-policy base case. (See Table 3)

Table 3: Structural adjustment results: regions

Effect of CPRS	Base Case prospects			
	Declining		Growing	
	Output	Employment	Output	Employment
Stimulatory	0	6	17	16
Contractionary	**0**	**7**	39	27

Source: Frontier Economics

These results demonstrate the uneven impact of the CPRS policy across sectors and regions. They include several examples of prima facie structural-adjustment problems, i.e., cases in which the CPRS policy is associated with absolute declines in gross output or employment, including cases in which the policy exacerbates sectoral or regional prospects that are already weak.

1 Introduction

The main focus of this report is on the ability of the Australian economy to absorb a greenhouse-gas emissions control policy such as is proposed in the Commonwealth government's CPRS White Paper (Department of Climate Change, 2008). In particular, we attempt to describe the structural adjustment task that the economy would face were such a policy adopted. Our time horizon is 2020.

We proceed by way of simulations conducted in a modelling system that combines a bottom-up model of the Australian electricity-generation system (WHIRLYGIG) and a multi-sector, multi-region computable general equilibrium model (MMRF-GREEN) that is maintained at the Centre of Policy Studies (CoPS) at Monash University. This modelling system is very similar to the system that was used for the modelling work that was done to support the CPRS White Paper and the Garnaut Climate Change Review (Garnaut, 2008). Both systems use MMRF-GREEN but whereas for this project we use Frontier's proprietary electricity sector model (WHIRLYGIG), the work for the CPRS White Paper and the Garnaut Review used an electricity model developed by McLennan Magasanik and Associates (MMA). Further details of the modelling system used for this project are given in Section 2.

Our approach requires two key ingredients: a realistic base case and realistic assumptions about the time lags involved in the adoption of emissions abatement in electricity generation and other emissions-intensive sectors. It is important to start with a realistic base case because our approach to structural adjustment is to ask the question: how do the prospects that sectors and regions would have if the policy were adopted compare to the prospects that those sectors and regions would have if the policy were not adopted? The dynamics of the adoption of abatement opportunities are an important determinant of a number of aspects of the structural response of the economy to emissions control policies.

With respect to specifying a realistic base, the key issue is the implications of the current global economic and financial crisis. In the work done for the CPRS White Paper and the Garnaut Review, the crisis was not anticipated. The base-case macroeconomic assumptions that we adopt for this project are summarised in section 3.1. We compare these assumptions to those adopted in the work done for the CPRS White Paper and the Garnaut Review.

Our assumptions about the dynamics of the adoption of abatement technologies for the electricity sector reflect the standard assumptions that are adopted in Frontier's WHIRLYGIG model. These differ from the assumptions used in the work done for the CPRS White Paper and the Garnaut Review, which are taken from the MMA electricity model.

The design of the simulations that we conducted for this project is outlined in Section 2.3.2. As well as the base (business-as-usual) case, we run a policy simulations that shows the effects of adopting the CPRS policy that is essentially the same as the design of the CPRS -5 simulation that is reported in the CPRS White Paper.

Simulation results are reported in Section 3. The modelling system generates annual time paths for variables over the period 2010 to 2020. For the base case, we report these annual growth paths of the variables over the simulation period, reported as indexes with base 2007=100. For the CPRS simulations, we report the deviations of the values of variables from their base-case levels – for variables reported in the base case as growth rates, we report percentage-point deviations. We summarise the macro-economic aspects of the base case and of the effects of the adoption of the CPRS policies (Subsection 3.1) but our main focus is on key structural variables, especially the effects of the CPRS policies on output and employment at the sectoral (Subsection 3.2.2) and regional (Subsection 3.2.3) levels. The emphasis is on assessing whether the effects of the CPRS policies are reinforcing of or offsetting to the activity and employment prospects that the sectors and regions face in the base case. Of particular concern from a structural-adjustment point of view are instances in which the policies have adverse implications for sectors or regions that already face poor prospects in the base case.

2 Outline of the modelling system

This section provides details about the electricity-sector model and the computable general equilibrium model that are used in this project and how they are combined to produce a base case and projections of the effects of introducing CPRS policies.

2.1 Electricity market modelling: *WHIRLYGIG*

For this project we use a model of an efficient and competitive electricity market where costs, prices and generator returns are determined on an optimal least-cost basis. This approach involves determining the future pattern of generation and hence the long run marginal cost (LRMC) of the generation system by computing the least-cost mix of future generation plant, having regard to the current stock of plant. LRMC is a proxy for a price in an efficient market.

Frontier's proprietary long-term investment model, *WHIRLYGIG*, computes the least-cost mix of generation, interconnection, demand-side management and greenhouse abatement investments, subject to *simultaneously* meeting a system reliability target (as determined by NEMMCO) and any greenhouse emission target (including, for instance, MRET, GGAS, the Queensland Gas Scheme or an emission trading scheme.

In addition to an investment path, *WHIRYLGIG* provides Short-Run Marginal Cost (SRMC) and LRMC, which may be used as a proxy for long-term price projections, which is the approached used in this project. The process for determining the LRMC is well developed and provides a systematic basis for comparison between scenarios including and excluding the CPRS.

2.1.1 Inputs

The model requires the following data for generation plant and potential greenhouse abatement options:

- new entrants' costs, including "technology curves";
- fuel cost projections;
- fixed costs for existing plant;
- electricity demand and demand-side impacts;
- carbon intensity coefficients;
- capacities and annual energy output potential;

- plant commissioning timeframes; and
- emissions target for the electricity sector in the case of CPRS policy simulations.

2.1.2 Outputs

The outputs of this electricity modelling include new plant build and carbon prices for each scenario and an indication of long-term dispatch and least-cost pricing. Although plant is dispatched on the basis of SRMC, *WHIRLYGIG* can also provide long-term forecasts of LRMC as a proxy for long-term market prices.

2.2 The CGE model: MMRF-Green

MMRF-GREEN is a multi-sector, multi-region dynamic model of the Australian economy. The key features of the model are summarised in the dot points below.

- It models the six Australian States and two Commonwealth Territories as separate economies, interacting with one another via inter-regional flows of commodities and primary factors.
- In each of the eight regions, it models the production and investment behaviour of a representative producer/capital creator in each of 58 sectors. These representative agents are price takers who choose inputs to minimise the costs of production and capital creation subject to functions that specify technological relationships between the relevant inputs and outputs.
- Each region contains a representative household that chooses a consumption bundle subject to its disposable income and the relative prices of consumption goods.
- The income and outlay sides of the budgets of the Commonwealth government and each of the State and Territory governments are modelled separately.
- International trade is included, with exports disaggregated by (domestic) region and sector of origin but not by (foreign) country of destination. Similarly, imports are disaggregated by (domestic) region and sector of destination but not by (foreign) country of origin. Australia is assumed to be a price taker in its import markets but to exercise some market power with respect to its main exports.

- Domestically produced commodities are used as inputs to current production and capital formation, in household and government consumption, and for export. Markets for these commodities are assumed to clear.

- In its treatment of energy, the model recognises:
  - production, domestic usage and trade for three primary fuels (coal, oil and natural gas);
  - six electricity-generating technologies (coal-fired[1], gas-fired, oil-fired, hydro, other renewable);
  - an electricity-supply sector covering transmission, distribution and retail activities; (In buying electricity from the generators the sector can substitute between the different generating technologies in response to changes in their relative costs.)
  - a petroleum-products sector, producing automotive petroleum, aviation fuel, diesel, LPG and other petroleum products; and
  - a transport sector comprising five sub-sectors -- road transport, rail transport, water transport, air transport and private transport services. ("Private transport services" is a dummy sector. Its capital stock consists of the domestic vehicle fleet. It purchases automotive fuels and supplies private motor vehicle services to the households.)[2]

- It accounts for greenhouse-gas emissions (measured in CO2 equivalents) from each of its regionally disaggregated sectors and households. The emitting activities that are recognised are the burning of fossil fuels and non-combustion emissions such as fugitives and agricultural emissions.

- The dynamic mechanisms in the model concern capital accumulation, labour-market adjustment and debt accumulation.
  - For capital accumulation, it is assumed that investment in year t augments the capital available for use in year t+1. Hence, year t+1's capital stock is year t's stock *minus* year t's depreciation *plus* investment undertaken in year t. Investment in year t is a function of the expected

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1 The model's regional dimension implicitly splits coal-fired generation into black-coal (NSW and Queensland) and brown-coal (Victoria and South Australia) components.

2 This treatment is analogous to the treatment of owner-occupied houses in the ABS input-output tables.

rate of return on capital[3]. Investors in each sector seek to expand the sector's capital stock so long as the expected rate of return exceeds the required rate of return for the sector. The higher the rate of growth of a sector's capital stock (relative to its trend growth rate), the higher is the rate of return required by investors assumed to be (relative to the normal rate of return on investment in the sector). Similarly, if the rate of growth of a sector's capital stock declines relative to its trend growth rate, investors are assumed to receive a rate of return that is below the normal rate. The percentage growth rate of a sector's capital stock is bounded by (the negative of) its depreciation rate and a maximum rate set at 6 *plus* its trend growth rate[4].

- The labour market is not assumed to clear instantaneously. Labour-market shocks affect the level of unemployment in the short run but over time real wage rates adjust to eliminate the short-run unemployment effects.
- Dynamic mechanisms track the accumulation of the net foreign liabilities and the net liabilities of the nine governments distinguished in the model.

2.3 Modelling approach: linking Frontier Economics' electricity models and MMRF-Green

The effects of emissions trading are modelled using *WHIRLYGIG* interactively with MMRF-GREEN. *WHIRLYGIG* provides more detail for the electricity sector than is available in MMRF-GREEN. The added electricity-sector detail is warranted because the sector generates a large share of aggregate greenhouse-gas emissions.

2.3.1 Base case

The first step is to generate a base case that is consistent between the two models. This comprises annual time paths for exogenous and endogenous variables over the period 2008 to 2020. Table 4 illustrates the structure of the computation: key exogenous inputs are shown in black text in the middle column of the table. They include scenarios on macroeconomic variables and world prices; these are taken from specialist forecasting agencies. Also included are assumptions about technological and preference changes; for most sectors, these

3 Although it is possible in the MONASH models to specify forward-looking (model-consistent) expectations for rates of return, static expectations are assumed in most applications.

4 For details, see Dixon and Rimmer (2002), especially section 21.1.

are extrapolations of trends observed in historical simulations[5] with the CoPS models but for electricity generation they are implied by detailed assumptions about the characteristics of existing and potential new generating technologies and by the program of capacity expansion that emerges from the electricity-sector modelling[6]. The outputs of the reference-case modelling (shown in the final column of the Table 4) are projections of annual time paths for numerous structural variables (e.g. outputs and employment by sector, prices, domestic usage, exports and imports by commodity), all with regional dimensions.

Of particular interest are projections for the electricity sector. These include: electricity demand by region; electricity output and fuel usage by generation technology and region; and wholesale electricity prices by region. These are endogenous variables for the modelling system as a whole but for the individual models comprising the system they are sometimes exogenous and sometimes endogenous. To emphasise this, the relevant variables have been colour-coded in Table 4. Electricity demand by region (green-coded) is endogenous in MMRF-GREEN but exogenous in *WHIRLYGIG*. On the other hand, electricity output and fuel usage, wholesale electricity prices and the carbon price (red-coded in the table) are endogenous in *WHIRLYGIG* but exogenous in MMRF-GREEN.

As in most previous studies combining MMRF-GREEN with a detailed electricity-sector model, investment in electricity generation is determined by MMRF-GREEN rather than by the detailed electricity-sector model. There is no formal process for reconciling the MMRF-GREEN investment projections with the more detailed investment projections produced by *WHIRLYGIG*. The assumption in MMRF-GREEN is that the generators' capital stocks adjust annually to keep their rates of return fixed. Rates of return for the generating technologies (at given capacity) are tied down by projections for the wholesale price of electricity and technology-specific fuel costs supplied by the electricity-sector model, together with MMRF-GREEN's own projections of the costs of constructing plant for the generating technologies[7]. Technologies that would otherwise be experiencing increases (decreases) in their rates of return expand (contract) their capital stocks to keep their rates of return fixed. In MMRF-GREEN, projections of investment are reconciled with projections of fuel usage, fuel prices, electricity output and the wholesale electricity price by an endogenous shift in capital intensity.

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5 For details about how historical, forecast and policy simulations are run in the MONASH models, see Dixon and Rimmer (2002), especially section 2.2.

6 Formally, projections of output, fuel usage and emissions are all supplied to MMRF-GREEN by *WHIRLYGIG*, as are projections of the wholesale electricity price. In MMRF-GREEN, this information is sufficient to imply fuel intensity, emissions intensity and capital intensity for the generating technologies.

7 In MMRF-GREEN, construction costs are determined by the prices of the main capital-goods inputs.

Table 4: Assignment of variables in the base case

Model	Key exogenous variables	Key endogenous variables
MMRF-GREEN	Macroeconomic variables World prices (including fuels) Oil and gas supplies Technological and preference changes outside electricity generation Electricity output and fuel usage by technology and region Wholesale electricity prices by region Carbon price	Numerous structural variables (sector by region) Electricity demand by region
whirlygig electricity investment model	Electricity demand by region Fuel prices Oil and gas supplies Technological specifications for existing and potential new generators	Electricity output and fuel usage by technology and region Wholesale electricity prices by region Carbon price

2.3.2 CPRS policy simulations

Policy simulations (in this case, simulations of the effects of the CPRS) are conducted as deviations from the base case. For whatever scheme is to be simulated, an assumption is made about the demand path for electricity[8] and the path of emissions reductions that will be required from the electricity sector[9]. Given that international permits will be accepted in the proposed CPRS, we assume that the Australian electricity sector will be a price taker in the global carbon market and adopt the same carbon price assumptions as Treasury. Then, in *WHIRLYGIG*, we compute the revised projections for electricity output and investment, fuel usage, fuel prices, and wholesale electricity prices after taking into account the international carbon price.

The carbon prices and revised electricity-sector projections are then fed into an MMRF-GREEN policy simulation. Among the variables projected by MMRF-GREEN in this simulation is the demand for electricity. It is necessary to check that the demand projection is consistent with the demand assumption that

8 Noting that the elasticity of demand for electricity is likely to be low, a reasonable starting assumption would be that demand is the same as in the base case.

9 A default assumption is that electricity provides the same share of the aggregate required reduction in emissions as it accounts for in the level of emissions in the reference case.

underlies the electricity-sector modelling. Another output of the MMRF-GREEN policy simulation is non-electricity emissions. It will be necessary to check that together with electricity-sector emissions, these are consistent with the overall emissions cap required under the emissions-trading policy. To eliminate any inconsistencies in electricity demand or the emissions cap, iteration between MMRF-GREEN and *WHIRLYGIG* may be required.

Figure 1 illustrates a case in which iteration leads to convergence with respect to electricity demand. "Demand (CGE)" is the electricity-demand schedule implicit in MMRF-GREEN. The supply schedules are the schedules implied by *WHIRLYGIG*, without and with emissions trading. "Demand (Elec. 1)" is the inelastic demand schedule initially assumed in the electricity-market modelling[10]. With this demand schedule, *WHIRLYGIG* projects a wholesale price for electricity of P2. At this price, MMRF projects a lower level of demand (Q3), which implies a lower price (P4) in the electricity-market model. Continuing this iterative process, the models would converge to the with-CPRS equilibrium (P*,Q*). Given that the elastiticity of demand for electricity in the CGE model is low, the demand schedule in Figure 1 will be steep relative to the supply schedule and convergence is rapid.

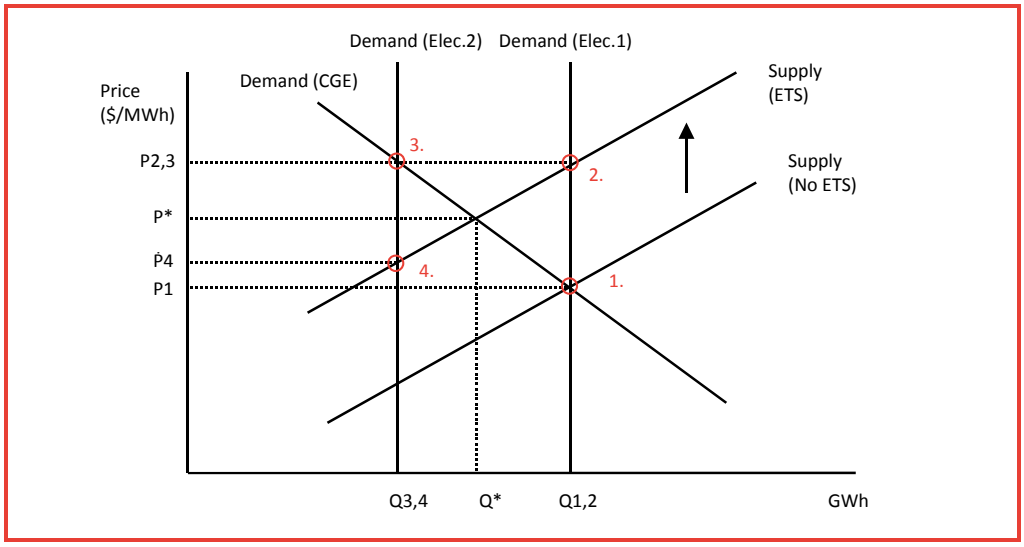

Figure 1: Illustrative iteration

As noted in above, the MMRF simulations assume that the capital stock in electricity generation continues to earn a constant rate of return: if the introduction of the CPRS would otherwise reduce the return on capital, the model responds by reducing the capital stock to maintain the required return on capital. A limitation of this approach is that it may underestimate the structural

10 Note that this is the equilibrium quantity demanded without emissions trading.

adjustment costs of an CPRS if there are significant amounts of sunk capital that cannot be adjusted to maintain the required rate of return. As an example, an CPRS may encourage the early retirement of emissions intensive plant in the electricity generation sector: this effectively reflects accelerated depreciation of those assets. These costs are not estimated or included in any of the reported figures.

3 Simulation results

3.1 Macroeconomic overview

3.1.1 The base case

We included projections of the effects of the global financial and economic crisis on the Australian macro economy and terms of trade. However, even the most recent projections suggest that recovery from the crisis will be quite rapid. Hence, including the crisis in our base case is of limited significance to our assessment of the structural adjustment problems posed by the CPRS in the period out to 2020.

The main focus of this report is structural-adjustment problems that might be posed by the imposition of the Commonwealth government's proposed CPRS policy. This requires us to compare the effects of the policy on various dimensions of the economy with the economic prospects for those dimensions in a no-CPRS-policy base case. We regard structural-adjustment problems as most likely to arise when the policy has adverse effects on parts of the economy that would already be facing poor prospects in the absence of the policy.

As the background for assessing structural-adjustment problems viewed in this way, we need a realistic no-CPRS-policy base case. In particular, we have attempted to include the likely effects of the current global financial and economic crisis in our base case. This crisis was not anticipated when the modelling work for the Commonwealth's CPRS White Paper and the Garnaut Review was completed.

To include the likely effects of the crisis in the base case for the current study, we used macroeconomic projections from Access Economics' December 2008 Business Outlook (Access Economics, 2008) and projections for the world-market prices of Australia's main exports and imports taken from data provided on-line by the Australian Bureau of Agricultural and resource Economics as at March 2009 (ABARE, 2009). Selected information from these sources is input into MMRF-GREEN to produce a base-case projection for the development of the economy over the period 2007-08 to 2020-21.

A summary of the main differences between the base-case macroeconomic scenario adopted for the current study and the scenario used in our 2008 study for the NSW State government is given in Figure 2. The chart plots indexes (2007-08=100) for some key macroeconomic variable from the two base cases, with indexes from the current study shown as solid lines and indexes from the earlier study shown as dashed lines.

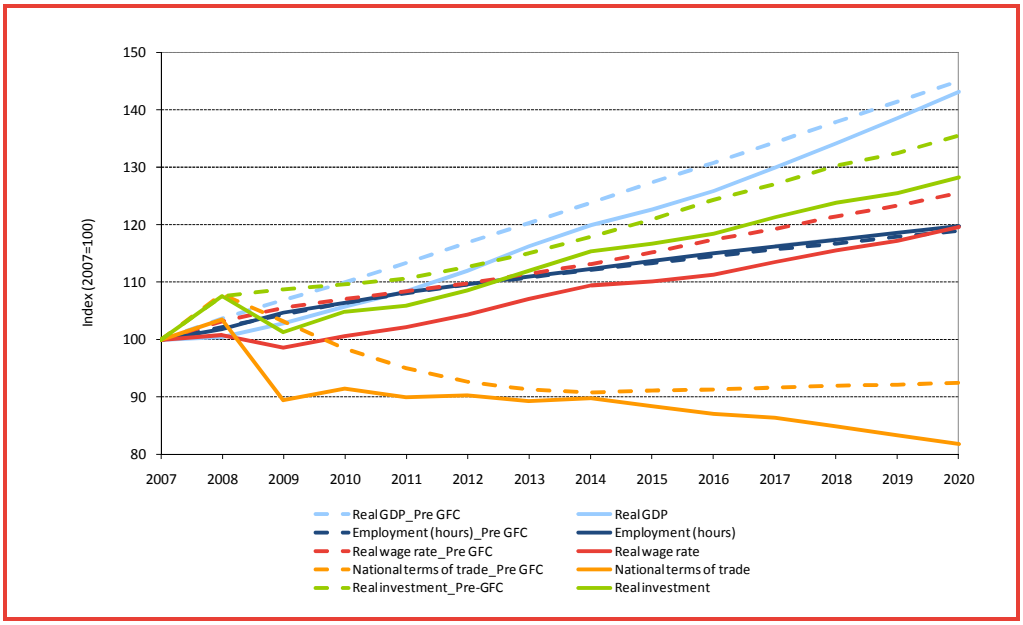

Figure 2: Macro variables in current and Pre-GFC base cases (2007=100)

The chart shows that real GDP, real investment and the terms of trade are all sharply lower in the early years of our current base-case scenario than they were in the earlier scenario. By the end of the projection period, the growth rate of real GDP has returned to the value that it had in the earlier scenario. However, the growth rates of real investment and especially of the terms of trade remain relatively low. The outlook for aggregate employment is similar in the two scenarios but to support employment in the early years of the current scenario the real wage rate has to decline sharply.

Since the base-case scenario for the current study was compiled, Access Economics has revised it projections of the macroeconomic effects of the global financial and economic crisis Access Economics, 2009). The extent of the revisions is indicated by the GDP projections reported in Table 5 below. The revised Access (March 2009) view is that the macroeconomic effects will be more adverse in the short run than is implied by the (December 2008) data that we used. But from 2011-12 onwards, projected GDP growth has been revised upwards. The last row of the table contains the official forecasts released by the Treasury in conjunction with the May 2009 Commonwealth Budget. The Treasury view is similar to the Access March 2009 view through to 2010-11 but more optimistic thereafter.

Table 6 shows Access Economics' projections for the terms of trade. In this case, Access has revised its outlook upwards.

Table 5: Projections of growth rates of real GDP

Source	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Access Dec 08	0.8%	2.4%	2.7%	2.6%	3.2%	3.9%	3.2%	2.3%	2.6%
Access Mar 09	0.1%	-0.2%	2.4%	3.4%	3.3%	4.0%	3.3%	2.3%	2.6%
Treasury May 09	0.0%	-0.5%	2.3%	4.5%	4.5%	4.0%	4.0%	4.0%	4.0%

Table 6: Terms-of-trade projections (2006-07=100)

Source	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Access Dec 08	105.0	112.4	81.8	85.5	84.1	84.3	83.4	83.9	82.6
Access Mar 09	105.0	112.4	93.4	85.9	85.0	85.1	84.9	84.8	84.8

Revising our base-case assumptions in line with the most recent data[11] would be unlikely to have much effect on our projections of the economic effects of the CPRS policy or of the structural adjustment problems likely to accompany the introduction of the CPRS. In particular, revisions of the extent illustrated by the tables would not lead to sectors and regions facing poorer economic prospects in the absence of a CPRS policy.

3.1.2 Macroeconomic effects of the CPRS

The effects of the CPRS on the growth of real GDP and aggregate employment are adverse, but modest, reflecting the shielding arrangements included in the CPRS package and the significant degree of labour-market flexibility that is assumed in the model. The macroeconomic effects would be more serious if wage adjustment was resisted or if investors responded to uncertainty about the policy by requiring higher rates of return on investment.

11 Note that the terms-of-trade assumptions used in our base case were derived from ABARE sources, rather than Access. As shown by Figure 2 however, the time profile of our ABARE-sourced assumptions is very similar to the Access profile.

Figure 3 shows the effects of the CPRS policy on the same macro variables as are included in Figure 2. The effects are shown as the percentage changes in the values of the variables relative to their values in the base case. The effects of the policy on real GDP and aggregate employment are adverse but modest, although not negligible. The policy reduces total growth in GDP over the period 2007-20 by *1 percentage point* (from *43.2% to 42.2%*). In dollar terms, this represents an *$11.05B* reduction in 2020 GDP (2007 prices). It reduces total growth in aggregate employment by *0.3 percentage points* (from *19.9% to 19.6%*). This represents a reduction of about 28,500 in persons employed in 2020.

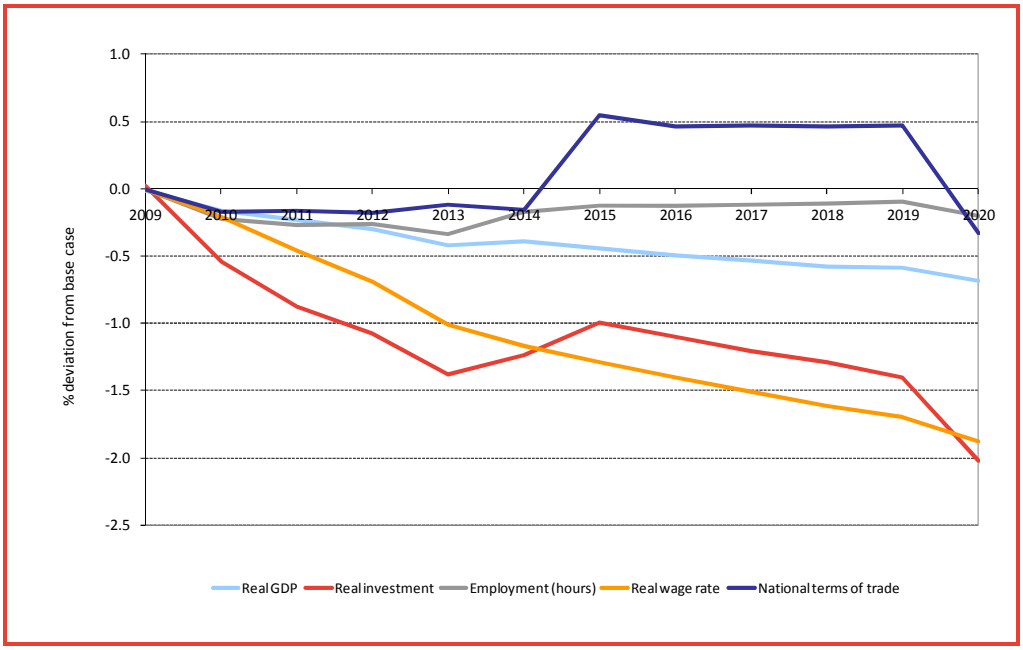

Figure 3: Macro variables in CPRS case: % deviations from base

Two factors limit the extent to which the CPRS policy generates adverse macroeconomic effects: the shielding arrangements included in the proposed policy package[12] and the assumptions about economic flexibility that are built into the model. In particular, the model assumes that real wage rates are sufficiently flexible to prevent the policy shock from generating an increase in unemployment in the long run. The CPRS policy reduces growth in real wages over the period 2007-20 by *2.3 percentage points* (from *19.7% to 17.4%*) Short-run reductions in employment are generated, however, because wages are assumed to adjust to shocks with a lag. Because the policy reduces real-wage growth, it increases the labour intensity of production and reduces investment.

12 For this purpose, we measure the effects of the CPRS policy on output and employment as percentage deviations between the levels that would eventuate if the policy is imposed and the levels that eventuate in the no-CPRS-policy base case.

The CPRS would have more dramatically adverse macroeconomic effects if it led to a sharper reduction in the usage of labour and/or capital. One possibility is that uncertainty about the policy could lead investors to demand sharply higher rates of return on capital than would have been the case in the absence of the policy. This is especially likely if investors regard the details of the policy package as likely to be manipulated for political reasons. The results in this report do not include this scenario. Another possibility is that the labour market is insufficiently flexible to prevent the negative shock from causing reductions in employment beyond the short run.

The fall in real GDP in Figure 3 is greater than can be explained by the small fall in employment and the reduction in the capital stock that is implied by the fall in investment. The additional contribution to the fall in real GDP comes from the resource cost to producers of emissions-saving changes in production technology. The charge on emissions that is implied by the introduction of the CPRS policy induces producers to implement these changes. The model assumes that producers reduce emissions up to the point at which their marginal abatement cost is equal to the emissions charge. Abatement costs are modelled as increases in the amount of all inputs required per unit output.

A final feature of Figure 9 is the effect of the introduction of the CPRS policy on the terms of trade. To understand this, it is important to note that our no-CPRS-policy base case assumes that neither Australia nor the rest of the world is adopting a CPRS policy, whereas in the CPRS simulation it is assumed that Australia adopts the Commonwealth's proposed CPRS-5 policy and that there is some move towards adopting similar policies in other countries. Our scenario with respect to the adoption of policies overseas is the same as was adopted for the CPRS White Paper modelling and for our earlier study for the NSW government. The adoption of emissions-control policies overseas affects the Australian economy mainly via effects on the prices of the things that Australia exports to or imports from overseas, i.e., via the effect on Australia's terms of trade. Projections of the effects of the policy regime on world prices are taken from ABARE, which used its global model (GTEM) to generate the projections. Overall, the adoption of policies overseas is likely to have a negative effect on Australia's terms of trade, due mainly to a reduction in the demand for and world price of coal. The ABARE world-price projections include small reductions in the price of coal for most of the period but a sharp increase in 2015, followed by a sharp decrease in 2020. This explains the shape of the terms-of-trade line in Figure 3.

3.2 The impact of the CPRS policy on sectoral and regional prospects

The direct and indirect emissions intensity of production processes varies greatly between sectors, as does the ability of sectors to pass on cost increases to their customers. Hence, there is a commensurate variation in the effects of the CPRS across sectors. Because individual geographic regions within the national economy can be much more heavily exposed to adversely affected sectors than is the national economy overall, the effects of the CPRS on output and employment in regional economies can be much more dramatic that its effect on GDP or aggregate employment.

3.2.1 Summary

Our primary focus is the effects of the policy on output and employment in particular sectors and regions relative to its effect on the macro-economy. The relevant macroeconomic benchmarks are that the CPRS policy reduces total growth in GDP over the period 2007-20 by *1 percentage point* (from *43.2% to 42.2%*) and total growth in aggregate employment by *0.3 percentage points* (from *19.9% to 19.6%*).

As noted in section 2.2, MMRF-GREEN distinguishes 58 industrial sectors and models the six Australian states and two Commonwealth territories as distinct economic regions interacting with each other *via* inter-regional flows of commodities and primary factors. Hence, at the state/territory level, base-case prospects and the effects of CPRS policies are modelled in considerable detail. From the point of view of structural adjustment issues, however, a finer level of regional disaggregation is of interest.

MMRF-GREEN includes a facility for generating base-case prospects and the effects of CPRS policies on gross regional product and regional employment for the 57 ABS statistical divisions shown in Figure 4.

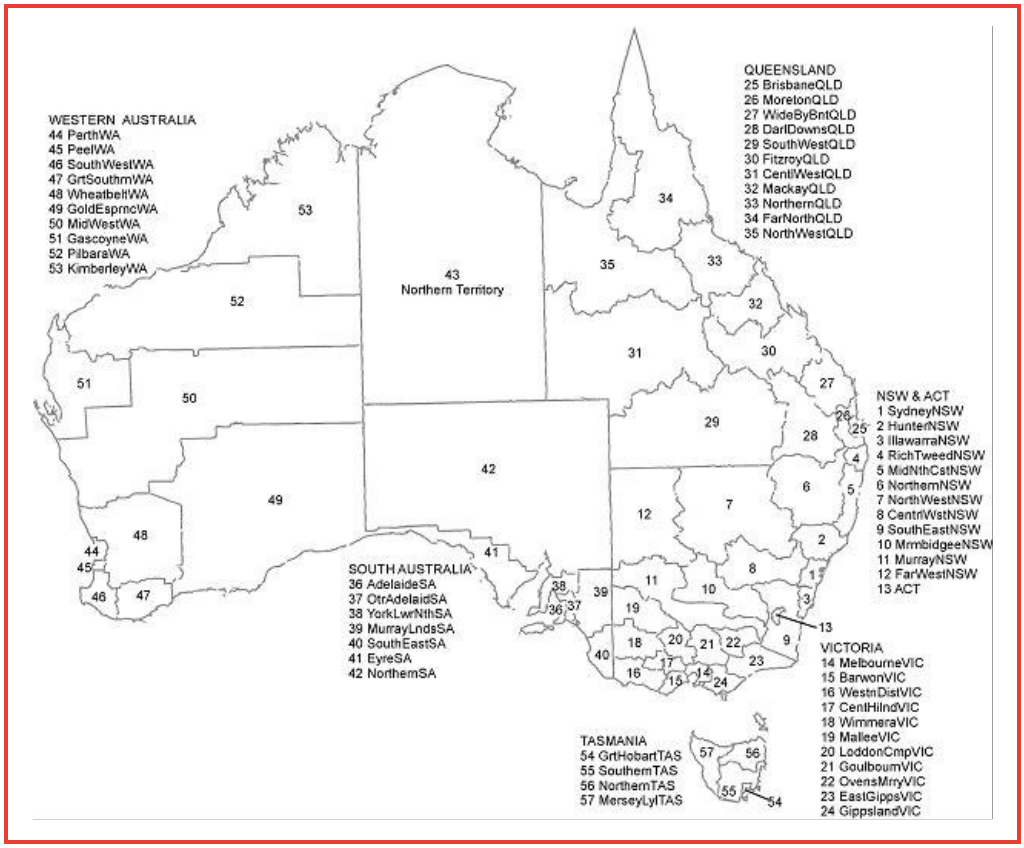

Figure 4: Map of sub-state regions

To generate results for the sub-State regions, we use a top-down procedure in which the model's 58 industry sectors are split into two groups: the group of sectors whose outputs are readily traded between regions and the group of sectors producing outputs (mainly services) that are not readily traded between regions.

For a sector in the first group, our assumption is that the CPRS policy has the same percentage effect[13] on output and employment in a sub-State region as it has on output and employment overall in the sector in the State to which the sub-State region belongs. If we were to apply this assumption to all sectors, then differences between sub-State regions in the estimated effects of the CPRS would depend simply on differences between regions in sectors' shares in output or employment. But in addition to this, we recognise that for sectors in the second (non-traded) group demand in a sub-State region will be met by output in that region. This means that changes in activity in a sub-State region arising from changes in activity in sectors in the first group have local multiplier effects.

13 For this purpose, we measure the effects of the CPRS policy on output and employment as percentage deviations between the levels that would eventuate if the policy is imposed and the levels that eventuate in the no-CPRS-policy base case.

In contrast to the macroeconomic effects, the effects of the policy on gross output and employment in particular sectors and regions can be much more dramatic. In summary, according to our results, the CPRS policy:

- generates changes in sector-specific output growth over the period 2007-20 ranging from *–15.4 percentage points* (from *10.1% BaU* to *–5.3% CPRS* for *Electricity_coal*) to *+171 percentage points* (from *328%* to *499%* for *Electricity_non-hydro renewables*). Of the 45 adversely affected sectors, there are three (*Textiles, clothing and footwear*; *Other manufacturing* and *Electricity_coal*) for which output is projected to shrink if the CPRS policy is introduced. Of these, the first two have shrinking output levels in the no-CPRS-policy base case;

- generates changes in sector-specific employment growth over the period 2007-20 ranging from *-12 percentage points* (from *18%* to *6%* for *Coal mining*) to *+116 percentage points* (from *199%* to *315%* for *Electricity_non-hydro renewables*). In terms of numbers employed[14], the range is *-16,248* (for *Construction services*) to *+11,485* (for *Forestry*). Of the 29 adversely affected sectors, there are 15 for which employment is projected to shrink[15] if the CPRS policy is introduced. All of these have shrinking employment levels in the no-CPRS-policy base case;

- generates changes in region-specific gross product growth over the period 2007-20 ranging from *-6 percentage points* (from *104.6%* to *98.8%* for *Kimberley_WA*) to *+6* percentage points (from *54%* to *60%* for *Lower Great Southern_WA*). Of the 39 adversely affected regions, there are none for which gross product is projected to shrink if the CPRS policy is introduced; and

- generates changes in region-specific employment growth over the period 2007-20 ranging from *–4.7 percentage points* (from *5.2%* to *0.5%* for *Hunter_NSW*) to *+4.7 percentage points* (from 15.6% to 20.3% for *Northern Tasmania*). In terms of numbers employed, the range is *-13,440* (for *Hunter_NSW*) to *+6,877* (for *Perth_WA*). Of the 34 adversely affected regions, there are 14 for which employment is projected to shrink if the CPRS policy is introduced. Of these 7 have shrinking employment levels in the no-CPRS-policy base case.

These results demonstrate the uneven impact of the CPRS policy across sectors and regions. They include several examples of *prima facie* structural-adjustment problems, i.e., cases in which the CPRS policy is associated with absolute declines

14 The implicit assumption is that hours worked per employee remain constant.

15 An absolute reduction relative to current levels, as distinct from a relative reduction in future growth.

in gross output or employment, including cases in which the policy exacerbates sectoral or regional prospects that are already weak.

Table 7 – Table 18 and Figure 5- Figure 16 contain simulation results showing the effects of the CPRS policy on gross product and employment in selected sectors and sub-State regions. For most of these tables, we focus on the sectors and regions that are most strongly affected (either adversely of favourably) by the introduction of the CPRS policy. In Table 18 and Figure 16, we give employment results for ten regions that Macquarie Generation has nominated as being of special interest. In the last column of each of the tables, we include comments indicating the main factors explaining the results. Table 19 and Table 20 summarise the implications of the results with respect to possible structural-adjustment problems.

One issue that arises in designing a presentation strategy for the results is the issue of scale. Scale is ignored if we present the results as percentage deviations between the values that variables attain with the CPRS policy in place and their base-case values. For example, we might identify a sector or region for which the CPRS policy has a large adverse percentage effect on gross product or employment but which is very small so that the effect of the policy is small in terms of dollars of gross product or numbers employed.

In such a case, although the CPRS has a large effect from the point of view of the particular sector or region, the significance of the effect from a wider (e.g., national or State) point of view would be small. An implication would be that any adjustment policy necessary to assist the sector or region to cope with the effects of the policy might be manageable.

In the tables, we deal with the scale issue by reporting the effects of the CPRS policy in two ways: as percentage deviations from base-case values and as dollars worth of real gross output (2007 prices) or numbers employed. In the figures we deal with the scale issue by making the areas of the dots representing the sectors or regions proportional to the dollars of gross product (2007 prices) or numbers employed lost on account of the CPRS in 2020.

3.2.2 Sector results

Adversely affected sectors

Figure 5 and Table 7 show the twelve sectors most adversely affected by the CPRS policy as measured by the percentage-point effects of the policy on the sectors' output growth rates over the period 2007-20. Not surprisingly, all of these sectors have production processes that are emissions intensive, either directly or indirectly *via* their energy intensity. The CPRS policy causes output to contract in these sectors through essentially three classes of mechanisms:

- emissions-intensive fuels and energy-generating technologies losing market share in energy production (*Electricity_coal*, *Electricity_gas*, *Coal mining*, *Gas mining*, *Petroleum refinery*);

- emissions-intensive exporters facing contractions of export sales (*Aluminium*, *Air transport*, *Sheep and cattle*); and

- energy-intensive services losing share in the domestic market (*Electricity supply*, *Electrical equipment services*, *Heating equipment services*, *Road transport passenger services*). The last three of these sectors are dummy sectors that combine energy and energy-using appliances or vehicles to supply the relevant services to households. The dummy structure is used in MMRF-GREEN to capture the complementarity between energy and energy-using equipment in households' expenditure patterns.

Figure 5 illustrates the results reported in Table 7. In Figure 5, the percentage-point effects of the CPRS are shown on the vertical axis and base-case growth prospects are shown on the horizontal axis. Because all of these adversely affected sectors have positive growth prospects in the base case, Figure 5 accords just to the bottom right quadrant of Table 1. In Figure 5 and in all of subsequent figures that cover the bottom right quadrant of Table 1, we include a dotted line separating the part of the quadrant corresponding to negative growth in the Base-*plus*-CPRS scenario from the section corresponding to positive growth in that scenario.

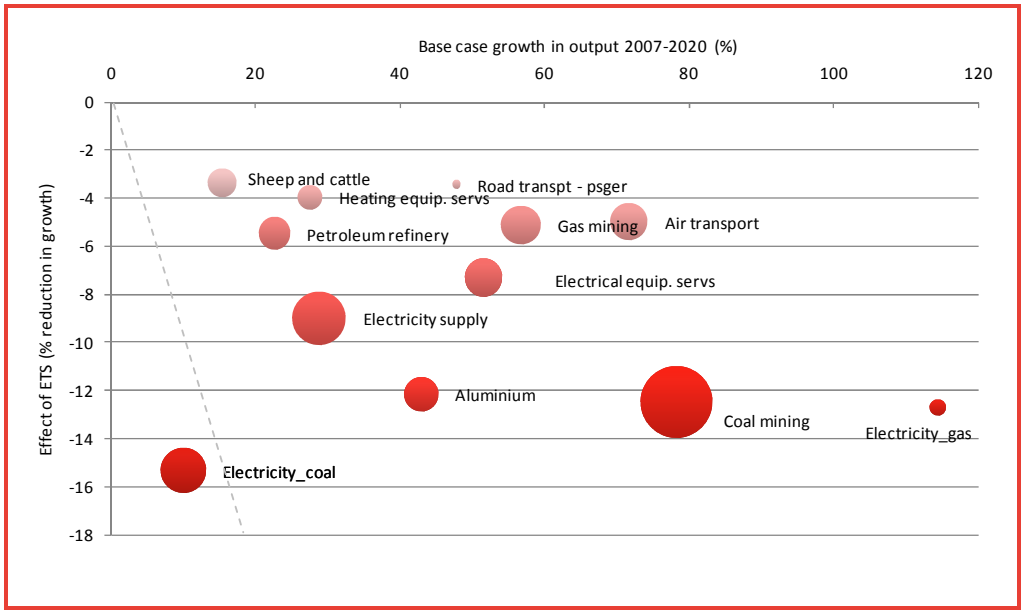

Figure 5: Sectors most adversely affected by the CPRS policy: output

The scale issue is best illustrated by the results for *Coal mining* and the gas-fired electricity generation sector (*Electricity_gas*). Both sectors experience a sharp percentage-point reduction in output growth (about 12.5 percentage points), but this equates to a much smaller dollar value of output loss in the relatively small *Electricity_gas* sector (which accounts for less than 0.1% of GDP) than in the *Coal mining* sector (which accounts for almost 2% of GDP). Hence, in Figure 5 the dot for *Electricity_gas* is much smaller than the dot for *Coal mining*.

Figure 6 and Table 8 show the sectors most adversely affected by the CPRS policy as measured by the effects of the policy on employment. There is a substantial overlap between these and the sectors included in Figure 5/Table 7, with all eight of the common sectors (*Electricity_coal*, *Coal mining*, *Gas mining*, *Aluminium*, *Air transport*, *Sheep and cattle, Electricity supply* and *Road transport passenger services*) having large percentage-point reductions in employment growth in Table 8. But many of these are not particularly large sectors in terms of employment; hence, their employment contractions represent relatively small numbers of jobs lost. On the other hand, Figure 6 and Table 8 include several sectors (*Construction services*, *Business services*, *Trade services*, *Accommodation & hotels*) that are large employers in which relatively modest percentage-point reductions in employment account for substantial numbers of jobs lost.

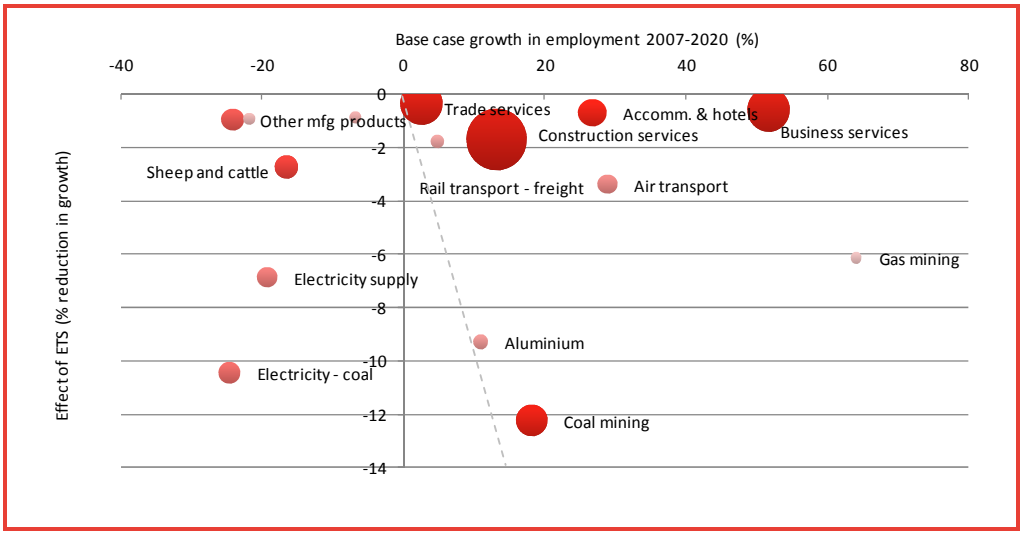

Figure 6: Sectors most adversely affected by the CPRS policy: employment

Note that Figure 5 and Figure 6 (Table 7 and Table 8) contain several examples in which sectors' output or employment levels are projected to shrink in the presence of the CPRS policy, either because the policy exacerbates decline already evident in the base case or because the adverse effects of the policy are sufficiently severe to offset base-case growth. Figure 5/Table 7 contain no examples of the first type but *Electricity_coal* is an example of the second type, i.e., it lies to the left of the dotted line in Figure 5. *Sheep and cattle*, *Other manufacturing*

products, *Electricity_coal*, *Electricity supply*, *Road transport_passenger*, and *Meat products* are all examples of the first type in Figure 6/Table 8. Because of these latter examples, Figure 6 spans both of the two lower quadrants of Table 1 and has all six of these sectors in the lower-left quadrant, which is the most problematic from the point of view of structural adjustment problems.

Favourably affected sectors

Figure 7/Table 9 and Figure 8/Table 10 list the sectors most favourably affected by the CPRS policy as measured by the percentage-point effects of the policy on the sectors' output growth rates over the period 2007-20 and by its effects on the sectors' employment levels in 2020. There are two sectors that are stimulated directly by the imposition of a charge on carbon emissions: *Electricity_non-hydro renewable* and *Forestry and logging*. The first of these gains share in the electricity market at the expense of the emissions-intensive fossil-fuel generators. The strong growth of this sector in the base case reflects mainly the expanded renewable energy target, which is included in the base case.. *Forestry and logging* effectively receives a subsidy reflecting the absorption of carbon dioxide that characterises forest expansion – this is due to a heavy reliance on forestry offsets to meet the Australian abatement task.

The other favourably affected sectors benefit from the re-allocation of the export bundle that follows from the adverse effects of the policy on other emissions-intensive exporters. Figure 8/Table 10 also include some large labour-intensive service sectors in which employment expansion is small in percentage-point terms but large in terms of numbers of jobs created.

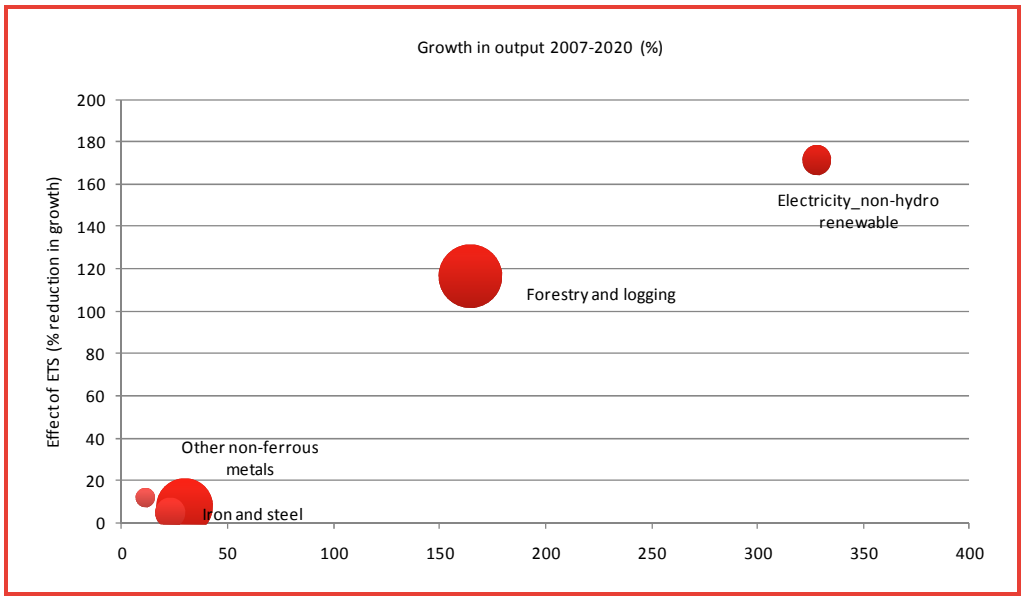

Figure 7: Sectors most favourably affected by the CPRS policy: output

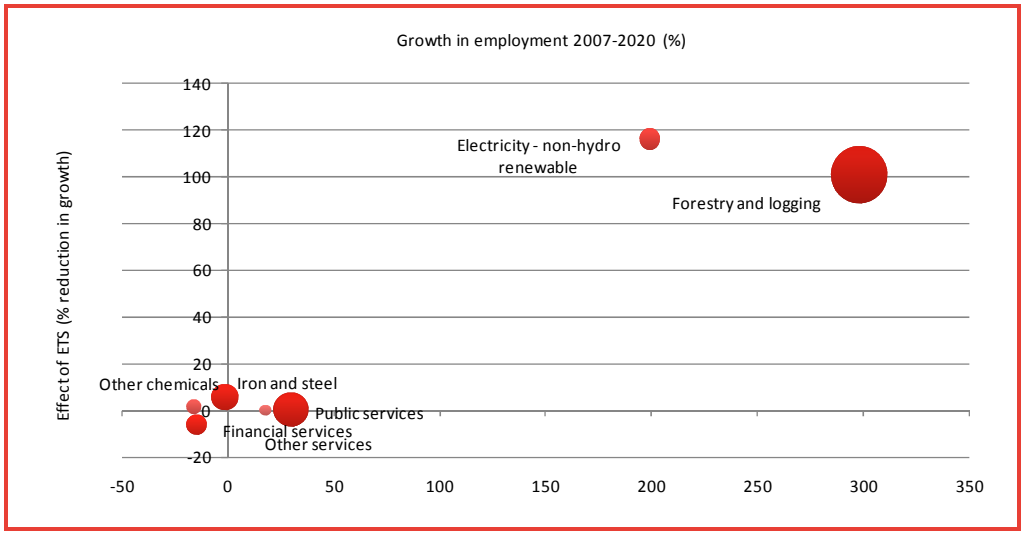

Figure 8: Sectors most favourably affected by the CPRS policy: employment

3.2.3 Regional results

Regional data

The key data input to our top-down method for generating output and employment results for the sub-State regions is a database showing gross value added and employment by sector and region. From this we can compute the shares of each region's gross regional product (GRP) and employment accounted for by each sector. These shares allow us to infer the implications for a region's gross product or employment of a change in a sector's activity level within the region.

Extracts of the data are given in Figure 9/Table 11 (output) and Figure 1/Table 12 (employment). The extracts refer to six sectors that are particularly vulnerable to CPRS policies and to twelve regions in which the six sectors in total account for relatively large shares of gross product or employment. As a benchmark, we show in the last bar of each figure/last column of each table the sectors' shares in GDP or aggregate national employment. For Australia as a whole, the six vulnerable sectors account for only 5 per cent of gross product (with *Coal* accounting for almost 2 per cent) and for less than 2 per cent of aggregate employment. But some sub-State regions are much more heavily dependent on the vulnerable sectors. Hence, we should expect that these regions will be much more vulnerable to CPRS policies than is the Australian economy overall.

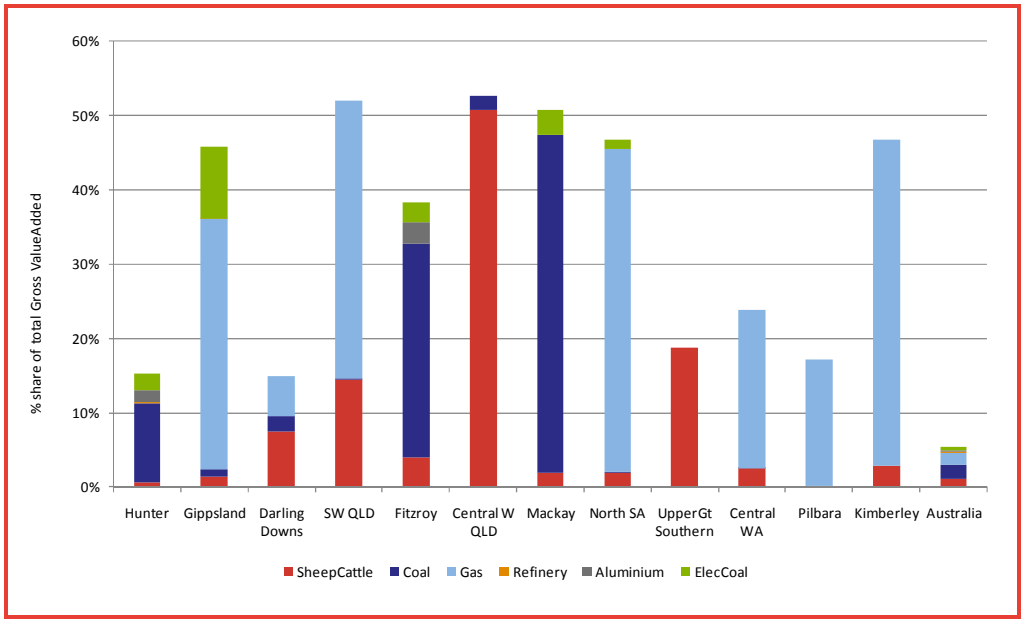

Figure 9: Gross Value Added by Region and Industry, 2005-06 (shares)

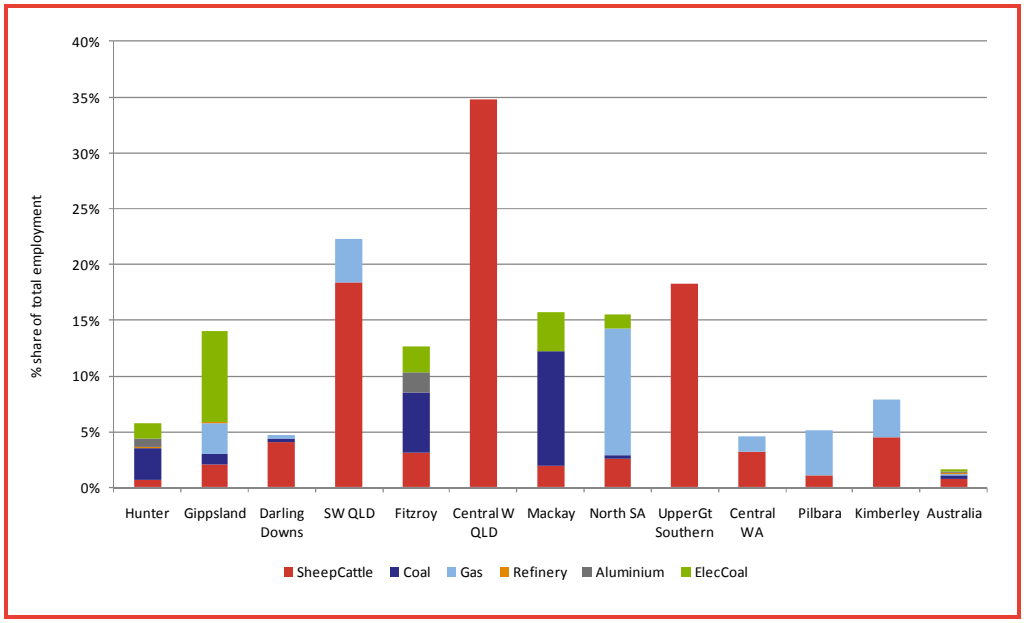

Figure 10: Employment by Region and Industry, 2005-06 (shares)

Adversely affected regions

Figure 11/Table 13 - Figure 13/Table 15 show regions that are adversely affected by the CPRS policy. Figure 11 and Table 13 show the 14 regions most adversely

affected as measured by the percentage-point effect of the policy on total growth of gross regional product (GRP) over the period 2007-20. Ten of these have GRP declines more than twice as large as the 1 percentage-point decline in GDP growth that the CPRS policy induces.

In the last column of the table, we identify the traded-goods sectors that contribute most strongly to the policy-induced declines in the regions' GRP growth. Not surprisingly, these are mainly sectors (fossil-fuel mining, thermal electricity generation, mineral refining and livestock agriculture) that are identified in Table 7 as sectors that are adversely affected by the CPRS policy. They contribute strongly to a decline in a region's GRP if they have large shares in the region's GRP. In the MMRF-GREEN computations, declines in activity in these sectors have local multiplier effects on sectors producing non-traded services within the regions.

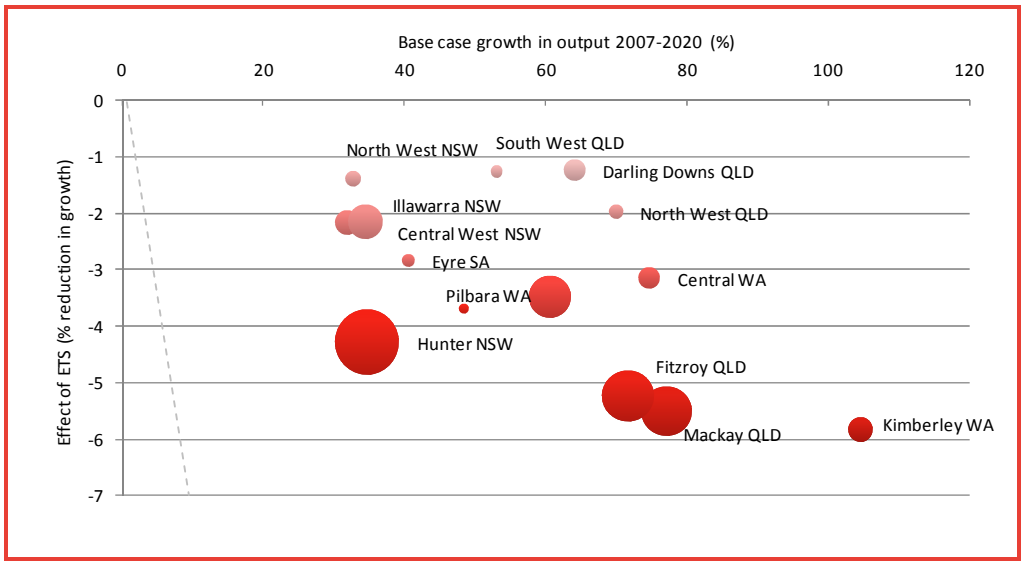

Figure 11: Regions most adversely affected by the CPRS policy: output

It is clear from Figure 11 and the last column of numbers in Table 13 that the real-dollar gross-product loss in *Hunter NSW* is of particular significance. The two central-coast Queensland regions (Fitzroy and Mackay), which have similar prospects, are also significant losers from the CPRS. Note finally, that all of the regions identified in Figure 11 and Table 13 lie in the lower right quadrant of Table 1. In fact, Figure 11 and Table 13 contain no examples of what we have classified as regional structural adjustment problems. All of the adversely affected regions are projected to continue to experience positive GRP growth even with the CPRS policy imposed.

We should recognise, however, that the effects of the policy on GRP may not be the best indicator of its local economic impact. The reason is that GRP measures value added generated in a region, not income accruing to the region's residents.

For example, the wage income and the profits generated by a mine operating in a region are both included in the regions gross product. But the profits may well accrue to shareholders who do not reside in the region. For this reason, a better indicator of the regional impact of the policy may be its the effect on regional employment. Employment results for regions affected adversely by the CPRS policy are reported in Figure 12/Table 14 and Figure 13/Table 15.

Figure 12 and Table 14 show the 14 regions most adversely affected by the policy as measured by its percentage-point effect on total growth of employment over the period 2007-20.

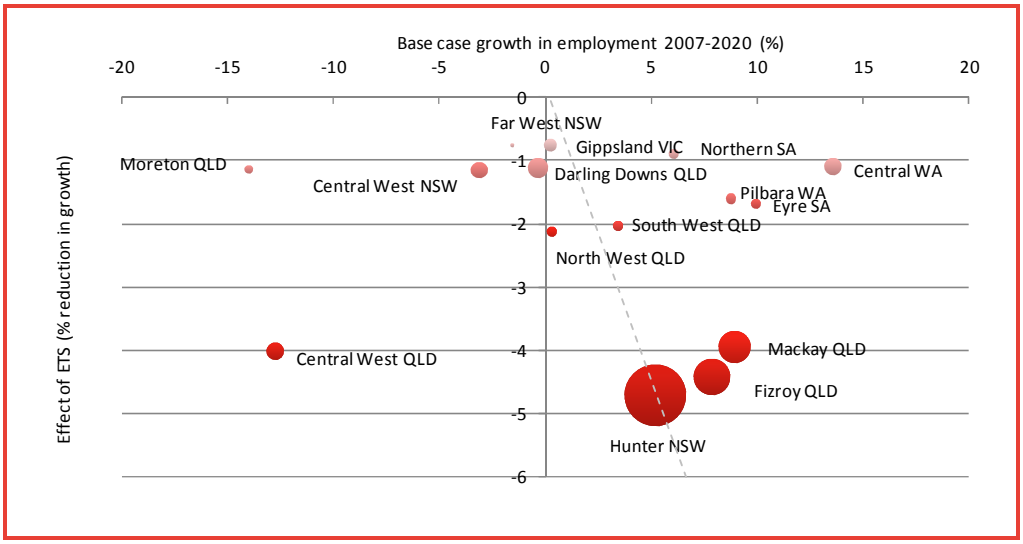

Figure 12: Regions most adversely affected by the CPRS policy: employment

There is a strong overlap between the regions included in Figure 12/Table 14 and those included in the GRP-based Figure 11/Table 13, although the ranking of regions differs a little. The sector drivers of CPRS-policy-induced declines in GRP that are identified in the last column of Table 13 apply also to the declines in regional employment shown in Figure 12 and Table 14. *Gippsland VIC* appears in Figure 12 and Table 14 but not in Figure 11 and Table 13[16]. As indicated in the last column of Table 14, the *Gas* and *Electricity_coal* sectors account for the negative effects of the CPRS policy on GRP and employment in this region, with the forestry and renewable power sectors providing offsets.

Note that Figure 12 spans both of the two lower quadrants in Table 1 – there are five examples of the CPRS policy exacerbating base-case declines in regional employment and two examples (*North West QLD* and *Gippsland VIC*) in which the negative effects of the policy result in negative employment growth when base-case growth was positive. In the penultimate column of Table 14, we report

16 Although not shown in Table 13, the CPRS policy does have a negative effect on Gippsland's GRP.

the numbers of jobs lost represented by the percentage-point reductions in employment growth shown in the previous column. All these regional structural adjustment problems arise in small regions. As is clear from Figure 12 and the penultimate column of Table 14, the three regions that account for the largest numbers of jobs lost are *Hunter NSW*, *Fitzroy QLD* and *Mackay QLD*.

Figure 13 and Table 15 are an alternative presentation of the projected adverse regional employment effects of the CPRS policy. In Table 15 we rank regions by the effects of the policy on numbers employed rather than by the percentage-point effects on employment growth. However, we retain the percentage-point effects in the penultimate column of the table. By the number-of-jobs-lost measure, Hunter NSW remains the most adversely affected region and most of the regions appearing in Figure 12 and Table 14 also appear in Figure 13 and Table 15. But Figure 13 and Table 15 also contain a number of large regions where the CPRS policy is projected to generate modest percentage-point declines in employment growth that translate into substantial numbers of jobs lost.

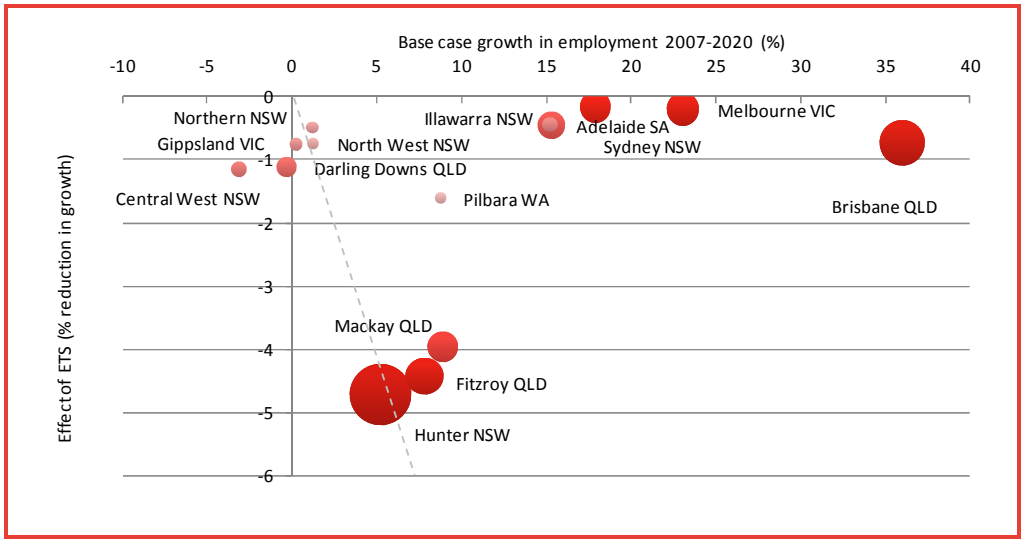

Figure 13: Regions most adversely affected by the CPRS policy: employment

Favourably affected regions

Figure 14 and Table 16 show the twelve regions most favourably affected as measured by the percentage-point effect of the policy on total growth of gross regional product (GRP) over the period 2007-20. As indicated in the last column of the table, the sectors that contribute most strongly to the policy-induced expansions in the regions' GRP growth are mainly the sectors (forestry and renewable electricity generation) that are identified in Table 9 as sectors that are favourably affected by the CPRS policy. They contribute strongly to expansion in a region's GRP if they have large shares in the region's GRP. In the MMRF-GREEN computations, increases in activity in these sectors have local multiplier

effects on sectors producing non-traded services within the regions. To account for scale, the real-dollar (2007 prices) expansions in GRP growth are given in the penultimate column of the table. Note finally, that eight of the regions included in Table 16 have below-average growth prospects in the base case.

Figure 15 and Table 17 show the twelve regions most favourably affected by the policy as measured by its percentage-point effect on total growth of employment over the period 2007-20. Nine of these regions are also included in the GRP-based Figure 14/Table 16, although the ranking of regions differs a little.

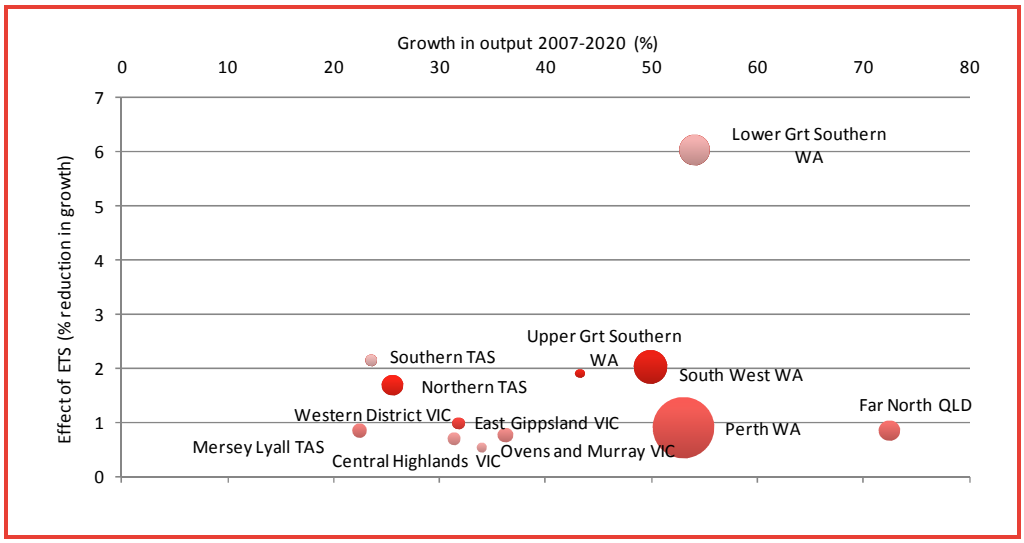

Figure 14: Regions most favourably affected by the CPRS policy: output

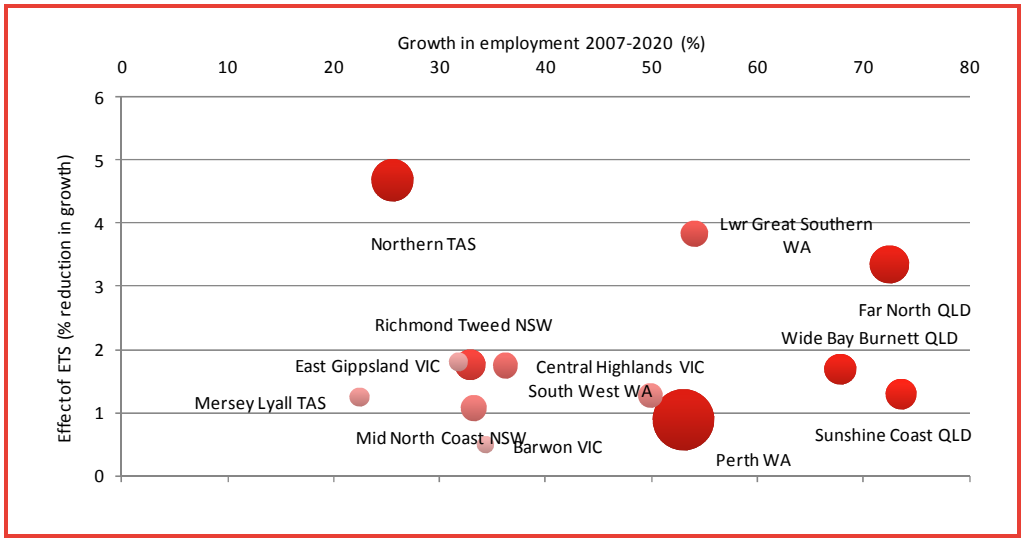

Figure 15: Regions most favourably affected by the CPRS policy: employment

Regions flagged as of special interest

Figure 16 and Table 18 report employment results for ten regions that have been flagged as of special interest to Macquarie Generation. The traded-goods sectors that make significant negative and positive contributions to the effects of the CPRS policy on employment growth in these regions are listed in the final two columns of the table.

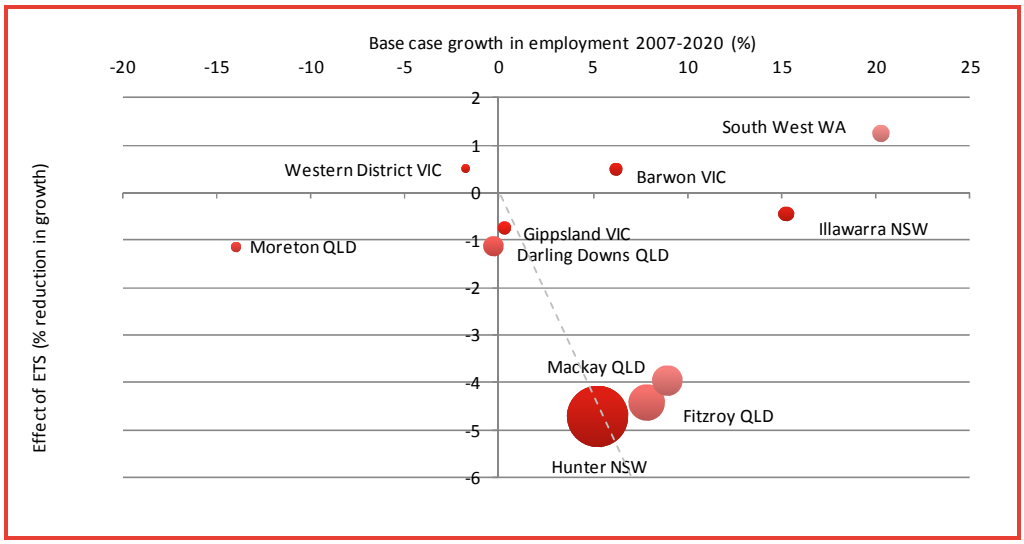

Figure 16: Regions of special interest: employment

4 Conclusion: structural adjustment summary

Table 19 and Table 20 give structural-adjustment matrices like Table 1 based on the employment results from our simulations for a selection of sectors most strongly affected by the CPRS and for all the regions distinguished in the model. There are six sectors in the problematic lower left quadrant of Table 19 and seven regions in the lower left quadrant of Table 20. According to our results, these are the sectors and regions that would be most likely to face serious structural adjustment problems if the CPRS were adopted.

Figure 17 provides a final perspective on the geographic aspect of the structural change that adoption of the CPRS would require. It is a version of the map given in Figure 4 but colour-coded to show regions in which employment growth is reduced by the CPRS (indicated by the reddish tones) and regions in which employment growth is stimulated by the CPRS (indicated by the greenish tones). As in Figures 5 – 15, the areas of the coloured dots in Figure 17are proportional to the numbers of jobs created or lost on account of the adoption of the CPRS.

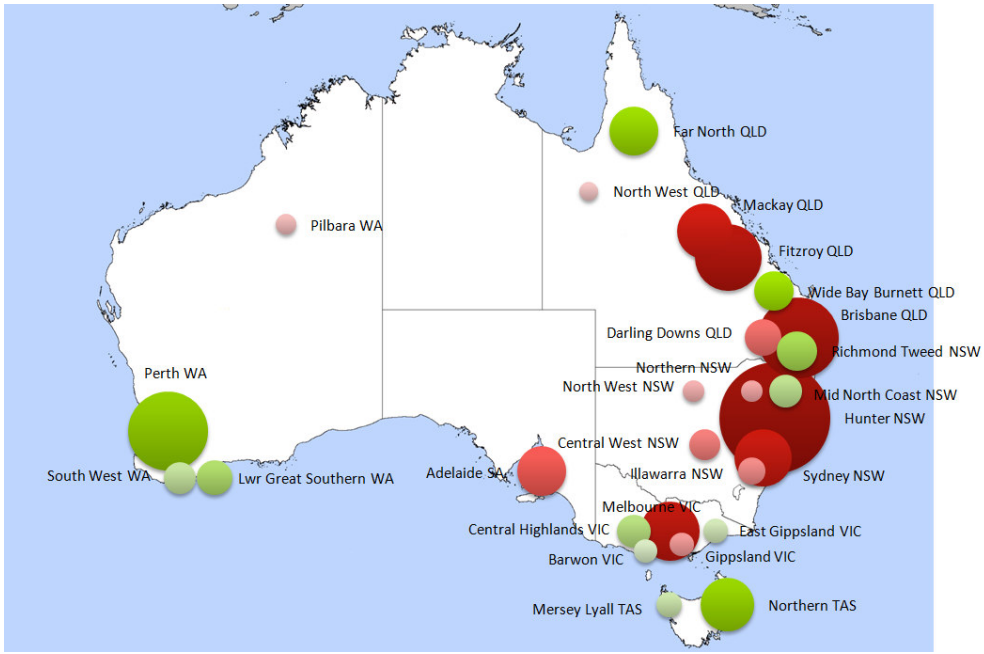

Figure 17: Geographic dispersion of employment effects of the CPRS

It is clear from Figure 17 that, in many cases, the stimulated regions are far from contiguous with the adversely affected regions. This suggests that there might be geographical adjustment problems to the extent that structural adjustment requires relocation of workers between adversely affected and stimulated regions.

5 References

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Final

Table 7: Sectors most adversely affected by the CPRS policy: output

Sector	Growth in output 2007-20 (%)		CPRS effect		Comment
	(1) Base case	(2) CPRS in place	(2)-(1) % point	$m in 2020 (07 prices)	
Electricity_coal	10.09	-5.26	-15.35	-1,341.51	Emissions-intensive generator.
Electricity_gas	114.46	101.74	-12.72	-194.24	Emissions-intensive generator.
Coal mining	78.25	65.77	-12.48	-3,290.63	Emissions-intensive; exports & domestic sales contract.
Aluminium	42.91	30.75	-12.15	-766.44	Energy intensive; exports contract.
Electricity supply	28.82	19.83	-8.99	-1,937.65	Transn/distribn/retail; demand for electricity contracts.
Electrical equip. servs	51.61	44.32	-7.30	-919.21	Dummy treatment of electrical-appliance services.
Petroleum refinery	22.69	17.23	-5.46	-694.79	Emissions-intensive fuel.
Gas mining	56.66	51.54	-5.12	-1,037.50	Emissions-intensive; exports & domestic sales contract.
Air transport	71.67	66.70	-4.97	-954.08	Exports contract.
Heating equip. servs	27.62	23.67	-3.95	-412.91	Dummy treatment of heating-appliance services.
Road transpt - psger	47.84	44.43	-3.42	-59.36	Dummy treatment of motor-vehicle services.
Sheep and cattle	15.38	12.01	-3.37	-565.62	Emissions-intensive livestock agriculture; exports contract.

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Table 8: Sectors most adversely affected by the CPRS policy: employment

Sector	Growth in employment 2007-20 (%)		CPRS effect		Comment
	(1) Base case	(2) CPRS in place	(2)-(1) % point	Persons	
Construction services	13.12	11.42	-1.70	-16,248	Large employer; investment contracts.
Business services	51.69	51.10	-0.59	-8,272	Large employer.
Trade services	2.52	2.15	-0.36	-7,902	Large employer; average percentage contraction.
Coal mining	18.07	5.84	-12.23	-4,399	Large percentage contraction but modest employer.
Accomm. & hotels	26.74	26.05	-0.69	-3,396	Large employer; international tourism contracts.
Sheep and cattle	-16.49	-19.23	-2.74	-2,445	Large percentage contraction but modest employer.
Other mfg products	-24.14	-25.11	-0.97	-2,173	
Electricity - coal	-24.59	-35.14	-10.45	-2,092	Large percentage contraction but modest employer.
Electricity supply	-19.32	-26.19	-6.87	-1,880	Large percentage contraction but modest employer.
Air transport	28.88	25.50	-3.38	-1,762	Large percentage contraction but modest employer.
Aluminium	10.92	1.65	-9.27	-957	Large percentage contraction but modest employer.
Rail transport - freight	4.83	3.07	-1.76	-880	
Road transport - psger	-6.84	-7.72	-0.88	-693	
Meat products	-21.74	-22.68	-0.94	-644	Exports contract.
Gas mining	64.07	57.95	-6.12	-610	Large percentage contraction but modest employer.

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Table 9: Sectors most favourably affected by the CPRS policy: output

Sector	Growth in output 2007-20 (%)		CPRS effect		Comment
	(1) Base case	(2) CPRS in place	(2)-(1) % point	$m in 2020 (07 prices)	
Electricity_non-hydro renewable	328.10	499.34	171.24	685.09	Low-emissions generator.
Forestry and logging	164.37	280.75	116.38	3,142.07	Emissions sink.
Other non-ferrous metals	29.78	37.52	7.74	2,631.96	Exports expand.
Iron and steel	22.85	27.79	4.93	763.44	Exports expand.
Other chemicals	11.03	12.12	1.09	318.38	Exports expand.

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Table 10: Sectors most favourably affected by the CPRS policy: employment

Sector	Growth in employment 2007-20 (%)		CPRS effect		Comment
	(1) Base case	(2) CPRS in place	(2)-(1) % point	Persons	
Forestry and logging	297.75	398.61	100.86	11,485	Very large percentage expansion.
Other services	29.75	37.39	0.40	4,453	Modest percentage expansion but large employer.
Public services	29.75	29.92	0.17	3,995	Modest percentage expansion but large employer.
Iron and steel	-1.55	4.19	5.74	2,602	Exports expand.
Other non-ferrous metals	-14.78	-6.13	8.65	1,649	Exports expand.
Electricity - non-hydro renewable	199.05	315.29	116.24	1,598	Very large percentage expansion but small employer.
Other chemicals	-15.83	-14.18	1.65	774	Exports expand.
Financial services	17.79	17.91	0.13	507	Modest percentage expansion but large employer.

Table 11: Gross Value Added by Region and Industry, 2005-06 (shares)

Sector	Hunter	Gippsland	Darling Downs	SW QLD	Fitzroy	Central W QLD	Mackay	North SA	UpperGt Southern	Central WA	Pilbara	Kimberley	Australia
SheepCattle	0.006	0.015	0.075	0.145	0.039	0.507	0.019	0.019	0.187	0.025	0.002	0.028	0.011
Coal	0.106	0.008	0.020	0.001	0.288	0.019	0.454	0.001	0.000	0.001	0.000	0.000	0.019
Gas	0.000	0.337	0.055	0.374	0.000	0.000	0.000	0.435	0.000	0.213	0.169	0.440	0.016
Refinery	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
Aluminium	0.016	0.000	0.000	0.000	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
ElecCoal	0.023	0.096	0.000	0.000	0.027	0.000	0.034	0.012	0.000	0.000	0.000	0.000	0.004
Total	0.152	0.458	0.150	0.519	0.384	0.525	0.507	0.468	0.187	0.239	0.171	0.469	0.053

Table 12: Employment by Region and Industry, 2005-06 (shares)

Sector	Hunter	Gippsland	Darling Downs	SW QLD	Fitzroy	Central W QLD	Mackay	North SA	UpperGt Southern	Central WA	Pilbara	Kimberley	Australia
SheepCattle	0.007	0.020	0.041	0.184	0.031	0.348	0.019	0.026	0.183	0.032	0.011	0.045	0.008
Coal	0.028	0.010	0.003	0.000	0.054	0.000	0.103	0.003	0.000	0.000	0.000	0.000	0.003
Gas	0.000	0.028	0.003	0.039	0.000	0.000	0.000	0.113	0.000	0.014	0.040	0.034	0.001
Refinery	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Aluminium	0.008	0.000	0.000	0.000	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
ElecCoal	0.014	0.081	0.000	0.000	0.023	0.000	0.035	0.013	0.000	0.000	0.000	0.000	0.002
Total	0.058	0.140	0.046	0.224	0.126	0.348	0.158	0.156	0.183	0.047	0.051	0.079	0.016

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Table 13: Regions most adversely affected by the CPRS policy: gross regional product

Region	Growth in gross product 2007-20 (%)		CPRS effect		Comment
	(1) Base case	(2) CPRS in place	(2)-(1) % point	$m in 2020 (07 prices)	
Kimberley WA	104.65	98.82	-5.83	-170.89	Small region dominated by Gas.
Mackay QLD	77.14	71.64	-5.50	-704.87	Coal dominated
Fitzroy QLD	71.61	66.37	-5.24	-737.69	Dominated by Coal and Aluminium
Hunter NSW	34.76	30.47	-4.28	-1,147.46	Dominated by Coal, Aluminium and Electricity_coal.
Central West QLD	48.47	44.79	-3.68	-28.56	Small region dominated by livestock agriculture.
Pilbara WA	60.64	57.16	-3.48	-492.12	Dominated by Gas.
Central WA	74.66	71.51	-3.15	-126.90	Small region dominated by Gas.
Eyre SA	40.61	37.78	-2.84	-42.66	Renewable electricity shrinking here
Central West NSW	31.90	29.73	-2.17	-166.25	Relies on Coal, Electricity_coal and livestock agriculture
Illawarra NSW	34.46	32.32	-2.15	-344.52	Relies on Coal, Electricity_coal
North West QLD	69.90	67.91	-1.98	-59.64	Small region relying on Non-iron ore mining and livestock agriculture
North West NSW	32.71	31.32	-1.39	-67.98	Small region relying on Coal, Electricity_coal and livestock agriculture
South West QLD	53.06	51.79	-1.27	-44.71	Small region relying on Gas, Electricity_gas and livestock agriculture
Darling Downs QLD	64.11	62.87	-1.24	-132.56	Relies on Coal, Gas, Electricity_gas and livestock agriculture with offset from forestry

Structural adjustment and the CPRS

Table 14: Regions most adversely affected by the CPRS policy: employment

Region	Growth in employment 2007-20 (%)		CPRS effect		Comment
	(1) Base case	(2) CPRS in place	(2)-(1) %	Persons	
Hunter NSW	5.21	0.49	-4.72	-13,440	See Table 13
Fitzroy QLD	7.83	3.41	-4.42	-4,875	See Table 13.
Central West QLD	-12.76	-16.77	-4.01	-1,066	See Table 13.
Mackay QLD	8.93	4.98	-3.95	-3,614	See Table 13.
North West QLD	0.32	-1.80	-2.12	-400	See Table 13.
South West QLD	3.41	1.38	-2.03	-393	See Table 13.
Eyre SA	9.92	8.24	-1.69	-388	See Table 13.
Pilbara WA	8.75	7.13	-1.61	-460	See Table 13.
Central West NSW	-3.13	-4.28	-1.15	-1,066	See Table 13.
Moreton QLD	-13.98	-15.13	-1.14	-358	See Table 13.
Darling Downs QLD	-0.34	-1.46	-1.12	-1,471	See Table 13.
Central WA	13.57	12.47	-1.1	-1,066	See Table 13.
Northern SA	6.04	5.15	-0.89	-373	See Table 13.
Far West NSW	-1.53	-2.28	-0.75	-74	
Gippsland VIC	0.27	-0.48	-0.75	-636	Dominated by Gas and Electricity_coal, with offsets from Forestry and Electricity_non-hydro renewable

Structural adjustment and the CPRS

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Table 15: Regions most adversely affected by the CPRS policy: numbers employed

Region	Employment in 2020 (persons)		CPRS effect		Comment
	(1) Base case	(2) CPRS in place	(2)-(1)	Percentage change	
Hunter NSW	299,537	286,097	-13,440	-4.72	
Brisbane QLD	1,334,733	1,327,507	-7,225	-0.74	
Fitzroy QLD	118,502	113,644	-4,857	-4.42	
Melbourne VIC	2,422,743	2,418,809	-3,934	-0.20	
Sydney NSW	2,695,812	2,692,198	-3,614	-0.16	
Mackay QLD	92,481	89,125	-3,355	-3.95	
Adelaide SA	677,920	675,266	-2,654	-0.45	
Darling Downs QLD	130,858	129,387	-1,471	-1.12	
Central West NSW	89,706	88,640	-1,066	-1.15	
Illawarra NSW	206,018	205,218	-800	-0.45	
Gippsland VIC	84,928	84,293	-636	-0.75	
Northern NSW	108,286	107,759	-528	-0.49	
North West NSW	68,865	68,362	-503	-0.74	
Pilbara WA	30,993	30,533	-460	-1.61	
North West QLD	18,860	18,459	-400	-2.12	

Structural adjustment and the CPRS

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Table 16: Regions most favourably affected by the CPRS policy: gross regional product

Region	Growth in gross product 2007-20 (%)		CPRS effect		Comment
	(1) Base case	(2) CPRS in place	(2)-(1) % point	$m in 2020 (07 prices)	
Lower Grt Southern WA	54.03	60.06	6.03	172.52	Forestry
Southern TAS	23.49	25.64	2.15	23.66	Forestry
South West WA	49.91	51.93	2.02	192.50	Forestry, with offsets from Coal and Electricity_coal.
Upper Grt Southern WA	43.22	45.13	1.90	18.18	Forestry
Northern TAS	25.56	27.25	1.69	79.14	Forestry, with offset from Aluminium
East Gippsland VIC	31.77	32.76	0.98	29.88	Forestry and renewable energy, with offset from livestock agriculture
Perth WA	52.95	53.86	0.91	665.12	Forestry, Electricity_gas, Other metals
Far North QLD	72.44	73.28	0.84	75.80	Forestry and renewable energy, with offsets from mining and aluminium
Mersey Lyall TAS	22.43	23.27	0.84	32.85	Forestry
Central Highlands VIC	36.19	36.95	0.76	40.63	Forestry and renewable energy
Western District VIC	31.41	32.10	0.69	29.20	Forestry and renewable energy, with offsets from livestock agriculture and Aluminium
Ovens and Murray VIC	34.02	34.56	0.54	19.88	Forestry
Lower Grt Southern WA	54.03	60.06	6.03	172.52	Forestry
Southern TAS	23.49	25.64	2.15	23.66	Forestry

Structural adjustment and the CPRS

Table 17: Regions most favourably affected by the CPRS policy: numbers employed

Region	Employment in 2020 (persons)		CPRS effect		Comment
	(1) Base case	(2) CPRS in place	(2)-(1)	Percentage change	
Perth WA	1,028,368	1,035,245	6,877	0.89	
Northern TAS	77,894	81,049	3,155	4.68	
Far North QLD	137,216	139,897	2,681	3.34	
Wide Bay Burnett QLD	106,714	108,466	1,752	1.68	
Sunshine Coast QLD	211,333	213,084	1,751	1.29	
Richmond Tweed NSW	113,847	115,583	1,736	1.76	
Lwr Great Southern WA	40,820	42,164	1,344	3.83	
Central Highlands VIC	79,857	81,064	1,207	1.75	
Mid North Coast NSW	123,911	125,118	1,207	1.07	
South West WA	107,041	108,165	1,123	1.26	
Mersey Lyall TAS	56,506	57,225	719	1.25	
East Gippsland VIC	39,674	40,324	650	1.80	
Barwon VIC	138,205	138,840	636	0.49	

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Table 18: Employment in 2020 in regions of special interest, with and without CPRS policy

Region	Employment in 2020 (persons)		CPRS effect	Sectors with negative contribution to CPRS effect	Sectors with positive contribution to CPRS effect
	(1) Base case	(2) CPRS in place	(2)-(1)		
Hunter NSW	299,537	286,097	-13,440	Coal, Electricity_coal	Steel, Forestry
Illawarra NSW	206,018	205,218	-800	Coal, Electricity_coal	Steel, Forestry
Barwon VIC	138,205	138,840	636	Aluminium, Refinery	Forestry, Electricity_non-hydro renewable
Western District VIC	53,121	53,403	283	Sheep/Cattle, Aluminium	Forestry, Electricity_non-hydro renewable
Gippsland VIC	84,928	84,293	-636	Gas, Electricity_coal	Forestry, Electricity_non-hydro renewable
Moreton QLD	26,838	26,480	-358	Sheep/Cattle, Coal	
Darling Downs QLD	130,858	129,387	-1,471	Sheep/Cattle, Coal, Gas	
Fitzroy QLD	118,502	113,644	-4,857	Coal, Alumina, Aluminium, Electricity_coal	
Mackay QLD	92,481	89,125	-3,355	Coal	
South West WA	107,041	108,165	1,123	Sheep/Cattle, Coal, Electricity_coal	Forestry, Alumina, Electricity_non-hydro renewable

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Table 19: Structural adjustment matrix: employment × sector

Effect of policy change	Base Case prospects: employment	
	Declining	Growing
Stimulatory	Iron and steel (5.7%, -1.6%) Other non-ferrous metals (8.6%, -15%) Other chemicals (1.7%, -16%)	Forestry and logging (100.9%, 297%) Other services (0.4%, 30%) Public services (0.2%, 30%) Electricity - non-hydro renewable (116.2%, 199%) Financial services (0.1%, 18%)
Contractionary	**Sheep and cattle (-2.7%, -16%)** **Other manufacturing products (-1.0%, -24%)** **Electricity-coal (-10.4%, -25%)** **Electricity supply (-6.9%, -19%)** **Road transport-passenger (-0.9%, -7%)** **Meat products (-0.9%, -22%)**	Construction services (-1.7%, 13%) Business services (-0.6%, 52%) Trade services (-0.4%, 3%) Coal mining (-12.2%, 18%) Accommodation and hotels (-0.7%, 27%)

Note: the numbers in parenthesis show (percentage point effect of CPRS, base-case growth rate) for percentage employment growth over the period 2007-20

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Table 20: Structural adjustment matrix: employment × region

Effect of policy change	Base Case prospects: employment		
	Declining	Growing	
Stimulatory	Mersey Lyall TAS (0.719, -0.794) Murray NSW (0.060, -4.741) Murrumbidgee NSW (0.143, -2.795) Goulburn VIC (0.271, -3.099) South East SA (0.279, -0.580) Western District VIC (0.283, -0.979)	Central Highlands VIC (1.207, 10.957) Lower Great Southern WA (1.344, 5.720) Richmond Tweed NSW (1.736, 14.947 Sunshine Coast QLD (1.751, 75.533) Wide Bay Burnett QLD (1.752, 2.414) Far North QLD (2.681, 22.716) Northern TAS (3.155, 10.494) Perth WA (6.877, 255.368)	Loddon Campaspe VIC (0.035, 4.364) South East WA (0.059, 3.638) Ovens and Murray VIC (0.466, 4.200) Southern TAS (0.506, 0.685) Barwon VIC (0.636, 8.105) East Gippsland VIC (0.650, 3.574) South West WA (1.123, 18.041) Mid North Coast NSW (1.207, 10.811)
Contractionary	**Darling Downs QLD (-1.471, -0.442)** **Central West NSW (-1.066, -2.894)** **Moreton QLD (-0.358, -4.362)** **Central West QLD (-0.318, -1.008)** **Far West NSW (-0.074, -0.150)** **Murray Lands SA (-0.055, -3.241)** **Outer Adelaide SA (-0.041, -1.607)**	North West QLD (-0.400, 0.060) South West QLD (-0.393, 0.661) Eyre SA (-0.388, 2.282) Central WA (-0.373, 4.600) Northern SA (-0.373, 2.535) Northern QLD (-0.325, 14.790) Midlands WA (-0.243, 3.819) Kimberley WA (-0.125, 4.073) York, Lower North SA (-0.105, 0.663) Mallee VIC (-0.070, 1.025) Wimmera VIC (-0.043, 1.356) Upper Great Southern WA (-0.029, 0.922) South East NSW (-0.011, 9.435)	Hunter NSW (-13.440, 14.837) Brisbane QLD (-7.225, 353.333) Fitzroy QLD (-4.857, 8.602) Gold Coast QLD (-4.216, 115.015) Melbourne VIC (-3.934, 453.643) Sydney NSW (-3.614, 409.212) Mackay QLD ()-3.355, 7.581) Adelaide SA (-2.654, 89.820) Greater Hobart TAS (-2.503, 23.879) Illawarra NSW (-0.800, 27.218) Gippsland VIC (-0.636, 0.228) Northern NSW (-0.528, 1.286) North West NSW (-0.503, 0.865) Pilbara WA (-0.460, 2.493)

Note: the numbers in parenthesis show (effect of CPRS, base-case growth) for employment growth ('000 persons) over the period 2007-20

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