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How Much Abatement Will Australia's Emissions Reduction Fund Buy?

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1 Introduction

On 1 July 2012, the then-federal Labour government in Australia introduced the Carbon Pollution Reduction Scheme (CPRS), which included a carbon tax to achieve Australia's abatement commitments under the Kyoto Protocol. The 2013 Australian federal election elected the Coalition party, whose policy was to abolish the carbon tax and replace it with an Emissions Reduction Fund (ERF). The ERF essentially "purchases" abatement commitments via an auction mechanism from polluting firms.[1] The key operational aspects of the ERF have been the subject of ongoing debate within Australia with the publication of a Green Paper in 2013 and a White Paper in 2014 (Australian Government, 2013, 2014).

The objective of the ERF is to procure reductions in carbon emissions at least cost by using an auction mechanism. There already exists empirical and theoretical evidence to support this type of incentive mechanism within Australia: BushTender, an on-farm biodiversity conservation procurement auction, ran in Victoria between 2001 and 2012. Evidence indicates that BushTender and other related schemes have yielded value for money for State and Federal governments (eg, Stoneham et al., 2003 and Connor et al., 2008).[2]

Under the ERF, firms will submit sealed bids to the government's Clean Energy Regulator that quote a cost associated with reducing greenhouse gas emissions beyond some pre-determined benchmark. All bids are then ranked according to cost per unit of carbon reduction and those offering best value are funded, subject to available funds. Establishing the benchmark is of fundamental importance in identifying real additional reductions in carbon emissions that would only be achieved if the government was prepared to fund the reduction.[3] Since the ERF uses a sealed bid auction, it should ensure that firm specific benchmarks are commercial-in-confidence. Also the benchmark baselines will be calculated in such a way that they take account of temporal variation. The 2014 White Paper has indicated that baselines will be the highest reported level of carbon emissions over the period 2009/10 to 2013/14.

[1]Similar incentive schemes have been used in the past: The UK's Non-Fossil Fuel Obligation Scheme saw the UK government purchase renewable energy from renewable energy installations, and the Japanese government purchased direct abatement and funded low-carbon technology diffusion through its Joint Credit Mechanism (Australian Government (2013), pp.16, 29).

[2]The actual extent to which policy is implemented using this type of incentive mechanism is limited. Less than 1 per cent of the Australian agri-environmental budget has been allocated using auctions even though this has been one of the main policy areas in which auctions have been tested and evaluated (Rolfe, 2013).

[3]It is proposed that an incentive mechanism be developed to ensure firms do not exceed historical emissions baselines, although no funding is identified to implement this part of the policy package.

Although there are economic benefits associated with employing an auction type mechanism, the removal of the carbon tax and the introduction of the ERF has been controversial. The ERF means that carbon reduction targets are no longer going to be pursued by employing policy that is based on the Polluter Pays Principle (PPP). Instead, policy will employ financial subsidies to induce polluters to reduce emissions and as such is embracing the Provider Gets Principle (PGP) (OECD, 2001). This approach to policy assumes that any reductions in carbon emissions above and beyond those that would occur in a business-as-usual context can be considered a public benefit and as such need to be induced by offering financial incentives.

In principle, tax and subsidy policy instruments can be regarded as equivalent in that each can achieve the same level of abatement: A subsidy is equivalent to a tax plus a lump-sum transfer to firms (Baumol and Oates, 1988). However, there are potentially important differences in the design and implementation of the two policies. For example, while the carbon tax would be scaled up progressively, the subsidy scheme as proposed under the ERF is currently designed to last only 5 years. There are also differences in terms of the budgetary implications of these two abatement policies. The 2013 Green Paper indicated that initial expenditure to fund the ERF would be \$1.55 billion. In the 2014 White Paper this was increased to \$2.55 billion. Importantly, repeal of the CPRS and abolition of the associated carbon tax implied that revenue generated by the carbon tax will no longer be forthcoming. Estimates such as those reported by the Climate Institute (2014) suggest that the net financial impact on the government budget of replacement of the CPRS with the ERF by 2020 will potentially be \$24 billion with the precise size depending on how the ERF is funded and whether or not Australia reaches its carbon reduction targets. Clearly, the implication is that scope for government to exercise discretionary fiscal policies under the two schemes will be very different.

But there remains the question: "How much abatement will an ERF funded with \$2.55 billion buy?" This paper seeks to answer this question. If we knew the economy's Marginal Abatement Cost (MAC) curve, we could approximate the cost of any given abatement level by the area under the MAC curve up to that level. We generate a MAC curve for Australia using a static Computable General Equilibrium (CGE) model of the Australian economy calibrated using version 8 of the Global Trade Analysis Project (GTAP) dataset for a 2007 global equilibrium. We then approximate the cost of any given level of abatement by calculating the area under this MAC curve. Using this process, we find that the cost of buying abatement consistent with Australia's commitment under the Kyoto Protocol of a 5 per cent reduction in carbon emissions below year 2000 levels by the year 2020 would be about one-third of one percent of year 2007 GDP. The $2.55 billion available through the ERF equates to about 0.16 per cent of the $1558.1 billion GDP for Australia in 2013-4 (see Australian Bureau of Statistics (2014:27)). We conclude that the ERF would fund about 50 per cent of the abatement implied by Australia's commitment under the Kyoto Protocol.

The structure of the paper is as follows. In Section 2 we briefly discuss, and place in context, the political and economic rationales that can be used to support implementation of the ERF, and outline the theoretical differences between a carbon tax and the ERF. This is followed in Section 3 by an illustration of the budgetary and emission reduction differences that will emerge from this change of policy based on simulations conducted by employing a static CGE model. Finally, we discuss the implications and some limitations of our results and conclude.

2 The Political Economy of the ERF

As is apparent from the ongoing debate within Australia the ERF is proving to be far from popular. Why is this? The ERF is just as much a market-based scheme as a carbon tax provided that subsidies are efficiently allocated to low cost pollution abaters. But there are clearly various other reasons that can explain the current concern with the ERF.

First, as already noted in the Introduction, a tax will yield revenue to the government whereas the ERF will cost the government revenue. There are two responses to this claim. First, the carbon tax scheme as introduced by the Labor Government was designed to be revenue neutral so consumers and many producers were offered benefits that compensated for the tax. Thus, as introduced, the carbon tax would not have yielded significant revenue. One could counter argue that times have changed and that these offsets should not now be paid because of looming public sector deficits. That presumably was what Garnaut (2014) had in mind when he claimed that restoring the carbon tax and abolishing the ERF could deal with the Government's fiscal difficulties. Furthermore, the government could decide to reduce the scale of transfers under the CPRS, and use the revenue generated by the carbon tax for other purposes (such as paying down debt, compensating households for higher energy prices, undertaking new infrastructure projects). Such options for changes in discretionary fiscal policy would not be available to the government under the ERF. Also, the ERF will not yield the double dividend benefits of a carbon tax, though the likely existence of a double-dividend and its magnitude are at best small (for example, see Fraser and Waschik (2013) and references therein). The difficulty is that extra costs imposed by a carbon tax in any event reduce real incomes which reduce any benefit from improved tax efficiency. But the ERF is funded by taxes on income, so even if the absolute scale of the ERF is not great, its "excess burden" (or deadweight loss) costs on the tax-payer should be accounted for.

Second, there are issues related to implementation. Like any policy instrument the ERF requires monitoring of current emission levels to check that genuine reductions are being achieved. But, the ERF also requires that an emissions baseline be established which determines the size of the subsidy payments. These will depend on the difference between baseline and current emissions. The difficulty here is to make sure that polluters are not "gaming" the ERF scheme by exaggerating initial emissions in order to get higher subsidy payments. Even without gaming the issue is to determine the genuine level of emissions reduction that occurs as a result of the ERF. In Australia emissions by coal-fired electricity generators have fallen in recent years not because of carbon charges but because of falling electricity demands. In addition, generators switched to using less polluting gas around 2008, even before carbon pricing was introduced. It would be unattractive if payments to carbon polluters were made for emissions reductions that would have occurred anyway.

Indeed, this decrease in electricity demand and the accompanying reduction in baseline emissions is responsible for other concerns regarding the eventual effectiveness of the ERF. Many electricity generators in Australia operate as multi-plant firms, and due to the recent decrease in electricity demand, many of these firms currently have non-trivial excess capacity. Suppose, for example, that when the government offers a subsidy to abate, the firm decides to completely close one of its plants. The resulting reduction in electricity capacity will cause electricity prices to rise, so now the firm has an incentive to increase output (ie: decreasing excess capacity) at its remaining plant(s). In this case, while the government is paying the firm to abate, it is possible that no real or net abatement will take place.

Such issues do not arise with a carbon tax since a firm's tax liability depends only on its actual emissions - there is no benefit to a firm in fudging a baseline or gaining an unwarranted advantage from a switch to gas. Also the two schemes differ in terms of the information required to implement each abatement policy. Under the CPRS the only information required is an estimate of total emissions by firms in each period, needed to calculate a firm's total carbon tax payments. Under the ERF it is necessary to ensure that any abatement undertaken is true abatement beyond that which would have occured without any abatement policy. Avoiding this problem requires a detailed determination of benchmark emissions by all firms submitting bids through the ERF. It will also be necessary to forecast these emissions into the future over the entire period of operation of the ERF. As a result, it is likely that the cost of writing emissions reduction contracts between the government and firms bidding under the ERF will become expensive.

Third, there is the issue of the timeframe over which policy operates. There are considerable difficulties in understanding whether firms will sustain emissions reductions over time. The current ERF is scheduled to run for 5 years. Presumably the Government assumes emissions reductions made during this 5 year period will be sustained into the future. There are real issues here of policy credibility. Will firms cut emissions now in response to an emissions subsidy which compensates them for the extra costs they will occur over such a short-term time horizon? Clearly, the longer-term future for the ERF needs to be spelt out.

Fourth, and probably the main reason for much of the negative response to this policy change is the rejection of the PPP in favour of the PGP. The PPP was defined in an OECD Recommendation adopted on 26 May 1972 on *'Guiding principles concerning international economic aspects of environmental policies'* (C(72)12). The definition takes as a premise that public measures are necessary to reduce pollution and to reach a better allocation of resources by ensuring that the prices of goods which depend on the quality and/or quantity of environmental resources reflect more closely their relative scarcity and that economic agents react accordingly. What this means in practice is that the polluter pays for carrying out policy determined requirements. But, it is likely that there are reasons for the change in the policy other than economic. Indeed, within the 2013 Green Paper fairness to industry is implicitly used in the Ministerial Forward as a justification for the change:

> *"The alternative global model is purchasing abatement. Instead of a heavy punitive tax, a buy-back model focuses on activities that reduce emissions. This is the basis of the largest and arguably the most effective system in the world, the United Nations Clean Development Mechanism, which to date has generated approximately 1.4 billion tonnes of emissions reductions."* (Australian Government, 2013:ii) [4]

Of course, once issues of fairness are considered we are now confronting normative rather than positive issues. Clearly policy makers are very aware of the distributional

[4] It should be noted that the CDM is underpinned by an incentive mechanism that generates funds to purchase the desired emission reductions.

consequences of a policy and how it affects different social groups. Therefore, it comes as little surprise to find that fairness considerations play a much greater role in the political decision-making process than cost-effectiveness or economic efficiency.[5]

However, another way of framing the policy change is to characterize the ERF as being an application of the PGP. The ERF is offering payment (subsidy) for an environmental service (a public good) which otherwise would not be forthcoming. Then polluting firms are rewarded for reducing emissions below a level that they would achieve without the policy in place. On this interpretation, the ERF has changed the allocation of property rights to the atmosphere to polluting firms in accord with standard Coasian reasoning.

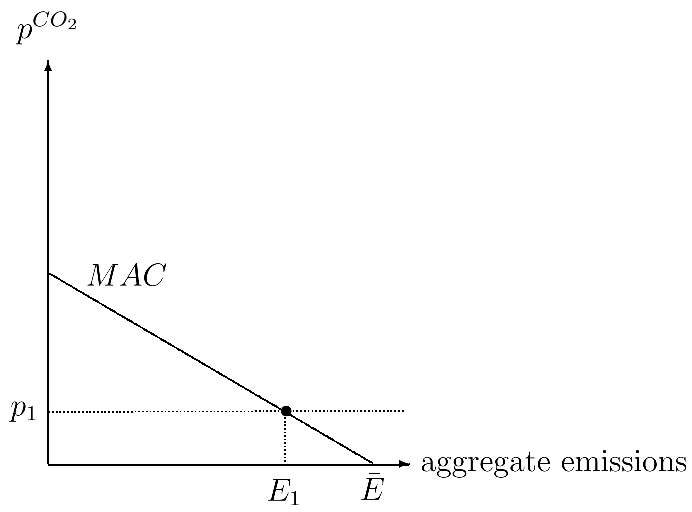

Figure 1: Economy's Marginal Abatement Cost Curve

But in spite of these considerations, a carbon tax like the CPRS or a subsidy scheme like the ERF can be constructed to have equivalent effects on aggregate emissions. Suppose the economy's aggregate MAC curve is given in Figure 1. With no carbon tax or subsidy scheme, aggregate emissions will be $\bar{E}$ units of CO_2. If the government charges a tax of p_1 per unit of emissions, firms will abate as long as the cost of doing so is less than p_1, so emissions will fall to E_1. As shown in Baumol and Oates (1988:10), this policy is equivalent to one where the government pays a subsidy to firms to abate, where the subsidy is equal to p_1. Now firms will abate as long as the subsidy per unit of abatement

[5]In fact the Australian Prime Minister in an address to the Minerals Week 2014 Annual Minerals Industry Parliamentary Dinner, Canberra appealed to the intergenerational "fairness" as follows: "It's particularly important that we do not demonise the coal industry and if there was one fundamental problem, above all else, with the carbon tax was that it said to our people, it said to the wider world, that a commodity which in many years is our biggest single export, somehow should be left in the ground and not sold. Well really and truly, I can think of few things more damaging to our future." (http://www.pm.gov.au/media/2014-05-28/address-minerals-week-2014-annual-minerals-industry-parliamentary-dinner-canberra-0)

is at least as large as the MAC, so again aggregate emissions will fall to E_1.

As noted in Baumol and Oates (1988), these two policies will be equivalent only so long as the subsidy policy does not result in entry of new firms into the abating industries. Such entry seems highly unlikely in emissions-intensive Australian industries. For example, entry into the electricity generation sector, in response to introduction of the ERF, would likely be met by a hostile regulatory response. Other emissions-intensive sectors in Australia like aluminium production are already in decline. It is further worth noting that the two schemes cannot be equivalent as far as their effect on the government budget balance is concerned. Under the CPRS with all revenues transferred to the private sector, the effect on the government budget is neutral, while, under the ERF, the government pays for the firms' abatement. That is, under the CPRS, firms pay for abatement, while under the ERF, the government pays firms to abate.

3 CGE Model and Results of Different Abatement Policies

To understand the fiscal and emission reduction implications of a change in carbon abatement policy, the CGE model in Clarke and Waschik (2012a,b) is used to simulate the effects of restricting CO_2 emissions below their benchmark level. The CGE model is solved for the equilibrium carbon price consistent with varying levels of abatement. Since the equilibrium carbon price will be the economy's MAC for that level of emissions/abatement, this allows us to identify the economy's MAC curve. A level of abatement consistent with Australia's Kyoto target is then selected and the revenue raised by the carbon tax under the CPRS computed. The cost of buying abatement through the ERF is also computed as the area under the same MAC curve. Then the revenue raised under the CPRS is compared to the cost of the same level of abatement under the ERF.

Our analysis begins with a general equilibrium dataset for the Australian economy in 2007, taken from version 8 of the Global Trade Analysis Project (GTAP) dataset. The production side of the general equilibrium model is represented using a series of nested CES functions as illustrated in Figure 2. Output at the top of any nest is a CES aggregate of inputs immediately below, with a CES substitution elasticity as specified. For example, starting at the bottom of Figure 2, liquid fuel is a CES aggregate of petrol and gas, where the central case substitution elasticity between petrol and gas is $\sigma_{lqd} = 2$. There is less substitutability between coal and liquid fuel in the nest above ($\sigma_{nel} = 0.5$),

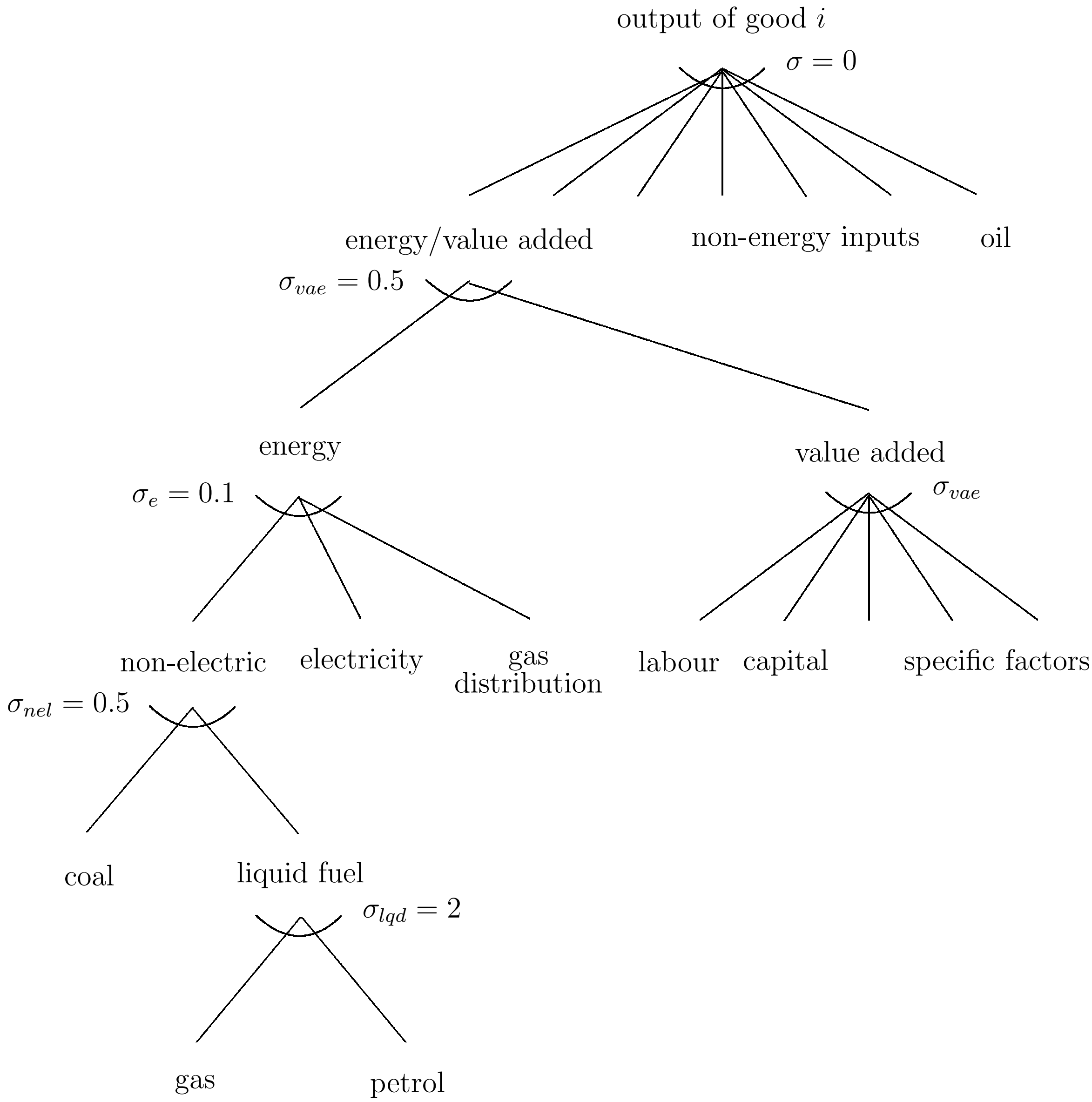

Figure 2: Structure of Production

and even less between non-electric fuel, electricity and gas distribution ($\sigma_{ee} = 0.1$), to produce energy, which is combined with value-added (a CES aggregate of primary factors of production) to produce an energy/value-added aggregate input into production. The top-level production function combines inputs using a substitution elasticity $\sigma = 0$, so top-level inputs are combined using fixed-coefficients production technology.

Of course, the MAC in any industry, and for the economy as a whole, will depend on the substitution elasticities specified in Figure 2, since these will directly affect the demand elasticities for energy products. Higher demand elasticities make it easier to substitute away from dirty energy inputs into cleaner energy inputs, reducing the MAC. The price elasticities of demand consistent with the central case substitution elasticities illustrated in Figure 2 are given in Table 1.

coal	-0.318	petrol	-0.405
oil	0.000	electricity	-0.410
gas	-1.069	gas distribution	-0.303

Table 1: Central Case Demand Elasticities

Oil is only used as an intermediate input in production, almost entirely in production of petrol. Private and public demand for oil is zero. Since oil enters as an input into the top-level of the production function with a substitution elasticity of zero, the price elasticity for oil is zero. Demand for other energy goods is relatively inelastic, except for gas. The price elasticity for gas is most dependant upon specification of σ_{lqd}. Reducing the value of σ_{lqd} from 2 to 1 reduces the demand elasticity for gas from -1.069 to -0.634, while leaving the demand elasticities for the other energy goods reported in Table 1 virtually unchanged.

The structure of household demand is modelled using two-level CES functions as in Figure 3. Public consumption is modelled using a Cobb-Douglas function, and aggregate public consumption is exogenous. To accommodate trade, imports are modelled as differentiated products using the Armington assumption. Any good used as an intermediate input or as an input into household or public demand is a CES aggregate of domestic and imported varieties of that good, with a substitution elasticity as specified in the GTAP8 model. On the export side, we model domestic and export markets as segmented, with a transformation elasticity between goods destined for the domestic and export markets set equal to 2. Australia is modelled as a small open economy facing fixed relative prices of traded goods. As we are modeling the effects of the different carbon abatement policies using a static CGE model, investment and capital flows are assumed fixed.

CO_2 emissions are incorporated into the model by attaching carbon in fixed proportions to usage of energy goods by firms as intermediate inputs or by households. Therefore usage of a given quantity of any energy good always results in a given amount of CO_2 emissions.[6] In the GTAP8 dataset, emissions only accompany the usage of energy goods: Coal, oil, gas, petrol and gas distribution. Total CO_2 emissions for Australia in GTAP8 amount to 396.4mT of CO_2. This total does not include emissions from agriculture, since these are not included in GTAP8. We augment this emissions data by incorporating emissions from agriculture, including: Enteric fermentation and manure management associated with production of cattle and other animal products;

[6]Australian public consumption of energy goods is virtually zero in the GTAP8 dataset.

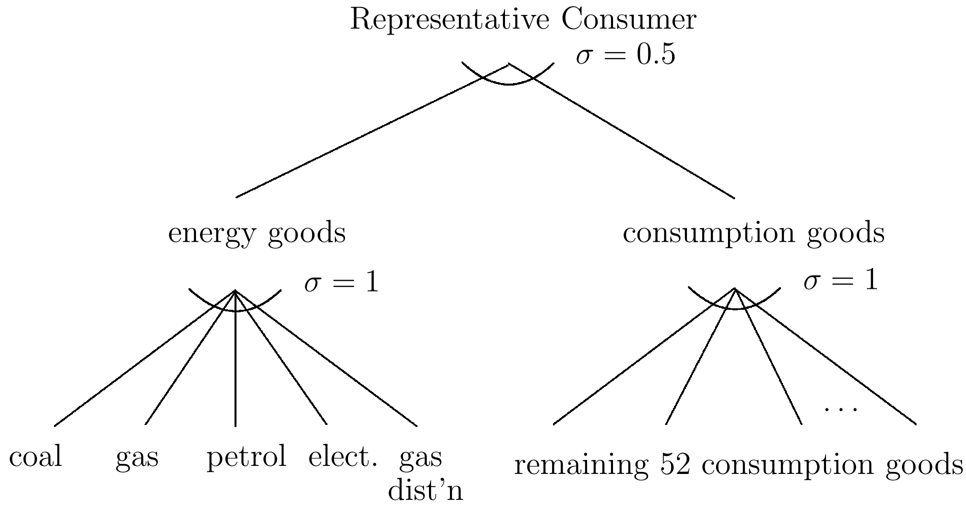

Figure 3: Structure of Consumption

emissions from rice cultivation; CO_2-equivalents of nitrous oxide emissions from agriculture soil management in cereal grain production; and field burning of agricultural residue associated with production of wheat and sugar cane. As a result, total Australian CO_2 emissions for 2007 in our CGE model are 472.4mT, which is much closer to the 541.3mT total reported for 2007 in the National Inventory Report of the Australian National Greenhouse Accounts (Department of Climate Change and Energy Efficiency (2008:xii)) than the unadjusted GTAP8 data.

A target level of abatement is adopted consistent with the medium-term objective under Australia's recent Carbon Pollution Reduction Scheme: A 5 per cent reduction in emissions below levels prevalent in 2000 by 2020. Using the baseline projections in Treasury (2008), *"... an absolute reduction of 5 per cent (in the CPRS-5 scenario) by 2020 corresponds to a 27 per cent reduction in per capita emissions"* (Commonwealth of Australia, 2008a:10).

To simulate the effects of a carbon tax, we introduce a price per tonne of CO_2 emissions and restrict total carbon emissions in equilibrium by 0-40%. Summary results are reported in Table 2.[7]

As mentioned, solving the CGE model for the carbon price that yields varying levels of abatement allows us to simulate the economy's aggregate MAC curve. For example, the first two rows of Table 2 show that an equilibrium carbon price is \$16.23 per tonne of CO_2 emissions is needed to reduce total CO_2 emissions by 10 per cent from 472.4mT to 425.1mT. Users of energy goods will pay the carbon tax of \$16.23 per tonne rather

[7]All prices are in 2007 Australian dollars. Since GTAP8 data are reported in US dollars, we convert to Australian dollars using an exchange rate of 1.19 as reported by the RBA in `http://www.rba.gov.au/statistics/hist-exchange-rates/index.html`.

Level of Abatement	Carbon Price ($/T)	Carbon Emissions (mT CO_2)	Carbon Tax Revenue ($ million)	ERF Cost of Subsidy ($ million)	Welfare (Hicksian EV %Δ)
0	0.00	472.4	0.0	0.0	0.00
10	16.23	425.1	6899.4	371.8	-0.20
20	39.20	377.9	14814.0	1663.3	-0.62
27	61.11	344.8	21067.8	3320.1	-1.09
30	72.45	330.6	23952.5	4272.3	-1.34
40	122.33	283.3	34658.9	8821.6	-2.52

Table 2: Summary results of CO_2 Abatement Using a Carbon Tax

than abate another unit of CO_2, so the carbon price is the MAC for the economy as a whole and for each user of energy goods. The CGE model is then solved for levels of abatement ranging from 0-40 per cent in increments of 0.25 per cent. The MAC curves for the economy as a whole and for the electricity sector are plotted in Figure 4.

While Figure 4 shows the MAC for all levels of abatement from 0-40 per cent, we illustrate the total receipts from application of a carbon tax of $61.11, consistent with a level of abatement of 27 per cent, to achieve Australia's medium-term abatement

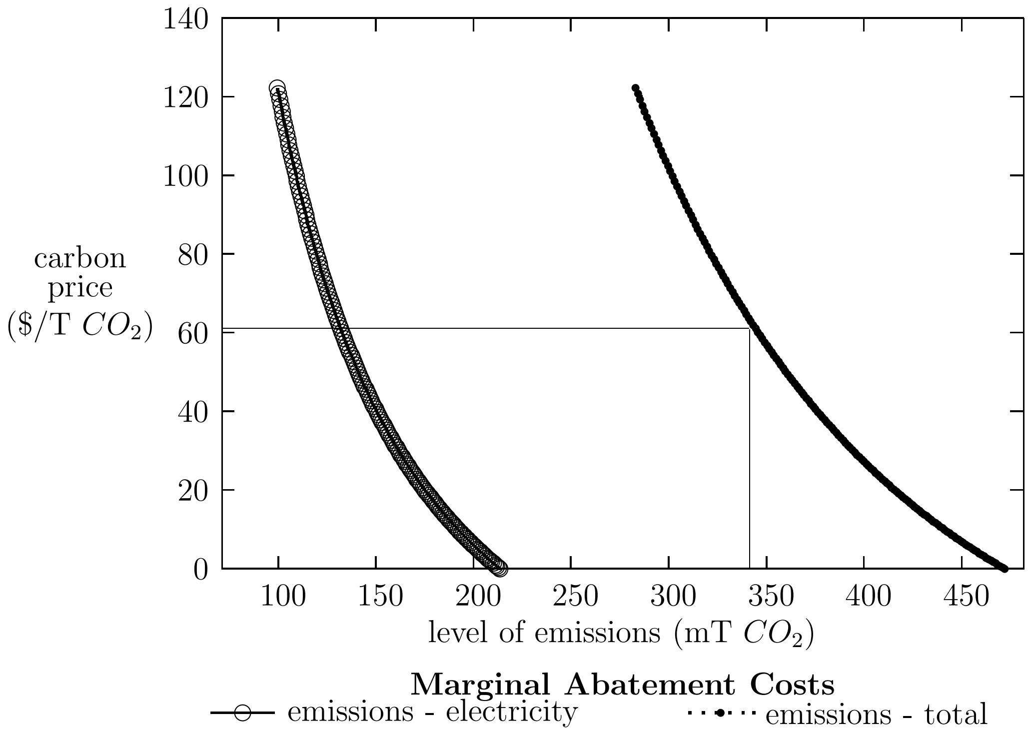

Figure 4: Marginal Abatement Cost Curves

objective under the CPRS scheme. This is shown by the rectangle in Figure 4, consistent with revenue generated by the carbon tax of just over $21 billion.

If the ERF is used instead of the carbon tax/CPRS to achieve a level of abatement of 27 per cent, we can use Figure 4 and the information in Table 2 to approximate the cost of funding this same level of abatement under the ERF. Firms will be granted a subsidy to fund the cost of this volume of abatement, so the subsidy will be the integral under the economy's MAC up to emissions of 344.8mT of CO_2. This is illustrated in Figure 4 by the area under the economy's MAC curve from initial emissions of 472.4mT up to the level of abatement of 27 per cent. The cost of the subsidy required to fund the ERF for a level of abatement consistent with Australia's medium-term abatement objective under the CPRS scheme is just over $3.3 billion, as reported in the final column of Table 2. This equates to approximately one-third of one percent of 2007 GDP.[8]

This analysis allows us to answer the following question: "How much abatement can the ERF buy?" If it still requires about one-third of one percent of GDP to meet Australia's Kyoto target, then since Australian GDP in 2013-4 was approximately $1558.1 billion (see Australian Bureau of Statistics (2014:27)), the ERF should enable the Australian government to buy about 50 per cent of the abatement needed to reach Australia's Kyoto target of 5 percent reduction in emissions below year 2000 levels by 2020. The clear implication of this finding, all other issues aside, is that the allocated expenditure on the ERF will mean that Australia is likely to come up short in relation to its Kyoto target. We would argue that this is the principal reason for concern with the ERF. The policy mechanism as funded will simply not make a sufficient impact on Australia's carbon emissions, which is unsurprising given the views expressed about climate change by many in the current Australian government.

4 Discussion and Summary

We have examined some of the economic implications arising from the removal of the Australian carbon tax and its replacement with the ERF. Our main empirical finding is that the current budget allocation for the ERF is unlikely to see Australia meet its Kyoto reduction targets. Thus, a major criticism of the ERF is that with current planned funding it is unlikely to hit emissions targets. Indeed, Australia's efforts are being shamed by the intended actions of the Obama Administration and by the intended actions in countries such as China and Indonesia.

[8]Recall that these results are generated using a static CGE model benchmarked to the year 2007.

However, we need to place our results in context and explain some limitations that might affect results presented. The introduction of any emissions abatement policy will generally have three effects:

1. scale effect: as carbon emissions become more expensive, the scale of production of carbon-intensive goods will fall
2. substitution effect: users of energy-goods will substitute away from dirtier more emissions-intensive inputs towards cleaner inputs
3. technological change effect: as dirty technology because more expensive with the introduction of a price on carbon, the relative price of cleaner technologies falls.

While the introduction of emissions abatement policies will generally encourage all three of these effects, the CGE model used to simulate the effects of a carbon tax or ERF only account for the first two. Results do not include the effects of technological change, so the carbon prices consistent with a given level of abatement in our CGE model will be upper bounds. Hence, revenues generated by the carbon tax and the cost of the ERF as presented in Table 2 will likely overstate the cost of meeting Australia's medium-term abatement target under the CPRS.

Note also that the total benchmark emissions in the augmented CO_2 emissions data in the CGE model understate actual year 2007 emissions as reported in Australia's National Inventory Report. For example, CO_2 emissions from waste are not included in the CGE model, and the reduction in emissions from savanna burning are not part of any abatement policy. Emissions from both of these sources are included in Australia's National Inventory Report. For any given percentage level of abatement, a higher initial or benchmark level of emissions would result in a higher equilibrium price per unit of CO_2 emissions and a higher volume of abatement, both of which would increase revenues generated by the carbon tax and the cost of the ERF as presented in Table 2.

The determination of baseline emissions was identified earlier as being important for designing the ERF. They are also important as an input into the CGE model that helps to identify abatement targets consistent with Australia's international obligations. For example, the baseline emission projections in Treasury (2008) equated Australia's target to a 27 per cent reduction in per capita emissions. This baseline had emissions of 579.1mT of CO_2 in 2005 rising to 774.2mT by 2020 (Commonwealth of Australia, 2008b:48). However, a number of factors are contributing to a much slower rate of growth in Australian emissions. Australia's National Inventory on Greenhouse Accounts submitted to the UN FCCC in April 2013 reported Australian emissions of 552.3mT for

2011 (Department of Climate Change and Energy Efficiency 2013:xii), suggesting that emissions have fallen since 2005. An important factor in this reduction in emissions is an unprecedented decrease in Australian electricity demand. For example, electricity consumption has fallen by 4.5 per cent since 2009 (Wood and Carter 2013:3).

Such an unanticipated reduction in baseline emissions will have implications for those of the CGE model. To meet an abatement target of 5 per cent below year 2000 emissions by 2020 will now require a smaller reduction in per capita emissions, thereby reducing the carbon tax needed to meet this abatement target. This would also reduce the cost of abatement purchases by the government under the ERF. This highlights an important difference between a carbon tax policy and the ERF. A given carbon tax will induce firms to abate even if baseline emissions fall, while a subsidy policy like the ERF will only do so if emissions reduction contracts are properly written to account for reductions in baseline emissions. And as noted in Section 2, if an electricity generator completely closes one of its plants to meet abatement requirements when accepting a subsidy under the ERF but at the same time increases capacity at some remaining plants, it is possible that no real or net abatement will take place under the ERF.

Finally, the results in the CGE model are derived under the assumption that Australia is a small open economy facing fixed relative world prices. While it is difficult to evaluate the effects of the abatement policies which are being adopted and debated in other countries, it is probably safe to expect that the world price of coal will fall as abatement induces a global switch away from coal towards cleaner fuels. Since Australia is such a large global exporter of coal, any terms-of-trade effect through the introduction of abatement efforts in other countries is likely to leave Australia worse off.

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