

Chapter 4

Economic modelling

Treasury modelling

4.1 Treasury released a lengthy paper called *Australia's Low Pollution Future: The Economics of Climate Change Mitigation*, on 30 October 2008. It reports the modelling work they had undertaken in conjunction with leading climate change economists on the impact on the Australian economy of climate change mitigation. The Treasurer and Minister for Climate Change described the report as 'one of the largest and most complex economic modelling projects ever undertaken in Australia'.¹ The work drew on a range of models with differing characteristics.²

4.2 The key conclusions reached are that:

...early global action is less expensive than later action; that a market-based approach allows robust economic growth into the future even as emissions fall; and that many of Australia's industries will maintain or improve their competitiveness under an international agreement to combat climate change.³

4.3 The key quantitative conclusion is that:

From 2010 to 2050, Australia's real GNP per capita grows at an average annual rate of 1.1 per cent in the policy scenarios, compared to 1.2 per cent in the reference scenario.⁴

4.4 Permit prices are assumed to increase by 4 per cent a year in real terms, reflecting a real risk-free interest rate of 2 per cent and a risk premium for permits of 2 per cent.⁵

1 Treasury, *Australia's Low Pollution Future: The Economics of Climate Change Mitigation*, October 2008, p iii. This report is hereafter referred to as Treasury (2008). Similarly, the Secretary of the Department of Climate Change commented 'the Treasury modelling is the most significant and comprehensive exercise ever undertaken in Australia'; Dr Martin Parkinson, *Proof Committee Hansard*, 18 March 2009, p 8.

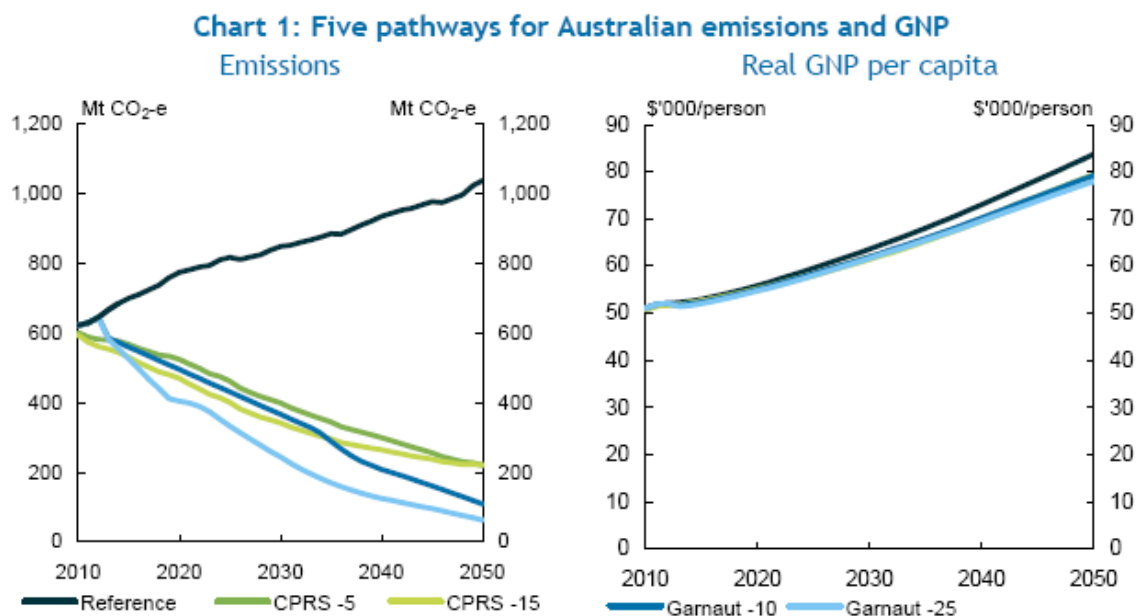
2 The three main computable general equilibrium models used were the Global Trade and Environment Model (GTEM) developed by ABARE, the G-cubed model developed by Professor Warwick McKibbin of the Australian National University and the Monash Multi-Regional Forecasting (MMRF) model. They were supplemented by industry-specific models. The impacts on households were modelled using Treasury's Price Revenue Incidence Simulation Model (PRISMOD). Treasury (2008, pp 12-14).

3 Treasury (2008, p ix).

4 Treasury (2008, p xi).

4.5 The impacts on real income of various proposals for reducing emissions are illustrated in Chart 4.1.

Chart 4.1



4.6 The White Paper includes modelling results comparing six possible regimes, assuming differing Australian and global targets, with a baseline projection based on doing nothing. In all scenarios real incomes continue to grow strongly. The modelling neglects the benefits from action on climate change. For simplicity, Table 4.1 below shows only three results; the baseline; the CPRS proposal of a 5 per cent cut in Australian emissions and a more ambitious regime where there is global agreement on targeting 450 ppm. In the second scenario it is assumed that there is a phased introduction across countries⁶ whereas in the third scenario it is assumed all countries participate from 2013.

5 Treasury (2008, p 78).

6 Advanced economies from 2010, China from 2015, India from 2020 and poorer countries from 2025; Treasury (2008, p 82).

Table 4.1: Modelling results

	No action	CPRS proposal	450 ppm target
Australia			
Change in Australian emissions 2000 to 2020	+40%	-5%	-25%
Change in per capita emissions 2000 to 2020	+8%	-27%	-44%
2010 carbon price	0	\$23	\$52
2020 carbon price (2005 dollars)	0	\$35	\$60
Real GNP per capita increase 2010 to 2020	+9.6%	+7.8%	+8.3%
Real GNP per capita average annual growth rate; 2010 to 2050	1.2%	1.1%	1.1%
Change in Australian emissions 2000 to 2050	+[50]%	-60%	-90%
Change in per capita emissions 2000 to 2050	+[30]%	-77%	-93%
Global impacts			
Change in emissions 2000 to 2020		+32%	+29%
Change in emissions 2000 to 2050		-9%	-50%
2020 carbon price (2005 dollars)		US\$31	US\$52
Real GDP average annual growth rate; 2010 to 2050	3.5%	3.4%	3.4%
Potential stabilisation of CO ₂ e	Not stabilised	550 ppm	450 ppm
Expected (median) increase in global average temperatures	+[8]°C	+3°C	+2°C

Sources: *White Paper*, pp 4-12, 4-25; Treasury (2008, pp xii, 76, 77, 93)

Criticisms and commentary on the Treasury modelling

No modelling of 'Australia going alone'

4.7 There has been criticism that Treasury has not modelled a 'worst case scenario':

Probably the biggest concern would be that there has been no modelling undertaken that factors in Australia going alone. All the modelling scenarios assume that the rest of the world will also take action...⁷

Given the nature of the collective action problem and the historical record of slow, partial and fragmented action, it is difficult to conceive why Treasury did not model and publicly release at least one policy scenario where comprehensive and coordinated global action fails to develop in the next decade.⁸

4.8 Treasury has responded that such a scenario would be very unlikely, especially given that many countries are already implementing an ETS. (See the discussion in Chapter 3). Furthermore, Treasury has defended the assumption by arguing that:

To assume otherwise — that is, to presume that the world's major emitters will not act at any time to decisively reduce greenhouse gas emissions — is to presume that the world will gradually succumb to potentially catastrophic damage to the global environment...The prehistoric peoples of Easter Island took this path, and paid the price (*Collapse*, Jared Diamond, 2005). We would do well not to follow their lead. Another logical possibility is that majority scientific opinion is simply misguided and will turn out to be a fad. However, to invoke such a possibility as a basis for deciding on public policy seems to me extraordinarily foolhardy.⁹

4.9 The Australian Industry Greenhouse Network indicated they agree with the Government's general assumptions regarding international climate change action:

AIGN agrees with the Government's assessment of the likely direction on international negotiations on mitigation of climate change.¹⁰

4.10 Indeed, the Treasury modelling already covers very pessimistic scenarios:

...it was judged that having China take on no targets until 2015, despite currently doing quite a lot in the greenhouse gas space to reduce emissions,

7 Mr Andrew Canion, Senior Adviser, Industry Policy, Chamber of Commerce and Industry of Western Australia, *Select Committee on Fuel and Energy, Committee Hansard*, 17 November 2008, p 5.

8 Dr Brian Fisher, 'A peer review of the Treasury modelling of the economic impacts of reducing emissions', *Concept Economics*, 30 January 2009, p 20.

9 Dr David Gruen, 'The economic costs of reducing greenhouse gas emissions: understanding the Treasury modelling', *Treasury Economic Roundup*, no. 4, 2008, p 27.

10 Australian Industry Greenhouse Network, *Submission 54*, p, 7.

we are being more pessimistic than current government policies out to 2015. Then from 2015, China's emissions allocation continues to grow until 2030, which was judged to be realistic. Similarly, India does not do anything at all in the greenhouse gas space until 2020 and then its emissions allocation continues to grow until 2040. Other developing low income countries do not do anything until 2025.¹¹

4.11 However, even critics of the Treasury modelling concede that China is taking some steps:

There is little doubt that the Chinese government has adopted an ambitious climate change related domestic policy program...¹²

4.12 Treasury drew the Committee's attention to some modelling for the Garnaut Review that did look at Australia acting alone:

In a situation in which Australia continues to act on climate change and there is no action other than existing arrangements in the current Kyoto protocol, going forward, the economic cost to Australia in that world was lower than any of the scenarios we looked at.¹³

Revised modelling to incorporate the global economic crisis

4.13 Treasury has also been criticised for not redoing the modelling to use a baseline incorporating the impact of the global financial crisis. Treasury explained:

The economic analysis modelling was undertaken over 18 months...There was no explicit decision to exclude the implications of the global financial crisis. It was judged in the context of the knowledge at the time that it would not materially affect the analysis in the report...in the context of looking at trajectories and targets over 20, 30, 40 and 50 years, we do not feel that it is material to the analysis in the report.¹⁴

The economic modelling focuses on changes in the economy resulting from climate change mitigation policies. In principle, even if the reference scenario was different, the direction and scale of these changes should be broadly unchanged.¹⁵

11 Ms Meghan Quinn, Treasury, *Select Committee on Fuel and Energy, Committee Hansard*, 19 November 2008, p 63.

12 Dr Brian Fisher, 'A peer review of the Treasury modelling of the economic impacts of reducing emissions', Concept Economics, 30 January 2009, p 36.

13 Ms Meghan Quinn, Treasury, *Proof Committee Hansard*, 25 March 2009, p 12.

14 Ms Meghan Quinn, Treasury, *Select Committee on Fuel and Energy, Committee Hansard*, 19 November 2008, p 63.

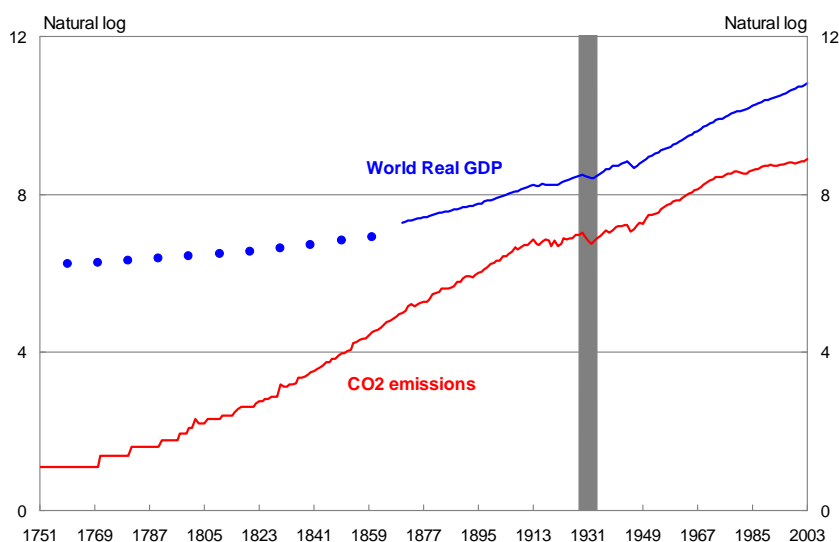
15 Treasury (2008, p xvi).

4.14 While Treasury has not redone all their modelling since the crisis, it is possible to derive an indication of how much the results would differ. As the previous statement from Treasury explains, the financial crisis is unlikely to change significantly the 'counterfactual results': that is, if in a world without a CPRS the crisis means that GDP will increase by X per cent less by 2050 than if there had not been a crisis, then in a world *with* a CPRS GDP will also increase by around X per cent less by 2050 as a result of the crisis.

4.15 Given this, an approximate result can be calculated by applying the simple and conservative—many would say pessimistic— assumption that real GDP will now be flat in 2009 and 2010 rather than growing by 3 per cent each year and that the economy thereafter grows at its long term trend rate of growth, never making up any of what it lost. This would imply that real GDP in 2050 will be 6 per cent lower than it otherwise would have been due to the crisis. The implication is that if the Treasury modelling exercise were redone now, instead of the modelling concluding that the CPRS might reduce annual average growth in real per capita incomes from 1.2 to 1.1 per cent, it would be reducing it from 1.1 to 1.0 per cent.

4.16 Another perspective can be gleaned from looking at real GDP and emissions over a long term. The slump in emissions during the Great Depression is evident in Chart 3.2. Also evident is that even such a large economic disruption as the Great Depression has a relatively modest impact on long-term economic growth.

Chart 4.2: CO2 emissions and world real GDP



Dr Fisher's criticism

4.17 Dr Brian Fisher of Concept Economics, a former head of the Australian Bureau of Agricultural and Resource Economics, attacked the Treasury modelling as 'unrealistic' and 'stretching credulity' within a day of its release.¹⁶ He was subsequently

¹⁶ 'Garnaut's myths of emission', *The Australian*, 31 October 2008.

commissioned by the Senate Select Committee on Fuel and Energy to review the Treasury modelling. His review questions Treasury's modelling assumptions and claims that:

...the interaction of these assumptions is likely to result in the Treasury modelling seriously under-estimating the economy-wide and sectoral challenges associated with particular emissions reduction targets...¹⁷

4.18 In general, no quantification is provided of any under-estimation. An exception is the LNG industry, where Dr Fisher comments:

Modelling work by Concept Economics suggests that under plausible ETS scenarios LNG output is likely to be between a third and a half less than it otherwise would be by 2030. This is the case regardless of whether or not the government offers to shield the industry with assistance for a period of time.¹⁸

4.19 Many of Dr Fisher's complaints that modelling is a simplification of a complex reality would apply to any modelling work, not just to this specific modelling exercise. Dr Fisher also calls for more details of the Treasury modelling to be released, but Treasury says some of the information requested was provided on a commercial-in-confidence basis.

A comment by Dr Parkinson

4.20 Dr Parkinson reminded the Committee that while the focus of the Treasury modelling is on the costs of introducing an emissions trading scheme, regard should also be given to the costs of deciding not to introduce one at this time:

...existing models do not capture the impact of ongoing uncertainty in climate policy frameworks. Business now knows that climate action is inevitable. Work done for the Task Group on Emissions Trading shows that uncertainty over climate action produced real costs to the economy, in particular in the electricity sector. This was one of the reasons why that group agreed that emissions trading should not be dependent on developments internationally.¹⁹

CSIRO modelling

4.21 In addition to the Treasury modelling, the CSIRO conducted modelling of the employment impact of introducing an ETS, using both their in-house biophysical model and Monash University's CGE model. The results, reported in a June 2008

17 Dr Brian Fisher, 'A peer review of the Treasury modelling of the economic impacts of reducing emissions', Concept Economics, 30 January 2009, p 6.

18 Dr Brian Fisher, 'A peer review of the Treasury modelling of the economic impacts of reducing emissions', Concept Economics, 30 January 2009, p 29.

19 Dr Martin Parkinson, Secretary, Department of Climate Change, *Proof Committee Hansard*, 18 March 2009, p 7.

report, *Growing the Green Collar Economy*, from the two models were similar to each other and also similar to those from the Treasury modelling. One of the authors told the committee that:

...achieving a rapid transition to sustainability would have little or no impact on national employment.²⁰

4.22 He also made the point that the creation of new 'green jobs' is not restricted to new firms or new industries. It also covers workers in existing firms who contribute to economising on their energy use:

...green jobs will be found in many sectors of the economy from energy supply to recycling, and from agriculture and construction to transportation. Green jobs, essentially, help to cut the consumption of energy, raw materials and water through high efficiency strategies.²¹

4.23 Quantifying this, Dr Schandl cited the estimate from his modelling:

...the number of jobs will grow, both in business-as-usual and in a scenario which takes into consideration all the things that have been described in the green paper that would happen in the emissions trading scheme. Overall, the number of jobs will increase over the next two decades—2.5 to 3.3 million new jobs, and 230,000 to 340,000 of these new jobs are in those sectors which we have identified as high-impact sectors, with regard to resource use, energy use and emissions.²²

The Garnaut Review modelling

4.24 The Treasury modelling built on work done for the *Garnaut Review*. That modelling assumed all countries act from 2013 and all money raised from the sale of permits is distributed to households, with no compensation payments to industry. In contrast to the Treasury modelling, it considered some of the costs of *not* addressing climate change. In particular it covered impacts on primary production, human health, infrastructure, tropical cyclones and international trade.²³ By 2100 real GNP, GDP, consumption and wages are 6-10 per cent lower than they otherwise would be as a result of climate change and the impact is continuing to grow.²⁴ Adding in the increased risk of absolutely catastrophic outcomes, and the non-market impacts, would raise these estimates considerably. Garnaut notes that other modelling has

20 Dr Heinz Schandl, CSIRO, 25 March 2009, p 24.

21 Dr Heinz Schandl, CSIRO, 25 March 2009, p 25.

22 Dr Heinz Schandl, CSIRO, 25 March 2009, p 33.

23 *Garnaut Review*, p 253.

24 *Garnaut Review*, p 253.

shown that costs in the 22nd century will be dramatically higher – perhaps approaching 70 per cent of global GDP by 2300.²⁵

4.25 The Garnaut modelling finds the cost of Australia's share of the costs of mitigating climate change are about a 0.1 per cent a year reduction in economic growth – the costs will depend on what new technologies are developed in response to carbon prices soaring into the hundreds of dollars.

4.26 The net costs of mitigation appear manageable and after 2060 they have become negative (ie GDP growth is stronger with mitigation than under business-as-usual). Agriculture is the big winner (as crops are more sensitive to temperature than manufacturing) but by the latter half of the century mining also is doing better.

4.27 The modelling also throws some light on the difference between aiming to stabilise at 450 and 550 ppm. The more ambitious target costs an extra 0.7-0.9 per cent of GDP (in net present value terms). Given the environmental benefits and the insurance value of reducing the risk of catastrophic impacts, Garnaut:

...judges that it is worth paying less than an additional 1 per cent of GNP as a premium in order to achieve a 450 result.²⁶

4.28 Garnaut's conclusion is that:

The costs of well-designed mitigation, substantial as they are, would not end economic growth in Australia, its developing country neighbours, or the global economy. Unmitigated climate change probably would.²⁷

4.29 He also comments that modelling of large changes to the structure of the economy is likely to overstate the costs of these changes:

Experience shows that once consumers and producers have accepted the inevitability of change, and face predictable incentive structures, they will alter their behaviour to account for the new conditions more efficiently and effectively than previously predicted. This experience suggests that economic models are more likely to underestimate the benefits or overestimate the costs of changes in economic conditions, so long as the change is to stable institutional arrangements and predictable incentives. This bias may be further exacerbated by lack of data about the full costs of climate change impacts and a corresponding downward bias in the estimated benefits of avoided climate change.²⁸

25 *Garnaut Review*, pp 262-3.

26 *Garnaut Review*, p 272.

27 *Garnaut Review*, p 268.

28 *Garnaut Review*, p 306.

Allen Consulting Group modelling

4.30 The Allen Consulting group was commissioned by a group of large Australian companies to model the effect of policies to induce large cuts in Australian emissions, either rapidly or slowly. The main conclusions were:

Under the early action scenario the deep cuts in GHG emissions are delivered while GDP grows strongly at an average 2.1% pa over the period to 2050, in comparison with the base case in which GDP grows on average by 2.2% pa. This early action scenario would provide an estimated \$2 trillion GDP in 2050, meaning that Australia would then be about three times wealthier than in 2002...Delaying for just nine years has a significant negative impact – under the delayed action scenario, the deep cuts are achieved but on a steeper trajectory from 2022 which in turn limits GDP growth to an average 1.9% pa over the period to 2050...A total of over 3.5 million jobs are created in the period from 2013 to 2050 under the early action scenario...Under the early action scenario, electricity costs are lower as business invests earlier in a wide range of low and zero emission technologies. Early market uptake of technology leads to cost reductions through greater economies of scale and market experience.²⁹

Frontier Economics modelling

4.31 Frontier Economics conducted some modelling for the NSW Treasury, which focused on the results at a regional rather than national level, but was otherwise broadly comparable with the Treasury modelling. The modelling has not been publicly released at this stage but reports on it have appeared in the media.

4.32 The modelling indicates, unsurprisingly, that the CPRS will lead to employment growing by less (but still growing) in areas with a heavy dependence on emissions-intensive industry, such as Gippsland, central-west Queensland, the Hunter Valley, Illawarra and the Kimberley while employment will grow more in other areas, especially Tasmania with its hydro-electric power.³⁰

Reserve Bank analysis

4.33 While only partly informed by formal models, the Reserve Bank have also commented on the likely impact on economic growth of the CPRS:

Overall, assuming an emissions permit price of \$25 per tonne of CO₂-e, it is estimated that the net result will be to reduce GDP growth by less than 0.5 percentage points in total, spread over the first couple of years following the introduction of the CPRS, with a reduction of about 0.1 percentage points per year thereafter. These effects, however, must be

29 Australian Business Roundtable on Climate Change, *The Business Case for Early Action*, April 2006, p 5.

30 *The Australian*, 26 March 2009; see also Danny Price, Frontier Economics, *Proof Senate Select Committee on Fuel and Energy Hansard*, 2 April 2009, p 19.

considered against the longer-term costs of not taking steps to ameliorate the negative effects arising from climate change.³¹

4.34 This modest effect is partly due to the Bank's view that it will not be tightening monetary policy (ie raising interest rates) in response to the one-off impact on prices of the CPRS:

As with other structural changes affecting prices (such as the introduction of the GST in mid 2000), monetary policy will be set with a focus on medium-term price stability as a means of promoting sustainable growth in output and employment. Given that the increase in the price level is expected to be largely one-off, the Bank should be able to look through the initial increase in inflation.³²

31 Reserve Bank, *Statement on Monetary Policy*, February 2009, p 69.

32 Reserve Bank, *Statement on Monetary Policy*, February 2009, p 69.

