Garnaut – The Economic Underpinnings

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1. Introduction

The focus of the present paper, as its title indicates, is a relatively narrow one, relative to most discussion in this area: the economics underlying the Garnaut Report. Specifically, the purpose of the paper is to isolate the economic propositions underpinning the report and to provide some critical perspective on those propositions and by implication, on the report itself. Attention will be focused primarily on the broad contours of the economic theory involved, rather than on the robustness of the “numbers” as such; although, in the view of the writer, reflection on the theoretical underpinnings does bring with it comment on the application. For the most part the discussion side-steps the scientific aspects of the issue, or rather it takes them as read.

There appear to be three main areas of focus:

(i) the fundamental view of the economic system, including growth, that underlies the Review’s analysis. This is in essence the economics of the so-called “reference case”;

(ii) the economic logic used in the translation of climate change effects into economic impacts absent mitigation => the “business-as-usual” case

(iii) the economic logic of the recommendations to deal with the problem, e.g. ETS, => climate change with mitigation (absent global agreement).

It is fairly clear from the Draft Report (hereafter DR) in particular that what is considered to be the most useful approach for dealing with economic questions is CGE (computable general equilibrium) modeling. For the uninitiated this is seen to have the advantage over other (partial equilibrium) approaches in being able to take account properly of the interdependencies between different parts of the economy and in this sense to offer a clearer picture of the overall economic costs and benefits associated with climate change and policy to deal with it.

2. The reference case and unmitigated climate change

Specifically, the basis of the economic analysis in the report is an assessment of the economic impact of climate change, absent any mitigation policy; and this economic impact is assessed in terms of the deviations from a “reference case”, absent climate change. Climate change shocks are expected to generate deviations from reference case growth and GDP per capita. From the economist’s point of view, one might argue, the goal is to devise policy so as to minimize such deviations consistent with desired emissions targets (cf. DR, Chapters 8 and 9, and TP1).

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1 The discussion makes reference to parts of the Draft Report (DR) and the Final Report (FR) as well as the Technical Papers (TP) available from the Garnaut Climate Change Review web site (http://www.garnautreview.org.au/domino/Web_Notes/Garnaut/garnautweb.nsf). With regard to the economic underpinnings, much of the material in the former in fact finds it’s way into the discussion in the latter.
Although fairly obvious, it is nonetheless worth making explicit at this point that the
discussion of the impact of climate change shocks and not only the appropriate policy
response to achieve the above-mentioned goal clearly reflects the nature of the economic
model being used; in particular, how that model explains economic growth as well as the
economic impact of climate change both unmitigated and mitigated.

Projections about growth reflect the standard orthodox view that growth is ultimately supply-
constrained i.e. the effective limit on the scale of economic activity in the long-run and thus on
economic growth is the growth rate of “total factor productivity” (e.g. see the statement in
TP5, p.4). This means in effect labour force growth and growth in productivity of “factors of
production” or resources. Of course, what comes with this view is that in the long-run there
should be no constraint (assuming markets are allowed to work sufficiently flexibly) on the
system’s ability to provide for full-employment of the available labour force.2

Thus, the costs of climate change and mitigation are assessed in terms of their impacts on total
factor productivity growth e.g. negative effects on productivity in agriculture; though the
assessment would also include so-called “valuation effects” via the impact of climate change
and mitigation policy on Australia’s terms of trade (ratio of export prices to import prices),
effects which are potentially significant for Australia, given it’s export profile

In this view of growth, there is a role for movements in demand (e.g. changes in growth rates
of net export demand or domestic demand) to impact on growth but these will be “short-run”.
To the extent that markets are allowed to work sufficiently flexibly, this view of growth would
suggests that such negative demand shocks would be dissipated over the long-run.3

Absent climate change, the key features of the long-term forecasts used in the report are
growth at an average rate of 2.3% to 2100, with 2/3 of this from productivity growth (and
conceivably, given the view of growth canvassed above, 1/3 from labour force growth); a
long-term rise in the terms of trade, this stimulating income growth and in turn generating a
structural change towards services, viz, a rising proportion of services in GDP vis a vis
manufacturing, agriculture and mining. This structural shift is also seen to be partly the result
of the declining long-term international competitiveness of manufacturing.4

In assessing the impact of unmitigated climate change, the report proceeds in two stages. The
first stage involves the use of “partial” models dealing with the impact on particular sectors of
the economy. The second stage involves introducing these impacts into the CGE model in
order to arrive at a view of the aggregate level impacts of climate change. Similarly, some
adaptation by producers to climate change impact – e.g. switching to technologies made
relatively cheaper by the impact of climate change – is also assessed separately and then
introduced to the CGE model in the form of exogenous (i.e. outside the model) shocks to
demand; that is, as changes in the demand for certain technologies relative to others.

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2 Perhaps the most controversial aspects of so-called macroeconomics through the twentieth century, albeit
with the dissenters clearly in the minority.
3 There is of course question here of how long is the “long-run”? This question we set aside.
4 Of course, these structural changes will themselves will necessarily impact on the rate of growth of
greenhouse emissions, in so far as they entail a change in the emissions-intensity of production.
One of the most significant economic impacts of unmitigated climate change identified in the report, at least for the purposes of the present discussion, is a significantly lower rate of growth of GDP—on average between 1 and 2%. This lower growth rate reflects lower productivity growth in agriculture and a long-run decline in the terms of trade (ratio of export prices to import prices).\(^5\)

The report appears to regard GDP growth and consumption growth as the most appropriate indicators of economic benefits or losses. From a standard “welfare” perspective, welfare losses would be judged in terms of declining consumption growth rates as a result of unmitigated climate change. Indeed in the final report, the emphasis in discussion of the welfare impacts of unmitigated climate change is on GNP as distinct from GDP, because, as the report suggests, the former offers a better guide to real consumption growth (TP5, p.7).

This predicted decline largely reflects declining real household income, in turn the product of increasing prices of necessities and declining wages growth and thus declining real wages. Declining GDP growth in this conventional view would entail a loss of product and is conceivably viewed as problematic because of a loss relative to potential production.

Yet, standard welfare analysis and hence the report as well, does not go into arguably the more serious ramifications from declining GDP growth certainly where the latter falls below the rate of growth of the labour force. In other words, these analyses do not go into the employment and unemployment consequences of the lower growth.\(^6\) But this is not surprising: the discussion of employment consequences—resulting from slowing GDP growth—of climate change are effectively sidelined by virtue of an orthodox economic approach, specifically a supply-side view of growth. In particular, from an orthodox standpoint, these consequences could not but be limited to the short-run. Indeed, the presumption of a long-term gravitation towards full-employment is explicit in Garnaut (e.g. TP7, p.10), no doubt, following on from the reasoning used in the Monash CGE model which underpins the economic analysis in the report (cf. Adams, 2007, p.441).\(^7\)

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5 In a traditional orthodox growth model, output growth should be a reflection of supply side considerations in the long-run. Hence any change in the terms of trade must have an impact on growth via an impact on the real value of output produced under conditions of full-employment and optimum capacity utilization. In other words, a fall in the terms of trade will reduce the real value of our export production expressed in terms of imports. If in turn, the overall price index used to determine real GDP moves more in line with import prices than with export prices, then the growth rate of exports in real terms (i.e. using a GDP “deflator”) will decline. *Ceteris paribus*, this would reduce real GDP growth.

6 For this very reason, in view of the author is much more useful in any “welfare” analysis than an emphasis on consumption. Indeed, the analysis of welfare in terms of consumption possibilities seems wholly inadequate without discussion of accompanying employment and unemployment implications unless one adopts the orthodox position that the latter dissipate over the long-run.

7 Thus, for example, in discussing the impacts of an emissions trading system in the Monash model, Adams notes that “[a]t the national level, we assume that initially the real wage is sticky and so employment can deviate from it’s baseline value ….. Over time, though, we assume that real wage steadily eliminates most, if not all, of the short-run employment impacts. This means that in the long-run the costs ….. Are realised almost entirely as a fall in the national real wage rate, rather than as a fall in national employment. This labour market assumption reflects the idea that in the long-run national employment is determined by demographic factors ….. [i.e. population growth, participation rates]”.

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Significantly, the mechanics envisaged in this adjustment to full-employment, in the face of a falling GDP growth rate, involve a fall in the real wage: this fall would act to adjust labour demand in line with labour supply. In other words, a reasonable reading of the Report and a standard interpretation of the economics on which the report is based would suggest that the negative impact of unmitigated climate change on GDP growth is envisaged to manifest itself in the long-run primarily in a fall in the wage share of income, rather than a long-term rise in unemployment.

This in turn raises a two further interesting points. First, the distributional impacts of climate change are primarily shouldered by labour. Even assuming (bravely) that mild downwards real wage flexibility could eliminate adverse employment consequences of slower growth, there appears to be no consideration of alternatives to such uneven distributional changes? Second, the costs of climate change in terms of lower consumption are at least partly a reflection of the mechanism which the report assumes would act to correct fluctuations in labour demand (employment). In other words, the distributional shift against labour which is seen as the necessary medicine to correct for employment losses, will likely be the key force behind the lower consumption demand envisaged in the report. Hence, the pictured painted by the report, at least with respect to the socio-economic impacts of unmitigated climate change, appears to involve a definite trade-off – maintenance of jobs, employment, but a lower wage share and lower real household consumption.

Clearly the report does recognize the threat to regional employment, particularly in energy producing, emissions-intensive industries; and, as noted below, the report envisages some assistance by government in the adjustment of these industries to lower-emissions intensive production technologies.

As already noted, this view involves considerable faith in the ability of real wage flexibility to adapt labour demand to labour supply; a faith, which, in the view of the present writer, lack sufficient robust foundation. Alternatively put, the notion that real wage flexibility could do what seems to be required of it, even in the long-run, is not a correct deduction of any sound economic reasoning.

Significantly, the real wage fall may well be larger than the report anticipates, not just because of a larger than anticipated rise in the price of energy products, but because of a slower growth in nominal wages precisely via the slackness in the labour market. This is also relevant to the question of compensation for the effects of mitigation on lower income households, particularly if the degree of compensation is tied to the rise in energy prices as a result of mitigation measures. This is taken up further below.

A less orthodox view of growth would emphasise that it is a demand-led growth process; viz., the ultimate constraint on the rate of growth is the growth of demand, not the growth rate of

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8 Strictly speaking, though the real wage is the key adjustment variable in an orthodox interpretation of the labour market, the consequent impact on the wage share in national income also depends on the consequences of unmitigated climate change on average productivity growth. In fact, to the extent that climate change slows productivity growth, this would lessen the negative effects on employment.

9 Though the same theory that underlies the faith in the ability of real wage adjustment to rectify aggregate employment losses would identify a role for adjustment in wage relativities and for labour mobility in dissipating over time structural and regional employment problems.
productive capacity. From this angle, the costs of climate change and mitigation, at least in terms of lower growth would occur via negative impacts on the demand side - e.g. lower consumption growth because of negative effects on real wages and because of lower growth in net external demand (international trade performance). As such, in the absence of global agreements on mitigation, a critical party of the policy challenge in minimizing losses in terms of lower GDP and employment growth is the degree to which expenditure switching can be engineered i.e. movement towards greater emphasis on internal/domestic demand and the degree to which the fall in real household disposable income can be counterbalanced by government intervention in terms of demand management. Of course, the trick is to engineer this sort of policy in a way consistent with emissions targets. One is therefore left in this view as well with the conclusion that minimizing the economic impact of climate change requires considerable structural change within the economy; and the related question of whether market mechanisms can be relied on to bring about this adjustment.

3. The economic impact of climate change with mitigation – the ETS

The issue of structural adjustment in the economy and the ability of the market to achieve this is of course brought into sharp relief when considering the report’s discussion of climate change mitigation. The approach to mitigation reflects the faith in market-oriented approaches expressed early on in the report, e.g. “the primacy of preserving market institutions in designing the approach to mitigation and adaptation” (DR p. 8).

In particular, the analysis of mitigation begins with the premise that without a reduction in per capita GDP, a fall in emissions per capita requires either a fall in the energy-intensity of GDP or in the emissions-intensity of energy production or a combination of the two. The problem is then to trigger a market-based mechanism which would make it profitable for producers to switch to less energy-intensive methods of production and/or methods using less emission-intensive energy sources.

In terms of traditional orthodox economic theory, this is a standard “choice of technique” problem. To the extent that firms seek to minimize costs, then, in this orthodox view, the problem is one of engineering an appropriate set of relative prices of inputs which would trigger the switch to a technique of production with lower emissions. Though not explicitly put in these terms in the draft report, that report does assume “weak11 price-driven substitution between commodities in the production decision of firms [and that] firms … … respond to large increases in the prices of inputs by undertaking technological innovation that reduces their reliance on the good in question” (TP1, p.9).

Underpinning this traditional view is the belief in systematic and inverse, “well-behaved”, relations between the relative prices of inputs and the cost-minimizing proportions in which these inputs are combined in production. Hence, from a traditional standpoint, a rise in the relative price of inputs produced with more energy-intensive methods of production would lead to a fall in the proportions with which such inputs are combined with others in production. Likewise, a rise in the relative price of energy inputs which generate higher per

10 In this view, technical progress and with it, productivity growth, is as much the product or result of growth as it is a cause of growth.

11 This presumably means a low price elasticity of demand for inputs but nonetheless negative.
unit emissions, should lead to these inputs being used in smaller proportions relative to other inputs.

In other words, it is not unreasonable to suppose, on the basis of the assumptions made in the report, and the nature of the economic reasoning which underpins the general equilibrium analysis on which the report relies, that a significant part of the role for the “market” in a mitigation strategy is anchored to the belief that pushing relative prices of particular inputs in a certain direction – specifically, pushing up the relative prices of inputs produced by more energy-intensive and/or emissions intensive methods of production – will encourage research into alternative less energy-intensive and/or emissions intensive methods of production and/or make profitable such methods which were hitherto unprofitable.

Thus, in the appendix to Chapter 15 of the DR dealing with an emissions trading scheme, one finds the statement that “a firm facing a more expensive cost in its production process (via a price on greenhouse gas emissions) will look to switch from high to low emissions-intensive production processes in terms of both direct and indirect emissions” (DR, p. 399).

Nor is it unreasonable, in the view of the present writer, given the economic standpoint adopted by the report, to suppose that this is the role or niche for an emissions trading scheme, i.e. not only to slow emissions directly; but to raise the relative price/cost of energy-intensive methods and emissions-intensive energy products to encourage switches of production to less energy-intensive methods and less emissions intensive methods in the production of energy.

Additionally, conventional theory would see a role for consumer substitution in the process of engineering the required changes in input proportions. To the extent that the relative costs of emissions-intensive methods of production rise, so will the relative price of consumer goods produced with these methods, in turn leading consumers to substitute away from such goods. It is clear that the report also envisages a role for this substitution: in fact, the wording of the final report suggests that this is actually seen as driving the substitution by producers between different methods of production. Thus, in the discussion of the benefits of a market based mitigation policy, it is argued that such a policy leaves consumers free “to choose whether, when and how to change from high to low carbon-intensive products. As they do so, firms begin responding to new consumption patterns by investing in alternative technologies and new products” (FR, p.308).

Purely from an economic point of view however, this kind of argument is not without serious difficulties. The economic theory underpinning the conventional notion of input substitution triggered by relative prices changes is not as robust as the confidence in the ETS would suggest. These difficulties in question concern the belief in systematic connections between relative prices of inputs and the proportions in which those inputs are combined and the direction of change in the relative cost of different methods of production.12 More specifically,

12 To clarify, the theoretical point underpinning this discussion relates to a long-debated but much neglected feature of orthodox economic theory, specifically orthodox capital theory. It concerns the lack of a robust theoretical foundation for the view that the relation between relative returns to inputs and the relative proportions in which those inputs are combined in production is monotonically inverse. With respect to the key variable for policy makers in the present discussion - the emissions-intensity of production – the problem is not exactly the same as above-mentioned capital-theoretic problem – since the issue for economic theory
in the present discussion, the relevant belief is that a rise in the relative price of emissions and the emissions-intensity of production are inversely related. Since the present context entails a definite limit on the aggregate level of emissions, by means of permits, doubt about the responsiveness of the emissions-intensity of production to changes in the relative price of emissions, effectively becomes a question of how much this relative price would need to rise in order to reduce the “demand” by industry for emissions in line with the mandated limit.

In complex input-output systems such as our own, the effects on the ranking of methods of production according to profitability, consequent upon a change in relative prices, need not be systematic. Additionally, it is not merely the introduction of a price on carbon, but also the ramifications for the real wage that matter. A given change in the real wage rate, since labour is an input in differing degrees to all production processes, entails complicated changes to relative prices generally. At the very least, this makes much less clear the extent of the increase in the carbon price and in energy products and the commensurate fall in the real wage required to reduce “demand” for emissions in line with the mandated limit.

A similar lack of clarity would seem to apply also to the changes in prices and real wages required to render for the private sector profitable technologies hitherto unprofitable, and thus render profitable certain low-emission innovations.

With respect to the emissions trading scheme envisaged in both Draft and Final Reports, it is useful to also briefly comment on the issue of compensation, not least because this also seems to be predicated on the efficacy of market mechanics to dissipate certain costs. Compensation is considered in the report for firms in trade-exposed, emissions-intensive industries as a result of mitigation policy (e.g. emissions trading) and in the absence of commensurate mitigation in competitor countries. In essence, the report envisages the need for compensation in order to provide as near as possible a level playing field in the absence of mitigation measures by our international trading partners. From a theoretical standpoint, in the absence of mitigation by our trading partners, the object is to prevent a fall in local production beyond what it would be in the presence of carbon pricing measures in the rest of the world (cf. DR, Appendix 15A). From the standpoint of enforcing emissions targets, the objective is one of preventing carbon leakage in a period of uneven mitigation responses between ourselves and our trading partners (FR, p. 316).

There are two points, not unrelated, worth noting in relation to the issue of compensation, particularly in respect of an emissions trading scheme. The first is that the report clearly recognizes the disproportionate impact of such a scheme on the lower end of the income scale and thus the need to devote funds from the sale of permits in the scheme towards compensation, via the tax and social security systems and indeed, conceivably via the provision of more climate friendly social infrastructure (e.g. new urban transport systems). The second point to note is that the compensation for trade exposed, emissions intensive industries is

relates in part very measurement of capital–intensity itself, and that no measure of capital is possible independently of relative prices and the real wage. The measurement of emissions intensity is somewhat less problematic, in that a physical unit of measurement, at least of emissions is possible. However that same debate in economic theory would nonetheless point to the inherent difficulty of being able to pinpoint a priori the changes in the relative price of emissions and the real wage required to achieve a reduction in the cost-minimizing emissions-intensity of production. Two significant theoretical papers in this regard are Metcalfe and Steedman, 1970 and Steedman, 1985.
clearly distinguished by the report from compensation for other losses of profitability generally as a result of mitigation policy. Presumably, these losses are those associated with rising costs in the production of non-tradeables or less trade-exposed industries and lower activity in these sectors resulting from lower economic activity generally. The position adopted in both the draft and final reports is clearly that the latter losses do not require compensation, either because they are part of a necessary and efficient process of structural adjustment; or because they are likely to be dissipated by other forms of adjustment (e.g. aggregate employment losses dissipated by real wage adjustment). One exception to this is the need for “preemptive structural adjustment assistance” in certain industries, e.g. coal.

A key question which arises, is whether this approach to compensation is likely to be sufficient; particularly, in view of the doubts expressed so far in relation to the efficacy of market processes?

4. Mitigation and policy

With regard to the economics of mitigation, as noted already, the report’s preference is clearly for market based measures as a means of ensuring compliance with the required cut in emissions and as a means of enabling “producers and consumers throughout the economy to determine the most effective response to meeting a mandated emissions limit” (FR, p.317).

There is an explicit rejection of the notion that government’s can “pick winners” and that such interventions “presuppose that government officials, academics or scientists have a better understanding of consumer preferences and technological opportunities than households and businesses. This is generally unlikely and cannot ever be guaranteed” (ibid).

Instead, according to the report, government intervention should be designed to fix market failures, although the report clearly recognizes a role in this regard for government encouragement (funding) of research and development in low emissions technologies and for investment in traditional areas of government responsibility consistent with climate-change priorities.

The presumption is clear nonetheless, that a market based process with well-defined property rights and driven by consumer preferences and profit-maximizing producers is the most “efficient” means of meeting the mandated emissions targets of governments. In this sense, rejecting the need for government to pick winners presumably means that governments should encourage research into climate friendly technologies but stop short of providing assistance to industries engaged in this process. The language of the report suggests that broad structural change in terms of relative growth and decline of low-emissions industries/processes and high-emissions industries/processes respectively should be primarily at the instigation of market processes.

For the present writer, such a view exhibits considerable unwarranted faith in the efficacy of the price mechanism, not so much to ensure consistency with mandated emissions targets, but rather as the lowest-cost means of achieving this. A broader definition of costs which would include shifts in the distribution of income and employment costs – and hence minus the intellectually indefensible belief in the ability of real wage flexibility to adapt labour demand to
labour supply – does not necessarily lead one to the view that the market is the lowest cost approach.

In particular, as noted above, if compensation to low income earners for higher costs of energy products and a fall in real household disposable income is linked to or limited by the rise in the price of permits under an emissions trading scheme, this would be adequate only if the fall in real household disposable income or fall in the real wage which causes it is equal to the percentage rise in prices of basic energy products. But if nominal wages growth is depressed by the inability of falling real wages to eradicate unemployment caused by structural change and reduced aggregate growth, then the overall decline in real wages and potentially in real household disposable income will exceed the percentage rise in energy prices. Compensation tied to the latter would be insufficient in this case.

But another sense in which one might doubt that the market represents the lowest-cost approach is in reliance on the changes in relative prices triggered by the emissions trading system in turn triggering increased demand for less emissions-intensive production process. The issue of costs is how much the prices of energy products will have to rise before there is a significant enough switch consistent with mandated emissions targets. How much will the price of energy products have to rise before the “backstop” low-emissions technologies arise?

The caution advanced earlier regarding the predictability of the direction of switches in production processes as relative prices of inputs change, including real wages, is pertinent here. If the complexity of this process is such that large increases in energy prices are required before there is a sizeable reduction in demand for inputs produced by emissions-intensive processes, the costs in terms of declining real household income, lower consumption demand and lower growth in output and employment are potentially greater. It is important to note here that what is being discussed here is not market failure. On the contrary, the issue here is how the market works when it is allowed to do so and whether, in that case, it can achieve the required structural adjustment – in terms of relative growth and decline of industries, as well as in terms of the appearance of some new and decline of some old methods of production – at an acceptable cost, in terms of distributional shifts against low income households and in terms of employment losses. A well-thought out policy of assistance by governments to speed up the process may be one way of minimizing these costs.

5. Conclusion

The discussion in this paper has sought to clarify the economics behind key aspects of the Garnaut Report and in doing so to highlight the problems raised in respect of some of the Report’s positions to the extent that one has problems with the economics.

Attention has been focused on what for the present writer are two of the most critical problems in this regard:

(i) the view of economic growth adopted by the Report and the implied view about the consequences of climate change and mitigation policy for employment growth and income distribution; and,
The belief in the ability of market processes, in particular, an emissions trading scheme, to reduce emissions consistent with mandated targets, at lowest cost and without significant distributional shifts against wage-earners.

The discussion has suggested that problems with the economic underpinnings in the Report with regard both of these issues raise the possibility that the losses from climate change and a mitigation policy heavily reliant on market based approaches have been underestimated. Alternatively put, the role for government in managing the economic impacts of adjustment to climate change may need to be much less about “fixing market failures” and much more about the recognizing the inadequacy of market “success”.

References


