Tradable Permits In Transport

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TRADABLE PERMITS IN TRANSPORT

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SPEAKING NOTES

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Despite popular interest in the contribution of transport to emissions of greenhouse gases, little comprehensive information has been published to date on the costs and effectiveness of the various abatement measures espoused.

This is particularly true of tradable (emissions) permits, where the literature has to date focused on the general principles, and on potential international arrangements.

However, the BTCE has produced a substantial amount of detailed sectoral information, and continues to be active in the field of applied economic research on greenhouse issues.

BTCE REPORT 94, *TRANSPORT AND GREENHOUSE: COSTS AND OPTIONS FOR REDUCING EMISSIONS*, AGPS, CANBERRA, 1996.

Following on from a series of detailed Working Papers, the BTCE released in 1996 a major Report on the costs of implementing various options for reducing greenhouse emissions in the transport sector. The Report is available at Government Bookshops.

BTCE Report 94 is probably unique. In contrast to most other studies, it did not estimate just the costs of implementing a specific abatement target. Using partial equilibrium analysis, the BTCE estimated the marginal costs of reducing emissions to a range of levels for 16 different measures. All greenhouse emissions, not just carbon dioxide, were included. Social costs, rather than private or just financial costs were estimated, because relevant non-greenhouse externalities were also taken into account.

The result is information which permits policy makers to assess the relative merits of the various abatement measures from a conceptually valid perspective, and to compare them to those in other sectors.

Major findings were that:

- planting trees is the only measure that can (eventually) absorb all of the carbon dioxide emissions (about 1600 million tonnes) that are projected to be produced by the transport sector between 1996 and 2015;

- significant reductions in all greenhouse gas emissions could also be achieved through imposition of carbon taxes (150Mt), using ethanol derived from wood (144Mt), accelerating the introduction of fuel saving technology for cars (101Mt), and urban road user charges (90Mt);

- 'no regrets measures (those that would generate net social benefits because total social costs are negative) include road user charges, reduced fares on urban public transport, city-wide parking charges for commuters, shifting some inter-capital freight from road to rail, a carbon tax on petrol, fuel efficiency labels on new cars, and fuel saving technology for commercial road vehicles. Combined implementation of these measures could reduce projected basecase cumulative transport emissions by 5 to 10 per cent by 2015; and

- if costs to Australia are to be minimised, the choice of abatement measures should be based on comparisons of the social costs of options in all sectors of the economy, not just those in the transport sector.

TRADABLE PERMITS

The BTCE has only recently begun to assess the potential implications for the transport sector of any future introduction of tradable permits to reduce Australian emissions of greenhouse gases. (In March 1998, the BTCE published Working Paper 37, *Tradable Permits in Transport?*, which provides a more detailed analysis than this paper, especially on carbon sinks and estimation of carbon credits.)

In the absence of specific proposals, either nationally or internationally, it is difficult to proceed much beyond generalisations and some speculation.

Article 16 bis of the 10 December 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change provides only the guidance that more guidance is needed:

> The Conference of the Parties shall define the relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability for emissions trading. The Parties included in Annex B may participate in emissions trading for the purposes of fulfilling domestic actions for the purpose of meeting quantified emission limitation and reduction commitments under that Article.

However, the Federal Minister for the Environment, Senator Robert Hill, is on record to the effect that:

> Australia supports emission trading in principle, recognising its possible contributions to improving the cost-effectiveness of emission reduction.' ('Australia's international Policy on Climate Change', address to the American Chamber of Commerce in Australia, ANA Hotel, Sydney, 9 July 1997.)

It is therefore timely to consider the potential implications for transport, as well as other sectors of the economy, of the possible introduction of tradable permits for greenhouse emissions.

For the purposes of discussion it has been assumed that a tradable permit scheme would:

- be national in scope. That is, would include all sectors of the economy, and allow permits to be freely traded between them;

- encompass both sources and sinks;

- ensure fungibility of permits, possibly by expressing them in carbon dioxide equivalents, and avoiding time limits on their use; and

- preclude the Government from regulating trading activity beyond initial allocation of new permits on an annual basis, monitoring, enforcement, and Open Market Operations designed to alter the number of permits held by the public.

THE TRANSPORT SECTOR IS DIFFERENT

There is no theoretical reason why tradable permits should not be capable of being applied to emissions from the transport sector. However, the transport sector is markedly different from other sectors where tradable permits have been used to date. It is therefore highly desirable to investigate the specific conditions involved.

- 'transport' is not homogeneous. There are five major competing modes, including road, rail, air, sea, and pipelines. The output of pollution is different for each, including greenhouse emissions. Four of the five can be further categorised into passenger and freight, so that the design of a tradable emissions permit scheme could differ for each, depending on the basis of allocation;

- compared to other externalities where tradable permits have been used to date, transport systems involve mobile, rather than fixed, sources of emissions;

- the transport sector is responsible for roughly 12 per cent of Australia's total greenhouse emissions, including all sinks and sources. As part of energy related sources alone, however, it accounts for about 25 per cent. Depending on whether a tradable permit scheme includes sinks or not, transport could be either relatively unimportant, or significant;

- although carbon dioxide forms about 85 per cent of the emissions from transport in general, other externalities are also generated. Noxious emissions, congestion effects, noise and accidents are produced in a way that is not independent of the production of carbon dioxide. Focusing on carbon content alone could result in socially sub-optimal results. For example, reductions in carbon emitted could involve noisier engines;

- probably more so than in the case of any other major greenhouse gas producing sector, pricing in the transport sector is not particularly close to optimal.

Although excise is levied on fuel, various selective rebates apply. Heavy vehicles attract road user charges that do not clearly reflect mass and distance travelled. The lack of a coherent, economically based charging policy mean that the marginal principle currently plays little part in setting taxes and charges borne by operators of vehicles (BTCE, 1997); and

- demand for petrol is highly inelastic.

Each of these points is important in assessing the potential effectiveness and practicality of a tradable permit scheme. They need to be taken into account when considering the major attributes of tradable permits.

THE TARGET POLLUTANT

Annex A of the Kyoto Protocol lists 6 Greenhouse gases that are to be counted as part of the abatement targets for each country. Permits traded either nationally or internationally would presumably be issued in denominations of carbon dioxide equivalent of the radiatively direct greenhouse gases listed in Annex A. Geographic considerations are not relevant because the gases involved are fully miscible in the atmosphere.

The gases listed in the Protocol do not include carbon monoxide (CO), which forms about 6 per cent of the total carbon dioxide equivalent emissions of passenger cars (BTCE, 1996, table III.4, p. 377). Not radiatively active, CO is nevertheless considered to be an indirect greenhouse gas because it eventually oxidises to CO_2, aids in the production of ozone, and scavenges hydroxyl radicals which would otherwise remove methane (a direct greenhouse gas) from the atmosphere. The sum of these effects would have a greater Global Warming Potential than CO_2.

Carbon monoxide (CO) is the result of incomplete combustion in internal combustion engines. If CO is not included in the gases targeted by a tradable permit scheme, there may be an incentive to avoid tuning cars to reduce noxious emissions as much as possible.

More importantly, CO is a noxious gas. In urban areas, up to 90 per cent of CO emissions are due to motor vehicles (BTCE, 1995, p. 137). Any increase in concentration in urban areas could add to adverse health effects, particularly circulatory and respiratory disorders.

Targeting directly radiative Greenhouse gases alone may also result in other perverse consequences. For example, catalytic converters reduce the output of noxious emissions such as CO and nitrogen oxides (NO and NO_2). Nitrogen dioxide (NO_2) is not only an ozone precursor but can cause lung damage, increased susceptibility to asthma, and damage to plants and buildings through acid rain. Three-way catalytic converters, which are now standard on Australian cars, reduce emissions of CO, NO_x and hydrocarbons. However, the use of catalytic converters can increase fuel consumption in cars. It is possible that motorists could thus be

encouraged unintentionally to disengage catalytic converters in order to reduce fuel consumption.

Transport vehicles produce three major indirect greenhouse gases: CO, non-methane hydrocarbons (sometimes called Volatile Organic Compounds), and NO_x. Uncertainty created by omission of such gases may also have an adverse effect on a tradable permit scheme. If purchasers of permits believe that other gases may be included in the future, and somehow dilute the value of the permits currently held, prices of current permits will be discounted to allow for the risk. Governments may be forced to reduce the number of permits available through Open Market Operations, thus increasing the Budgetary costs of the scheme.

THE TARGET POLLUTER

It is natural to think of a system of tradable emissions permits being directed at the users or producers of fuel. However, BIE (1992, p. 27) put forward two other possibilities, albeit in the context of pollutants from a non-Greenhouse perspective:

- motor vehicle manufacturers could be permitted to build any combination of polluting or non-polluting vehicles, subject to an overall permit quota of total emissions. Under this system, producers of gas guzzlers would need to purchase permits from producers of fuel-efficient cars; and

- a tradable permit system based on commuters' destinations. This strategy would work by defining the destination as the source of emissions, since it can be argued that a destination's output is dependent upon the number of commuters travelling to it. Destinations such as businesses, theme parks, or beaches would effectively be required to reduce visitors' vehicular emissions through strategies such as providing company buses, rationing parking spaces, imposing parking taxes, and so on.

These options are not pursued here on the principle that it is better to control the actual source of the pollution, rather than an indirect agent.

A major unresolved issue in international negotiations that is particularly relevant to Australia is the attribution of bunker fuel used by ships and aircraft on international routes. To ensure that all fuel use is accounted for, the IPCC recommends that countries should 'record separately [from domestic usage] the quantities of fuel uplifted' by international ships and aircraft (IPCC / OECD 1994, p. 1.11).

Fuel used by international transport would presumably be excluded from the ambit of any emissions trading scheme. However, the obvious distortion would occur, with trips to Bali or Singapore becoming relatively more attractive than those to Darwin or Perth. The consequence for total global emissions would not be positive.

ALLOCATION OF PERMITS

In theory, the initial assignment of permits will not affect economic efficiency. In practice, however, the situation is not that simple.

Allocating permits to individual motorists is attractive because it would provide each with a direct incentive to reduce fuel not only through choice of vehicle, patterns of travel behaviour (including mode choice), and residential location, but also through driving behaviour such as reduced acceleration. Electronic on-board emission monitoring devices could be used to measure actual emissions with a reasonably high degree of accuracy.

But the following disadvantages would probably outweigh any efficiency advantages of allocation of permits to individual users of transport:

- administrative, monitoring, and enforcement costs could be very high in the case of a large number of motorists, particularly if permits were auctioned separately for the transport sector;

- if permits were 'grandfathered' (issued free, approximately on the basis of past usage of fuel or kilometres travelled), special arrangements would need to be made for migrants (would migrants bring with them their emission quotas from their 'home' country?), new car owners, newborn babies, and tourists. Car ownership per head, for example, has grown about 1.5 to 2 per cent per annum in recent years; and

- some degree of equivalence would need to be established to facilitate exchange of permits between modes of transport. For example, how would a train passenger travelling from the Melbourne CBD to St Albans be allocated permits? And what if the train is only half full? The easiest method of overcoming this problem would seem to be to allocate permits to operators of vehicles. Train operators would be required to buy and sell permits, rather than individual travellers;

Allocation to fuel wholesalers, or producers, offers an alternative. Transactions costs would be lower. And the effect of rationing of fuel through the quotas established by a tradable permit scheme would be passed on to all vehicle operators in the form of higher prices.

Some commentators (eg Cornwell, Travis, and Gunasekera 1997, p. 19) warn that imperfect competition could result from allocation just to a few large participants. While this point may be valid for one sector alone, it is unlikely to hold as strongly for a national scheme.

Grubb (1990, pp. 101-103) makes an extremely important point about tradable permits for CO_2. Unlike the case of other pollutants such as lead or SO2 which form only a relatively minor component of relevant emissions, carbon cannot be removed

from the fuel. Control of carbon through tradable permits therefore effectively means rationing of fossil fuels.

Where there is no close substitute, demand for a fossil fuel is generally inelastic. (This is particularly true of petrol.) Any restriction in supply will increase price. If the initial allocation of permits is free and directed at wholesalers or producers of fuel, then large companies could reap significant windfall profits. If the Government sought to recover some of these windfall gains through taxation, the companies would pass on a large proportion of the taxes to individual buyers. Final prices of fuel would be higher than warranted solely under a tradable permit scheme.

If the initial allocation were not free, and permits were auctioned, then the price paid would presumably reflect the value to the buyer of any windfall gains. In this case, the Government would skim off the gains immediately and more fully. However, recycling of large revenues back to transport users through general Government expenditure and provision of services might not be optimal.

MARKET MECHANISMS

Once issued, permits should be available until used. Artificial time horizons would be likely to generate large movements in fuel prices at various times of the year. Time limits for using a permit would also be illogical, unless emissions today cause a different degree of Greenhouse 'damage' than emissions in the future.

Allocation of permits to individual motorists would have the advantage of helping to create a wide market. But allocation to individuals would necessitate small denominations of permits for the whole scheme, to allow individuals to trade amongst themselves or with large users. That is, major power stations would in theory need to be able to sell to, as well as buy from, individual motorists. In practice, middlemen would probable buy and sell small denominations in larger 'lots' or bundles. But in the absence of small denominations, prices would not be determined 'at the margin', resulting in a disjointed market and consequential loss in efficiency.

Of greater concern, however, is the potential for distortion where only one externality is addressed. In theory, externalities can be addressed through a Pigovian tax that reflects public costs at an optimal point of production. Tradable permits are set in theory at the same point.

However, the transport sector is unlikely to be close to a point of market optimality, because of the absence of road user charges based on economic principles. Ideally, a Pigovian tax (or tradable permit scheme) should be introduced only after the imposition of rational road user charges. It is not clear whether a tradable permit scheme without road user charges, or correction of other externalities such as noise and noxious emissions, will increase or decrease optimality. This is one area where more research would clearly be beneficial.

MONITORING AND ENFORCEMENT

In principle, the transport sector would not be likely to differ significantly from other sectors in requiring monitoring and enforcement to ensure that cheating did not occur.

Australian wholesale petrol prices are currently set at world parity on the basis of the Singapore spot price. A tradable permit scheme would effectively amount to rationing the quantity of petrol available, increasing the price above world parity. The resulting temptation to import or produce additional black market supplies would be strong.

Monitoring and enforcement could also be more expensive if tradable permits were issued to many mobile sources, rather than to a relatively small number of fuel wholesalers or producers.

SINKS

Inclusion of sinks in any tradable permit scheme raises issues such as estimating carbon sequestered over time, giving credits today for sequestration in the future, and the problem of allowing for fires (after a permit has been used) that may destroy a 'sink' plantation.

BTCE (1996, ch. 14) uses a 'steady state' approach to estimate the costs of absorbing CO_2 through tree planting. BTCE estimates are roughly that an average car produces about 4.3 tonnes of CO_2 annually. This annual level of emissions can be sequestered permanently by planting 7 fast growing trees such as Pinus radiata, and replanting them every time the trees are harvested.

The Stanley Foster Foundation in Gippsland (ph. (03) 5664 2397) has been the driving force behind the 'Greenfleet' scheme under which motorists pay $25 with their annual registration in return for the planting of 7 trees. The scheme was launched by the Premier of Victoria, Jeff Kennett, in 1997.

A similar scheme run by the supermarket chain Tesco in England involves small levies on petrol purchases. It has even been suggested by the scheme's officials that 'babies could be bought climate-care warranties by godparents. More could be bought on the child's 18th and 21st birthdays …'.!!! (Nuttall, 1998)

It is not clear, however, from an initial reading of Article 6 of the Kyoto Protocol whether such schemes, being voluntary rather than government initiated, would qualify as part of a country's reductions. It could be argued that they would have occurred anyway and are therefore not 'additional to any [reduction] that would otherwise occur'.

IS A CARBON TAX PREFERABLE FOR THE TRANSPORT SECTOR?

A valid question that arises naturally from the points made above is whether it would not be preferable to rely on a Pigovian (carbon) tax in the transport sector, rather than on tradable permits.

In theory, it should be possible to utilise taxes in one sector, with tradable permits in another. However, further consideration of the issues is highly desirable.

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