ECONOMIC ISSUES PERTINENT TO ENERGY POLICY:
A SCHEMATIC REVIEW OF MARKET AND NON-MARKET PERSPECTIVES

F.H. Gruen and A.L. Hillman *

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ABSTRACT

This paper seeks to provide a schematic review of the economic issues pertinent to a discussion of Australian energy policies and, in particular, those concerned with liquid fuels. It discusses the issues involved in producer and consumer pricing of oil; the pros and cons of old/new oil price distinctions and of resource rent taxes. Subsequent sections discuss depletion, substitutes, research, development and exploration, storage and international trade. A particular issue discussed throughout the paper concerns the effect on optimal policies if the likelihood of oil import disruptions is increased by greater dependence on oil imports. "Market" and "interventionist" philosophies are compared as each issue is discussed. These philosophies are broadly exemplified by two recent government internal documents - the Treasury Submission to the Senate Standing Committee on National Resources and the draft of an intended Green Paper on Energy Policy. The final section contrasts these two rival philosophies within the framework of a policy for liquid fuels.
INTRODUCTION

1. PRICING
   1.1. Static efficiency
   1.2. Dynamic pricing considerations
   1.3. Uncertainty about import supply
   1.4. The Treasury Submission and the Energy Policy Draft on pricing and market intervention

2. DEPLETION
   2.1. The fundamental market failure
   2.2. The social rate of discount and socially optimal depletion
   2.3. Foreign supply uncertainty and domestic depletion
   2.4. Post-disruption depletion
   2.5. Pre-disruption depletion
   2.6. Depletion when the stock is uncertain
   2.7. The Treasury Submission and the Energy Policy Draft on issues related to depletion

3. SUBSTITUTES
   3.1. The market mechanism
   3.2. Substitutes as not-necessarily utilized supply options
   3.3. Market structure and substitutes
   3.4. The Treasury Submission and the Energy Policy Draft on substitutes and the need for government intervention

4. RESEARCH AND DEVELOPMENT AND EXPLORATION
   4.1. Research and development
   4.2. Exploration
   4.3. Externalities and moral hazard
   4.4. The Treasury Submission and the Energy Policy Draft on research and development and exploration

5. STORAGE

6. INTERNATIONAL TRADE
   6.1. Comparative advantage and energy as an intermediate input into trade goods
   6.2. The Treasury Submission and the Energy Policy Draft on international trade

7. DEMAND-SIDE INTERVENTION
   7.1. World Parity - for producer or consumer prices
   7.2. Merit-wants and energy pricing
   7.3. The Energy Policy Draft on merit-wants

8. CONCLUDING REMARKS: THE ROLE OF THE MARKET
   8.1. Conflict between efficiency and equity objectives
   8.2. Economic philosophy and the role of the market mechanisms
   8.3. Political and economic costs of import disruption

FOOTNOTES

REFERENCES
INTRODUCTION

A distinguishing feature of the decade of the 1970's has been the prominence which has come to be assigned to energy as a factor of production or produced intermediate input. This prominence has led to a focus on the type of government intervention which might be associated with energy and hence to the identification of energy policy as a distinct component of a government's broad interventionist strategy. However, rather than being monolithic, as might be suggested by association with one particular factor market, the notion of energy policy encompasses a diverse range of issues. The purpose of this paper is to provide a schematic review of a particular set of these issues, with orientation towards those considerations pertinent in the Australian setting. Our categorization of issues is not comprehensive in that we shall not be concerned with macroeconomic implications of energy policy (effects on inflation, unemployment, the balance of payments) nor with the various technological aspects of research and development and interfuel substitution. The focus of the paper is on market efficiency and possible conflicts between efficiency and equity aspects of energy policy. Further, given the relative domestic abundance in Australia of energy sources other than crude oil, the paper is concerned with liquid fuel energy.

The format is to review what economic theory has to say about particular issues, and then to compare the views on the issues expressed in two recent internal government documents. The first document is the Treasury Submission to the Senate Standing Committee on National Resources (published as "Energy Markets - Some Principles of Pricing", Treasury Economic Paper No. 6, AGPS, 1979); the second is the final draft of an Intended Green Paper on Energy Policy, which was scheduled to have appeared at the end of March 1979, but was never published. However, the draft (along with previous drafts and pertinent departmental comments) became available to the press, and was the topic of a leading article (Malone, Australian Financial Review, September 10, 1979).
The Draft was quoted extensively, with the press comment focusing on the contrast between the pro-interventionist perspective adopted therein and the more market-oriented views emanating from the Treasury Submission. Since the Energy Policy Draft, although unpublished, has nevertheless been made public and its contents have been the subject of public discussion, the Draft is employed in conjunction with the Treasury Submission to provide counterfoils in the presentation of some of the opposing views taken on energy policy.

1. PRICING

The first issue we address concerns domestic pricing of crude oil. We abstract at this juncture from the effect of excise taxes levied on domestic consumption. The question is whether domestic production ought to be priced at the world price: that is, is world parity pricing of domestic production optimal?1

1.1 Static Efficiency

It is a basic proposition of economic theory that the attainment of allocative efficiency requires that prices reflect opportunity costs. In the context of a traded good such as crude oil, the implication is that domestic marginal cost (equal to price in a competitive market) ought to be equal to the price at which imports can be secured from abroad. Hence, for an economy confronting an exogenous world price, free trade is optimal. That is, world parity pricing merely implies free trade; the domestic market is unified via trade with the world market to achieve a uniform price for a (relatively) homogeneous commodity.

In the case of crude oil, the world price is set by a foreign cartel with the intent of raising cartel profits by appropriate exploitation of world market power.3 Consequently, for economies with their own stocks of crude oil, there has been a tendency for domestic governments to seek to
maintain the price to local consumers at 'reasonable' levels below this monopolistically exploitative world price.

Besides cushioning domestic consumers against OPEC, the intent of a policy of maintaining the domestic supply price below the world price also appears to be to avoid providing domestic producers with windfall gains on their unexploited reserves. In some cases these windfall gains could be expected to be very large; for instance, it can be estimated that BHP - Australia's largest company and its largest oil producer - would double or treble its income in 1980 were it to receive the full import parity price for its oil. Hence, below world parity pricing has a distributional basis.

However, there are evident efficiency losses from departing from prices which reflect opportunity costs. Although set for OPEC's gain, the world price is nevertheless the exogenous world price which Australia confronts in the international market for supplementing domestic production. Since this price reflects the domestic opportunity cost of production from local stocks, the allocatively-efficient domestic price is the world price, notwithstanding this price having been set from the optimal perspective of OPEC.

Moreover, domestic pricing has influences beyond static allocative efficiency. Also affected are exploration incentives, the development of substitutes, and the technical efficiency of utilization of existing oil pools. Incentives for exploration are reduced if anticipated new discoveries are priced below market value, as similarly are the incentives to seek out and develop alternative means of providing energy inputs. Given the increasing marginal cost of exploiting a given stock of crude-oil, providing producers with less than the market-price results in the wastage of reserves whose cost is less than the opportunity cost of securing alternative supplies via imports.
A compromise between the distributional effects of permitting the value of stocks to increase with the world price and the efficiency effects of not adopting world parity pricing is often sought in schemes which distinguish between 'old' and 'new' oil. The broad intent of such distinctions is that oil be priced at its value at the time of its discovery. In Australia, under the domestic crude oil pricing arrangements, oil discovered before 14 September 1975 is considered 'old', and subsequent discoveries 'new', and up to the 1977-78 Budget old oil was priced substantially below world parity. Subsequently, a crude oil levy was imposed, which was raised to "import parity levels" in the 1978-79 Budget.

A difficulty with schemes entailing such differentiation is that old and new oil are often not readily separable. In a given well, there may be reserves which it pays to extract at the 'old' oil price, and further reserves which it only pays to extract at 'new' oil prices. Indeed, in the absence of expensive and elaborate recovery techniques, 40 to 70 per cent of the oil contained in a given well is frequently left unexploited, and application of more sophisticated (and more expensive) recovery techniques sometimes permits up to half of the remaining reserves to be extracted. The quantitative importance of this consideration for some major Australian oil fields may not be very great, since the expected recovery rates are relatively high with simple, inexpensive techniques. Nevertheless, the IAC Report on Crude Oil Pricing estimated that additional recovery of some 400 million barrels from existing Australian wells was likely if prices were raised to (1976) import parity levels and, according to the Prime Minister's statement of 27 June 1979 on energy policy, the import parity policy has already led to an increase in recoverable reserves of some 600-700 million barrels - or about three years consumption.

The distinction between old and new oil may be further blurred if new discoveries are contiguous with old fields; then it becomes difficult to
ascertain where one field ends and the other begins - as is, for example, the case with the Fortescue field in Bass Strait.

World parity pricing is sometimes suggested in conjunction with a resource tax on extraction from existing stocks, the inference being that such a scheme permits the efficiency gains from world parity pricing to be captured while, at the same time, appropriating the windfall gains accruing to the holders of property rights over existing oil stocks.4 It has been acknowledged in a press statement by the Minister for National Development (29 June 1979) that a resource rent tax would be a more efficient interventionist device than the government's taxation policy, which is discriminatory with respect to the old-new oil distinction and also with respect to the size of the field. A resource rent tax would eliminate controversy about when a field is a 'new' field and about demarcation between fields. A resource rent tax would also do away with uncertainty induced by substantial and sudden changes in governmental crude oil levy charges.5 Ad hoc per unit levies are likely to lead to inefficiencies in extraction policies which a resource rent tax (yielding the same revenue) would avoid, since the resource tax makes any additional net revenue profitable (even though high marginal taxes are applied to exceptionally profitable investments).

There are, however, caveats associated with a resource rent tax which makes one doubt whether a resource tax on extraction from existing stocks could be set so as to extract no more and no less than the economic rent (i.e. to preserve complete neutrality in taxation). First, there is the difficulty granted by two proponents of the tax, Garnaut and Clunies Ross (1979), that such tax must set interest and discount rates at the 'correct' levels for each mineral project - that is, at the levels at which these rates would be set by investors in each project. Second, if a resource tax is applied ex ante, exploration expenditure is likely to be sub-optimal, even if development expenditure and actual current expenditures are not likely
to be depressed below optimal levels. But proponents of such a tax may be able to argue that subsidizing exploration expenditure is likely to be a cheaper way of restoring optimal levels of exploration expenditure than allowing mineral explorers the so-called resource rents.

One should grant the point that the adverse effects of resource taxes on static allocative efficiency are likely to be less than pricing oil below world parity or separating 'old' and 'new' oil for pricing purposes. As we have indicated, the last of these pricing formulae is likely to distort current expenditures so as to leave oil in the ground which it would pay to extract at current world parity.

1.2 Dynamic Pricing Considerations

In the case of a depletable resource the rents accruing over time to holders of the resource are the essential determinant of producers' supply decisions. As Harold Hotelling (1931) pointed out long ago, supply equilibrium for a depletable resource does not derive from aspects of flow equilibrium, but rather stock equilibrium.

Suppose that cost of extraction per unit of product were not to vary with the rate of extraction. If the holder of a depletable resource is to be induced to retain reserves for a given period, then the marginal gain from refraining from extraction of a marginal quantity of the resource must at least equal the marginal return from extraction. In a competitive capital market the return from extraction and investment of the proceeds is the market rate of discount. Hence, in dynamic equilibrium, the net unit value of unexploited quantities of the depletable resource must grow at the rate of interest. This means that one must expect the net price of a depletable resource such as crude oil to increase over time. The returns which such price increases yield to holders of stocks are economically justified as the reward for refraining from current extraction and monetization of the
depletable stock, and are an essential aspect of dynamic price equilibrium. If the resource extraction market is competitive, it is price which reflects the marginal gain from extraction and hence, in a competitive dynamic equilibrium, price increases at the rate of interest; in a monopolistic market profit maximization dictates that marginal revenue increases at the rate of interest.⁶

However, prices of depletable resources have not always followed such increasing dynamic paths. In particular, before the embargo by the Arab oil producers in 1973, it would appear that monopoly power was not being exercised in the world oil market, but oil prices did not follow the predicted competitive time-path. In the post-1973 period, with the OPEC cartel determining price, oil prices have, however, tended to increase over time (in real terms).⁷

Domestic Australian producers of crude oil do not have the discretion to adopt profit maximizing policies in accord with the rates of discount expressing their opportunity costs of alternative investments or subjective rate of time preference. Rather, assuming world parity pricing, they confront the dynamic time-path for prices set by OPEC. The implication from the theory is that a resource rent for domestic producers, as such exogenously determined by OPEC's pricing policy, should appear as a characteristic of an asset market equilibrium condition, where here the asset held consists of stocks of a depletable resource.

1.3 Uncertainty about Import Supply

We have until now assumed that import supplies to supplement domestic extraction are available with certainty. However, events in the international oil market in the 1970's have indicated that this assumption is not appropriate. More realistically, it would appear that importing countries cannot be assured of uninterrupted supplies in the world market. Does uncertainty
of supply in the world market justify departure from world parity pricing?

A point of departure for investigating this issue is the observation that, if there are no adjustment costs in production, and if the probability of trade disruption does not depend upon any of the discretionary variables in the economy which might be influenced by the domestic price, then world parity pricing remains optimal. That is, in these circumstances an embargo-threatened economy should enjoy the gains from trade while they last, and then, in the event of embargo, make the costless adjustments required by the cessation (or reduction) of imported supplies.

On the other hand, the presence of adjustment costs in production means that an economy confronts costs contingent on the occurrence of import disruption. Risk aversion suggests an outcome which goes part way in the direction of meeting the contingency of trade disruption and its associated costs. This provides a case for setting before competitive agents in the economy parametric prices which embody the adjustments to be made should trade disruption occur. Insofar as the adjustment costs are associated with the need to change the composition of domestic output, the theory of optimal policy indicates that the form of intervention aims directly at production, i.e. a producer tax or subsidy.

However, proponents of intervention would have to show that private agents were not themselves moving in the direction of socially optimal pre-disruption adjustment by internalizing the threat of disruption in their discretionary behaviour. A reason for intervention might be that government agencies and ministries have more accurate and updated information about the likelihood of trade disruption, and that the cost of transmitting this information to all the individual agents in the economy is high relative to the cost of administrative embodiment of the information in policy decisions.
It is quite conceivable that the likelihood of disruption of Australia's imports of crude oil is independent of the character of domestic production, consumption and trade, and derives solely from possible exogenous disturbances abroad. Still, there is nevertheless the possibility that the factors influencing the probability of disruption might be endogenous to the domestic economy. In particular, the likelihood of disruption of import supply might be expected to increase with the economy's dependence of foreign supplies of oil. In that event, the probability of trade disruption may be reduced by decreasing import dependence via a tariff (or quantitative restrictions) on crude oil imports. Since a tariff is a tax on imports, the volume of imports is reduced, thus reducing the likelihood of disruption. Notice that in these circumstances, one cannot look to private internalization of the threat of import disruption. Because of the public good nature of the gain from reducing the threat of disruption, there is a free-rider problem, with no one individual having an incentive to reduce consumption of imports.

Whether the likelihood of disruption of Australia's import supplies of crude oil is in this sense endogenous is an empirical question, the answer to which would appear to be outside the realm of economics per se.

If it were true that the probability of an embargo being threatened (or implemented) varies inversely with the potential damage that an embargo can do, this would seem to be the best of the various reasons put forward for increased Australian crude oil self-sufficiency. But note that it is not an argument for complete self-sufficiency (or autarky). Elimination of all imports certainly does away with potential damage from trade disruption, but also eliminates all the gains from engaging in international trade.
Finally, if indeed the threat of disruption of import supplies is endogenously determined with respect to import dependence, then setting the domestic price of oil below world parity has a cost additional to allocative inefficiency; for below world parity pricing in effect constitutes a trade subsidy, so increasing imports beyond the free-trade level, and hence increasing the likelihood that trade disruption will occur.

1.4 The Treasury Submission and the Energy Policy Draft on Pricing and Market Intervention

The Treasury Submission forcefully argues the case that world parity pricing is desirable, and that the market mechanism rather than governmental administrative decisions ought to be relied upon to allocate energy supplies:

For sources of energy which are traded internationally, for example, oil, natural gas and coal ... the price [ought] be equivalent to the world parity level. This will provide a return to producers for fuel consumed in Australia equivalent to that obtainable for the fuel on the international market ... producers will be encouraged to seek out and exploit all sources of energy which can be exploited as profitably as, or more profitably than, energy can be imported. Consumers will be encouraged to adopt the most economic pattern of energy use. (pp.9,10)

In the Energy Policy Discussion Paper Draft there is also acknowledgement of the efficiency properties of the market mechanism, and attendantly of world parity pricing:

The operation of market forces through the pricing mechanism will enable a rational choice to be made between energy and other wants, and thus will tend to bring about a desirable degree of conservation of energy. (p.71)

However, in contrast with the cogent commitment to the market found in the Treasury document, the Energy Policy Draft refers to 'tendencies' for market prices to reflect opportunity costs ("The operation of market forces would tend to result in energy prices being set at their 'opportunity..."
costs”, (p.71)). It is recommended that the information provided by
the market about opportunity costs be embodied in administrative pricing
decisions. The Draft takes note of the preponderance of intervention in
energy markets and suggests that:

As many energy prices in Australia are administered
by government instrumentalities, rather than the
result of the free interplay of commercial forces
within the private sector, it would be desirable in
terms of national energy objectives for the
instrumentalities concerned to take into account
opportunity costs when fixing prices. (p.71)

Although the Draft argues that administered price-setting ought to
encompass awareness of opportunity costs, caveats to the opportunity cost
principle are immediately thereafter emphasized:

In practice, in Australia there are many exceptions
to the application of this principle. (p.72)

One caveat relates to the desire to restrict the rents accruing to
domestic producers, in particular when domestic production is the
consequence of foreign investment. In this regard the Draft reports that
the Australian Government has considered implementing a resource rent
tax, but decided against such a tax because of "the possible adverse
effect of such a tax on exploration and development decisions and on
investor confidence" (p.84). Other caveats to the opportunity cost
principle (or world parity pricing) relate to international trade,
demand-side intervention, and distributive implications for domestic
consumers. We address these issues in Sections 6, 7 and 8
respectively.

We do not intend to imply a contrast wherein the Treasury Submission
is devoid of arguments for interference with the market mechanism. However,
In identifying circumstances where intervention might be warranted, the Treasury Submission focuses less on distributive issues, and is more circumspect about the cost of government interference:

Government measures can be employed to supplement the operation of the market mechanism in encouraging conservation and more efficient use of petroleum fuels, the switch away from those fuels, the search for and development of new indigenous sources of petroleum, and research into and development of alternative energy forms. When measures are proposed to meet these objectives, it is necessary to consider in what respects the results of the operation of the market mechanism are inadequate, where the benefits of intervention by the government will outweigh the costs, and the most appropriate form of assistance to achieve a chosen objective. (pp.36, 37)

The possible grounds for intervention mentioned here by the Treasury Submission are considered in Sections 3 and 4, which deal respectively with substitutes, and research and development and exploration.

2. DEPLETION

Australia is endowed with its own domestic stocks of crude oil. Hence the question arises as to the rate at which those indigenous stocks ought to be depleted. Depletion is very closely related to the issue of pricing. However, there are a number of considerations which lead to a focus on depletion as a distinct issue.

2.1 The Fundamental Market Failure

There is a fundamental market failure bearing upon depletion of a stock of an exhaustible resource such as crude oil. Since the stock is exhaustible, any consumption by a current generation detracts from the amount available for future generations. Intertemporal Pareto-efficient allocation of the depletable stock could theoretically be established between the current and future generations; but, of course, the trades
necessary cannot take place because future generations do not currently exist. Consequently, one might argue that the role of government is to institute policies which look beyond the myopic interests of the current generation. Because of the government’s responsibility for future generations, is there a case for intervention to influence the depletion undertaken by private firms?

2.2 The Social Rate of Discount and Socially Optimal Depletion

The social rate of discount reflects society’s time preference. In the particular case of an exhaustible resource, time preference determines the socially optimal depletion program for the resource. Socially optimal depletion requires that the price of the resource rise over time at the social rate of discount, with price at each point in time determining instantaneous demand and therefore the rate of depletion.

Subject to some qualifications, the extraction program resulting from competitive firms’ profit-maximizing decisions is known to be socially optimal.\(^{10}\) A most important qualification is that firms’ rate of interest, reflecting their available return on alternative investment, equal the social rate of discount. We shall not enter into a discussion of how the social rate of discount ought to be computed. Rather, we observe that the social rate of discount might intrinsically be expected to differ from the rate of interest confronting domestic firms. This is so because the market rate of interest will generally encompass allowance for risk which, from the economy-wide viewpoint of social risk-pooling, is not a pertinent component of the social discount rate.\(^{11}\) Another reason for discrepancy between the social and market rate of interest is the presence of taxes: firms are concerned with post-tax returns, whereas society is concerned with pre-tax returns. Were one to assign credence to Frank Ramsey’s (1928) argument that the social rate of discount ought to be zero, then any positive market
rate of interest certainly exceeds the social rate.

However, as interesting in themselves as propositions concerning the optimality of competitive depletion of an exhaustible resource might be, the structure of the oil market does not suggest that these propositions are all that pertinent. Domestic Australian supply is essentially in the hands of a single producer, Esso-BHP, and foreign supply is governed by the price and quantity dictates of the international oil cartel, OPEC.

Yet, although domestic competition may be limited, local producers are nevertheless compelled to behave competitively insofar as they confront the exogenous world price set by OPEC. That is (assuming now world parity pricing), domestic firms respond in their depletion decisions to OPEC pricing policy. Hence, abstracting from extraction costs, if the rate of interest expressing domestic firms' opportunity cost were to exceed OPEC's rate of price increase, then firms would be expected to seek to refrain from depletion altogether if their own rate of interest were less than OPEC's rate of price increase. Conversely, the theory suggests that domestic firms would be expected to refrain from depletion altogether if their own rate of interest were less than OPEC's rate of price increase. Other influences, of course, mitigate against such extreme depletion equilibria. For example, tendencies for immediate total depletion are countered by increasing marginal costs of extraction at each point in time.\textsuperscript{12} Anticipated reactions of governments (Federal and State) would also tend to mitigate against the adoption of extreme depletion policies. Nevertheless, the relation between domestic firms' alternative rate of return and OPEC's rate of price increase must be expected to impart a particular direction of intertemporal bias to domestic depletion decisions. Conversely one could expect such intertemporal bias to be absent, only if OPEC's pricing policy yielded domestic producers' capital gains on unextracted reserves equal at the margin to the alternative return
2.3 Foreign Supply Uncertainty and Domestic Depletion

Let us now set aside the issue of intertemporal depletion bias emanating from differences between the domestic producer's rate of interest and the OPEC rate of price increase, and focus rather on a fundamental asymmetry in the nature of domestic and foreign supply. Whereas (known) domestic supplies are available for domestic consumption with certainty, foreign supplies are subject to the possibility of disruption and hence are not available with certainty. Given uncertainty about import supplies, one may enquire into the nature of the socially optimal rate of depletion of the domestic stock. Having identified the socially optimal depletion program for the domestic stock of the exhaustible resource, one may ask whether it is plausible that a single domestic producer would adopt the socially optimal depletion program.  

The economy confronts two possible states of the world: (i) continued import supply with uncertainty about future import availability, and (ii) disruption of import supply. So we require reference to the two distinct settings.

2.4 Post-Disruption Depletion

Consider first a state of the world in which trade disruption (which was anticipated) has already occurred. Suppose that disruption is complete. No import supplies at all are available, so the equilibrium is autarkic (at least with respect to oil). The predominant domestic producer who, before trade disruption, confronted import competition at an exogenous world price is now, for all practical purposes, a domestic monopolist. Suppose that price can be set to maximize profits without any government intervention. Further, suppose that the social and private rates of discount coincide so that competitive depletion is socially optimal.

In this situation there is little that in general terms can be said
about the direction of deviation of the monopolistic profit-maximizing depletion program from the competitive socially optimal program. Even abstracting from considerations raised by possible different extraction costs, the nature of domestic demand determines whether the monopolist's extraction policy is overly conservationist or overly extravagant relative to socially optimal depletion. In one special case where domestic demand has a constant price elasticity (and demand is elastic), the monopolistic and socially optimal competitive depletion paths coincide. If demand is becoming more elastic over time, the monopolist over-conserves relative to socially optimal depletion. Conversely, if demand is becoming less elastic, the monopolist under-conserves. Hence, in an autarkic post-disruption equilibrium, a decision as to intervention necessitated by a domestic monopolistic market structure requires awareness of the characteristics of the domestic demand function.¹⁴

Nevertheless, although there is this general ambiguity in the relation between monopolistic and socially optimal depletion, one finds the presumption in discussions in the literature that a monopolist will be overly conservationist in depleting an economy's exhaustible resource stock. A basic reason is the empirical inference that, due to the appearance of substitutes over time, demand can be expected to become more elastic over time.¹⁵

Finally, we have abstracted from possible government responses. Would a domestic firm finding itself a monopolist after foreign supplies have been cut off in practice attempt to follow a profit-maximizing course? Such behaviour is likely to invite additional taxation (for example, a super crude oil levy) or price control and/or rationing by government.

2.5 Pre-Disruption Depletion

Now consider a situation wherein trade disruption is anticipated, but
has not occurred. A single domestic producer then behaves competitively in
the sense of being confronted with the parametric world price. Nevertheless,
the domestic firm anticipates monopoly power in the event of trade disruption,
and such anticipation of monopoly power may be expected to influence the
firm's depletion program in the pre-disruption period. Indeed, anticipation
of monopoly power in itself affects depletion (independently of whether
during the course of exhaustion of the domestic resource stock disruption
actually occurs). It may be shown in particular that for the constant-
elasticity demand case - where otherwise monopolistic and socially optimal
depletion programs are identical - the anticipation of future monopoly power
by the single domestic producer gives rise to a tendency for over-extraction
of the domestic stock of the depletable resource. This result presumes
that: (i) the domestic firm employs the social rate of discount, and
(ii) the subjective probability of the likelihood of trade disruption under-
lying the domestic firm's depletion decisions over time is the same as that
which a policy-maker would employ in determining the socially optimal
depletion path.16

Hence, the presumption is that a single domestic producer anticipating
future monopoly power will be overly extravagant in running down the
economy's stock. However, once again, a definitive policy implication
requires awareness of the nature of domestic demand. For example, if
domestic demand is such that the price elasticity is increasing over time,
then this tendency towards over-extraction will be countered by that aspect
of monopolistic profit maximizing strategy which, in the standard autarkic
equilibrium, leads to overly conservative extraction.

Although currently a single firm produces most of Australia's crude oil,
it is possible that future discoveries will lead to the existence of a
number of competitive producers. Competitive firms employing the social rate
of discount and correctly anticipating the likelihood of disruption of
import supplies can be shown to adopt profit maximizing depletion programs which are socially optimal. Accordingly, if the domestic market structure in the crude oil extractive industry were competitive, and if firms did indeed have correct expectations (and used the social rate of discount), no market failure would occur. On the other hand, should domestic competitive firms fail to embody in their depletion decisions the likelihood of disruption of import supplies, more than socially optimal quantities would be extracted from the domestic stock. So ascertaining whether policy intervention is required once more reverts to establishing whether appropriate internalization of the threat of trade disruption takes place.

2.6 Depletion when the Domestic Stock is Uncertain

Thus far in our discussion we have assumed that the size of the economy's stock of crude oil is known with certainty. There has been some investigation of how firms engaged in resource extraction react to uncertainty about the size of the depletable stock of the resource. In the presence of such uncertainty, firms must form expectations about the size of their own stocks, and also the stocks of their competitors. In a competitive market setting, uncertainty about the size of the stock leads firms to take into account the possibility that they will be the last ones with a remaining stock, and hence that they will eventually be monopolists. In this case, it has been shown that, for constant elasticity demand, monopoly is optimal but competition is not.

2.7 The Treasury Submission and the Energy Policy Draft on Issues Related to Depletion

In neither the Treasury Submission nor the Energy Policy Draft is there explicit reference to the relation linking anticipated trade disruption, market structure in the domestic extractive industry, and the course of depletion of the exhaustible domestic stock. As a pertinent observation,
however, the Treasury Submission notes the basic element of uncertainty in reliance on the world market for uninterrupted supply of crude oil:

Because there can be no guarantees against future interruption to supplies ... uncertainty appears likely to be a continuing feature of world oil markets. (p.55)

Need for government involvement is seen as a possible implication of this uncertainty, and maximal self-sufficiency is suggested as a means of minimizing the effect of possible trade disruption on domestic consumption:

... the control by OPEC of a high proportion of the world's oil production increases uncertainty about supplies and reinforces the need for government involvement. In the Australian context, this implies a desire to maximize self-sufficiency in energy supplies so as to minimize our vulnerability to OPEC manipulation of oil supplies and oil prices. (p.38)

As observed in the section on pricing, in the presence of adjustment costs, there is a case for restricting trade if the likelihood of disruption of import supplies is increased by import dependence. But autarky could never be optimal since then not only is the threat of trade disruption eliminated, but so also are the gains from trade. When the domestically supplied substitute for imports further consists of quantities of a depletable resource, such recourse to current import replacement has the effect of increasing future vulnerability to trade disruption. The domestic stock is depleted and, insofar as domestic supplies are forthcoming at increasing costs, current usage raises the future domestic supply price. Hence, as noted by Cox and Wright (1975):

... more self-sufficiency in energy would give rise to a paradox: pursuing independence through self-sufficiency today would mean greater dependence on foreign energy tomorrow ... In general, any policy which restricts present imports and, through the resulting higher price of oil, induces an increase in present domestic oil output will impair future energy independence. (p.31)

The Energy Policy Draft devotes considerable attention to the topic
of conservation. It proposes that:

Energy conservation [is] capable of making a major contribution to levels of self-sufficiency in energy supplies ... (p.61)

Here, 'energy conservation' appears to refer to reduced domestic consumption; this would have a spillover in reducing imports (and accordingly promoting self-sufficiency). Yet, of course, insofar as a policy of seeking self-sufficiency entails reliance on domestic depletion, such a policy is anti-conservationist.

Because of the implications for domestic depletion, unqualified self-sufficiency in itself does not appear an appropriate goal. The optimal domestic depletion path for an economy's own exhaustible resource stock (and hence the optimal conservationist policy) derives from trading-off the gain derived from exploitation of limited domestic stocks against the gain from substituting foreign supplies which are currently available, but may not be forthcoming in the future. Generally, one would expect it to be non-optimal to refrain completely from utilizing domestic stocks when imports are available; likewise, one would also expect the second extreme solution of utilizing only the domestic stock and refraining from consumption of imports also to be non-optimal.

3. \textbf{Substitutes}

In this section we consider the basis for government intervention with respect to the introduction of substitutes for a depletable resource such as crude oil.

3.1 \textit{The Market Mechanism}

The market mechanism in itself can be expected to provide for efficient introduction of substitutes for a depletable resource. The theory of extractable resources suggests that least-cost substitute resources will be
exploited and exhausted consecutively. The availability of a substitute, or back-up technology, for a particular depletable resource is a prominent element in the determination of the optimal depletion program for the resource. The nature of the socially optimal dynamic equilibrium is that the scarcity rents for a given resource cannot rise over time beyond a level which causes the replacement of the resource by a substitute waiting in the wings. The original depletable resource rises in price over time until a final equilibrium is attained wherein price has risen to choke off demand for the resource and, at the same time with no further incentive (given the interest rate) to withhold the resource, supply declines to zero. During the process the back-up technology enters, providing a substitute for the depletable resource. In this scenario, the market mechanism ensures that least-cost alternatives are utilized first, and hence is efficient.19

Importantly, however, optimal depletion of the domestic stock of a depletable resource such as crude oil requires knowledge of the nature of substitutes, and at what stages back-up technologies can be expected to provide competitive output. Consequently, an essential role for government is to assure that such information is available to domestic firms engaged in domestic resource depletion, and to consumers undertaking investments in capital equipment specific to particular energy input forms (for example, domestic heating installations).

3.2 Substitutes as Not-Necessarily Utilized Supply Options

Given the possibility of trade disruption and gains from access to alternative means of meeting domestic demand, there is a benefit from having available substitutes which may not be needed. Such substitutes are more costly than foreign import supplies, and would only be exploited in the event of trade disruption. Private agents may invest in the provision of such substitutes on the basis of anticipations of trade disruption. However,
it may be that the private sector's evaluation of trade disruption is inappropriate, or that private capital markets fail to accommodate the sort of long-run risky investment implied in the provision of substitutes which remain unutilized until disruption of imports occurs.

On the other hand, insofar as the cost of introducing substitutes exceeds the supply price of the domestic stock of crude oil, then even in the event of import disruption, substitutes would not be called forth by market forces until the domestic crude oil stock is depleted. So, as long as domestic stocks of crude oil remain, the urgency of development of substitutes is reduced.20

3.3 Market Structure and Substitutes

In evaluating the need for intervention with respect to substitutes, one also has to consider the implications of market structure. For it would appear to matter whether possible substitutes are to be supplied by firms which are competitive with respect to the dominant domestic Australian producer of crude oil, or whether that producer is the source of the substitutes. In an autarkic setting, it has been shown that, if a monopolist controls resource extraction and substitutes are to be supplied competitively, the monopolist's initial price is higher and initial extraction is lower than when the monopolist controls both resource extraction and the timing of the introduction of future substitutes.21 Further, when the declining size of the remaining stock provides the incentive to introduce competitive substitutes, it has been shown that the prospect of such substitutes leads a monopolist to be more conservationist than he would otherwise be, and also, ceteris paribus, to be more conservationist in his depletion program than competitive firms.22 Substitutes also influence a monopolist's depletion program via the effect on projected future demand elasticities: by resulting in more elastic future demand, substitutes give rise to profit-maximizing
depletion programs which are conservationist relative to socially optimal depletion paths.\textsuperscript{23}

It should be noted, however, that since these various results on monopoly and substitutes have been established under the assumption of autarky, the pertinence of any policy implications in the Australian setting is not immediately obvious. For, as we have proposed, the Australian setting is described by a single domestic producer whose monopoly power is only anticipated, and will be manifested only in the event of trade disruption.

3.4 The Treasury Submission and the Energy Policy Draft on Substitutes and the Need for Government Intervention

The Treasury Submission and the Energy Policy Draft offer different perspectives on the role of the market in facilitating the introduction of substitutes. The former places prime emphasis on the efficiency of market forces:

\begin{quote}
The price mechanism signals to businessmen the amount that should be given to the search for development, and use of various sources of energy, and will thus inevitably be the prime determinant of the timing of commercial development of alternative technologies and previously uneconomic reserves of energy sources. (p.8)
\end{quote}

The approach in the Energy Policy Draft is to identify a number of basic issues associated with the introduction of substitutes (the availability of new technologies and associated inputs; the structural difficulties in adjusting to substitutes; and 'appropriate timing of the introduction of new sources of fuel supplies'). However, rather than noting the role which the market might play in achieving efficient outcomes with respect to these matters, the Draft expresses concern about:

\begin{quote}
possible imperfections in the market systems' ability to provide alternative fuel supplies within the time-frame which accords with the national interest. (p.34)
\end{quote}

What constitutes 'the national interest' is left unspecified.
4. RESEARCH AND DEVELOPMENT, AND EXPLORATION

4.1 Research and Development

The considerations underlying whether governments should intervene in fostering research and development (R & D) are quite general rather than specific to energy policy and have been the subject of wide discussion. Two prominent aspects of the nature of R & D investment introduce a role for governments.

Firstly, investment in R & D is a risky undertaking. Should governments generally subsidize risky investments? While there may be uncertainty with respect to any particular R & D venture, from an economy-wide viewpoint which encompasses all R & D ventures, uncertainty is dissipated by risk-pooling. It has been argued that the government is a partner in each risky venture via the taxation system, and to the extent of the government (or social) interest, it is the social rate of discount that ought to be employed in establishing the optimal scope of investment.24

The second consideration concerns the public good nature of knowledge. In the absence of a patent system, investors in R & D ventures cannot be assured of appropriating the returns from their investments. However, a patent system has the undesirable consequence of bestowing (temporary) monopoly rights, and hence inhibits the broad application of knowledge. Consequently, rather than provide a legalized exclusionary device in the form of a patent, it may be preferable for the government to undertake or subsidize investments in knowledge, and then subsequently permit knowledge to be applied at the marginal cost of dissemination.

Given the public good nature of knowledge, it is sometimes suggested that Australians forgo investment in R & D, and rely on the products of foreign R & D ventures. However, the international patent system precludes adoption of foreign developments at will, and at the same time provides a
means of appropriating the benefits of successful Australian R & D ventures. Moreover, reliance on foreign R & D may entail the domestic application of technologies which are less appropriate for domestic conditions. For example, the scope of Australian potential for exploitation of solar energy is not generally matched by the climatic conditions of other Western economies.

4.2 Exploration

Since exploration is a risky investment, one justification for government intervention derives from the general case for risky ventures, and relates to risk-pooling and implicit government involvement via the taxation system. These considerations are essentially the same as those applying to research and development. However, the knowledge yielded by successful R & D ventures has a public good character, whilst the outcome of successful exploration ventures yields a marketable product, with returns readily appropriable by the holders of property rights over the newly-discovered resource.

4.3 Externalities and Moral Hazard

The outcomes of both research and development and exploration ventures yield social externalities because of the uncertainty associated with import supplies of crude oil. When successful, these ventures add to the domestic stocks of energy which would be available to sustain domestic consumption in the event of disruption in the world oil market. If the likelihood of trade disruption is further dependent on the degree of vulnerability of the domestic economy, then successful R & D and exploration ventures provide the domestic economy with an additional element of security. As such, there is consequently a case for adding an additional (expected) social benefit to the privately perceived gains from R & D and exploration ventures. This then provides a further ground for government subsidization of these ventures.
On the other hand, mitigating against government subsidization of R & D and exploration ventures is the moral hazard problem implicit in these activities. In both cases realization of benefits depends on effort and intent, but is also subject to uncertainty. The difficulty is that the productivity of effort and intent are particularly hard to monitor independently of the results achieved.

4.4 The Treasury Submission and the Energy Policy Draft on Research and Development and Exploration

The Energy Policy Draft proposed that there were "compelling reasons for Government involvement with energy research and development" (p.55). These reasons were: (1) the need to assure that resources allocated to research and development were directed towards ends compatible with "the objectives and priorities of energy policy"; and (ii) in the light of the national research and development strategy, the need "for Government to ensure that the strategy is implemented in a co-ordinated and collaborative manner" (p.55). There is here a presumption that centralized decision-making rather than decentralized market forces ought to underly the allocation of resources to research and development, and there is symmetrically an absence of acknowledgement of the effectiveness of the market mechanism in providing incentives for private agents to engage in research and development.

Further, in proposing a pervasive role for government, the Draft makes no allowance for possible costs of intervention.

In contrast, the Treasury Submission emphasizes the efficiency of the market mechanism in directing resources towards investment in research and development, and exploration. World parity pricing is in itself proposed as a basic stimulus in this regard. The Submission notes that the government provides incentives for private agents engaging in exploration by offering various taxation concessions, and offers the option that "the
capital write-off provisions available for miners are now very generous" (p.46). It is noted that these concessions are not costless, but rather result in higher taxation for the community at large or a greater budget deficit:

Additional petroleum or other energy supplies obtained as a result of concessions (if those supplies are, as they should be, priced to Australian consumers at import parity prices) will actually cost the nation somewhat more than import parity, when the cost of the concessions is taken into account. (p.49)

So the implication is that a social benefit must be specified to warrant government taxation concessions for research and development, and exploration. In this case it might be increased security from trade disruption.

While stressing the effectiveness of market forces, the Treasury Submission points to three areas where nevertheless there is suggestively a role for direct government involvement in research and development:

(i) basic research, where "the fundamental scientific relationships underlying energy using technologies may not yield immediate commercial benefits and so may not be undertaken on a sufficient scale by private enterprise" (p.59); (ii) where there are public services involved; and (iii) in instances where applied research and development may be under-provided by the private sector because the patent system does not provide sufficient protection to permit private appropriation of the returns from investment. However, the Submission concludes that:

... in the final analysis, the most important way in which government can ensure the effectiveness of energy R & D in both the public and private sectors is by maintaining appropriate general economic conditions and facilitating the pricing of energy at levels that fully reflect the costs of alternatives. (p.34)
5. **STORAGE**

Short-term disruptions in supply can be met by having on hand inventories of crude oil. Or, paralleling the effects of storage, a country such as Australia with its own domestic stock of crude oil might invest in extra extractive capacity to be utilized in the event of disruption.\textsuperscript{25}

Since the motive for storage is anticipation of disruption of foreign supplies, one might ask whether private individuals might not, on the basis of their own expectations, themselves undertake storage as an investment option. There is indeed a good deal of evidence that some consumers who are physically able to store oil products safely have very substantially increased their storage. Thus farmers are storing record quantities of diesel oil and petrol to safeguard against supply disruptions - especially at harvest time. The sole Australian manufacturer of drums and oil storage tanks in 1979 was working to capacity, and was not able to meet the demand for his products.

Due to economies of scale in storage capacity, one might further expect specialized firms to engage in storage activities rather than individual consumers. However, permitting private speculation to establish storage capacity will only be effective if speculators believe that they will be rewarded for their intertemporal arbitrage by prices reflecting future scarcities. Should speculators believe that the domestic market will be controlled in the event of trade disruption so as to preclude a free market equilibrium (as, for example, by rationing at the post-disruption price), then expected gains from intertemporal arbitrage via storage are pre-empted, and investment in private storage will be discouraged.

A further consideration affecting storage stems from oligopolistic influences in the oil market. If some local firms increase storage, international oil companies may respond by storing less domestically than they
were previously inclined to do. The Energy Policy Draft observes that:

... in the case of supply disruptions generally, the international oil companies in practice allocate available supplies among consuming countries on some defined basis (either agreed to by governments or not) which may in fact take into account the existence of stockpiles in certain countries. (p.48)

The fact of domestic production, on the other hand, mitigates against the need for storage. It is perhaps significant that (as indicated by Folie and Ulph, 1979, p.111) storage as a percentage of annual Australian domestic oil consumption declined from respective levels of 41 and 44 per cent in 1960-61 and 1962-63, to 30 per cent in both 1974-75 and 1975-76. During the same period the subjective probability of disruption of import supplies must certainly be expected to have increased so, ceteris paribus, providing a greater incentive for storage. However, suggestively, during the same period the appearance of local crude oil on the domestic market reduced import dependence, and hence reduced the adjustments necessary in the event of an embargo.

6. INTERNATIONAL TRADE

6.1 Comparative Advantage and Energy as an Input

into Trade Goods

Oil, in addition to being traded directly, is also traded indirectly via the factor content of those goods into which it enters as an input. While there are a number of theories of the determination of comparative advantage in international trade, the prominent general equilibrium framework is that provided by the Heckscher-Ohlin model. This offers the prediction (subject to a number of necessary conditions) that comparative advantage will be a reflection of an economy’s factor endowments. With energy identified as a factor of production, the Heckscher-Ohlin theor
would in particular predict that an economy relatively abundantly endowed with energy would have a comparative advantage in goods which are relatively energy intensive in production.

There have been no empirical studies of the relative energy intensity of Australian exports and imports. However, the Treasury Submission proposes that Australia's international trade would reflect a comparative advantage in energy-intensive output:

Australia's relatively abundant reserves of a number of energy forms ... confer on it a natural competitive advantage, relative to energy-scarce countries, in relation to energy-intensive activities. (p.12)

Although Australia may be relatively abundantly endowed with energy sources, crude oil in particular is nevertheless imported rather than exported. If, at the same time that input is exported indirectly via the factor content of international trade, then pricing below world parity implies a loss via factor trade. Moreover, there are no apparent offsetting advantages which domestic subsidization yields (i.e. from the perspective of international trade). On the contrary, by distorting domestic factor prices, pricing below world parity leads to inefficient allocation of the economy's resources. Accordingly, there appears to be no sound basis for arguments to the effect that world parity pricing of energy will, via the implications for usage of energy as a productive input, compromise Australia's comparative advantage.

6.2 The Treasury Submission and the Energy Policy Draft on International Trade

The Treasury Submission dismissed the case for intervention to influence the pattern of Australia's international trade:

Any arrangements seeking to set domestic prices at below parity levels simply confer an unnecessary subsidy on energy users and their customers and induce them to make economically inefficient decisions about consumption of and investment in energy-using products and processes. (p.12)
In contrast, in the Energy Policy Discussion Paper Draft it was proposed that "a relevant consideration" in evaluating the argument that 'cheap' energy is desirable to attract industry, particularly energy intensive industry, to Australia is "whether any comparative advantage which Australia may possess in respect of a particular industry rests on the availability of 'cheap' energy or whether it would exist without it" (pp.73,74). The inference is that energy ought to be subsidized to a particular industry if 'cheap' energy is necessary for the industry to exhibit a comparative advantage in international trade. This reflects a misunderstanding of the meaning of comparative advantage and of the nature of the gains from international trade. Comparative advantage stems from the interplay among an industry's technology, the economy's relative factor endowments, domestic demand conditions, and the world price of the industry's output. The gains from trade derive from international exchange according to comparative advantage - determined without consideration of the effect of input subsidies on domestic prices.

7. **DEMAND-SIDE INTERVENTION**

7.1 **World Parity - for Producer or Consumer Prices**

In the discussion of pricing in Section 1, and in the subsequent sections up to now, the primary focus has been on producer prices. However, independently of the level of producer prices, in Australia - as in Western economies generally - sizeable excise taxes separate producer and consumer petroleum and oil prices. One may be led to ask whether there is a case for retaining high excise taxes when OPSC is setting high monopolistic supply prices or when, for example, there is already a substantial increase in domestic consumer prices as a consequence of a move to world parity pricing.
Although the Treasury paper argues the general case for energy resources being priced at levels equivalent to world parity, on the issue of excise duty it contents itself with two comparisons. Firstly, excise taxes on petrol are shown to be a lower proportion of the retail price than in the major OECD countries (with the conspicuous exception of the USA). Secondly, excise taxes have become a smaller proportion of the retail price in Australia since 1974 and, as a proportion of the consumer price index, excise taxes were (in June 1979) only two-thirds as high as in 1972 to 1974. However, the issues pertinent to the levying of excise taxes on petroleum have been well summarized in another document, the Preliminary Report of the (Asprey) Taxation Review Committee, which made the following observations:

There is an overwhelming case in principle for the taxation of motoring, whether by levies on petrol or on vehicles or by registration fees or some combination of all three, on the grounds of charging for the use of roads (a most expensive publicly-provided facility), for their policing, for limiting congestion and accidents (which cost the community great sums), and as an anti-pollution measure. But the form and the scale of such taxation must be considered in relation to its adequacy and its efficiency for these specific ends, and not simply as a matter of revenue-raising ... The Committee ... recommends that decisions involving any great change in existing revenue from motoring should be made in the light of ... special studies (directed towards these issues). (para.12.15, p.132)

Still, consumption taxes may be motivated by considerations other than the costs which motorists impose on the community. Paralleling the discussion of adjustment costs in production (in Section 1), one can consider adjustment costs in consumption as a consequence of trade disruption. Again, the important question for policy purposes is whether consumers internalize the threat of trade disruption in their personal discretionary behaviour. If internalization does not take place, then as with production, adjustment costs in consumption suggest a need for tax intervention, here on the consumption side.27 The possibility that internalization may not occur because consumers lack appropriate information moves us onto a consideration...
of the merit-want argument for intervention.

7.2 Merit-Wants and Energy Pricing

Abstract from considerations related to excise taxes as tax prices for publicly provided goods, and consider the case for demand-side intervention for what Richard Musgrave (1959) termed merit-want market failure. The notion of merit-want pertains to instances where a competitive market equilibrium is felt to have undesirable properties because of the nature of consumer preferences underlying market demand. This supposition often appears in the form of the argument that consumers are too extravagant with 'scarce' energy resources; or relatedly, by implication, in the argument that conservation is per se desirable, because consumers are myopic. But the same supposition often appears in the converse argument that, notwithstanding the high world price of energy resources, energy ought to be available to domestic consumers at 'reasonable' prices.

Since introduced by Musgrave, the appropriateness of the notion of merit-want as a justification for intervention has been a subject of contention; for there is a contradiction between paternalistic decision-making and percepts of a liberal society wherein it is axiomatically accepted that consumers ought to be judges of their own interests. If one seeks to have recourse to the notion of merit-want as underlying a case for intervention, one is obliged to establish that there are indeed certain social externalities associated with individual behaviour which would be internalized by the existence of appropriate markets, or that individuals indeed are myopic or lack adequate information necessary to make choices which ensure outcomes in their own best interests.28 Insofar as the merit-want market failure is informationally based, the appropriate role for government may be limited to providing the pertinent information.
Rather than coerce individuals via legal restraint or influence consumption choice via tax subsidy market intervention, the government's role might be viewed as limited to the setting of guidelines which embody available information.

As an example, consider the question whether there is a merit-want case for interfering with consumers' free market purchases of motor vehicles. Such intervention could take the form of mandatory regulation of the fuel efficiency of vehicles, or of the imposition of taxes on vehicles with low fuel economy. One could argue that the higher costs of travel in fuel-inefficient vehicles are known to consumers. Hence, the fact of purchase indicates consumers are willing to pay for extra cost of travel in such vehicles (i.e. they have fully internalized such costs). However, suppose that the authorities decide that, in the event of trade disruption, available fuel supplies will be rationed with given quantities being supplied to all users. Then only owners of fuel-efficient vehicles may effectively be able to utilize their vehicles. While rationing will lead to readjustments for all petrol users, the export adjustment cost of trade disruption will be much greater for those individuals who purchased fuel-inefficient vehicles. Such a case for intervention would rest on private individuals' imperfect perceptions of the likelihood of trade disruption, and imperfect awareness of the extent of adjustment required in the event of a decision to ration limited fuel supplies.

7.3 The Energy Policy Draft on Merit-Wants

Although not mentioned explicitly, the merit-want notion appears to figure prominently in the Energy Policy Draft's arguments, in particular with respect to energy (or petroleum) conservation. For example, the Draft states that:

Negative attitudes towards energy conservation need to be changed to positive attitudes (p.65)
and while acknowledging the consumption reducing effect of higher prices, the Draft goes on to argue that consumer preferences may be an impediment to achieving desired goals:

But pricing, on its own, may not be enough to bring about prompt changes in consumption habits. In usage of petroleum, there are indications in most communities of strong disposition to inertia. Supplementary policies will probably be needed. (p.65)

Indeed, the Energy Policy Draft takes the notion of merit-want beyond even the contentious limit of dissatisfaction with consumer discretionary behaviour, and suggests that not only consumers, but also government and society itself, may be in need of paternal guidance:

In the longer term, there is a need to change deeply ingrained community attitudes not only at the level of the street but throughout society, including government. (p.64)

The Draft also discusses whether merit-want intervention ought to take the form of changing preferences (or attitudes) via voluntary means such as information provision, or whether direct mandatory controls ought to be placed on consumer choice:

Voluntary measures such as information, education and consumer guidance campaigns are less coercive than regulatory measures, and are beneficial in that they can maintain public awareness of energy problems, and they can help develop the broad support base needed for the successful implementation of more stringent measures. While increases in the price of energy will increase the incentive to conserve energy and to use alternatives to petroleum fuels, consumers may need to be made aware of energy costs and the scope for savings, and also instructed in methods of achieving savings. [On the other hand], mandatory measures (e.g. standards and regulations) can be applied to both the production and consumption of energy. These measures may be highly discriminatory, and can immediately influence the pattern of energy use within the economy. Their main value is that they are direct. (pp.67,68)

It is acknowledged that consumers may not be prepared to accept the imposition of mandatory constraints on their discretionary consumption behaviour:
The effectiveness of these [mandatory] measures is dependent to some degree upon public acceptance. (p.68)

In the light of the emphasis placed on the notion of merit-want, one feels that the position taken in the Draft could have been accompanied by an evaluation of the conflicts between violation of consumer sovereignty and the maintenance of a democratic liberal free-enterprise society. In particular, since in a liberal democracy politicians formulate platforms with the objective of maximizing support from consumer voters, one should address the question of how merit-want intervention (which by its nature runs counter to consumer preferences) is ever sustainable.29

Finally, of course, one might take exception to the merit-want judgments in themselves; but since informational deficiencies figure prominently in the consideration of energy-policy related issues, the economic theory encompassing the notion of merit-want does appear pertinent to the energy-policy discussion.

8. CONCLUDING REMARKS: THE ROLE OF THE MARKET

The previous sections have sought to provide a schematic framework for the consideration of issues pertinent to Australian energy policy; within that framework we have compared the views expressed in two documents taking essentially opposing positions on the need for intervention. In this final section we consider the foundation of the conflict between the two views.30 We begin with the well known equity-efficiency conflict, and proceed to consider the more general question of disposition towards reliance on market outcomes. Then we consider briefly a further non-market factor - the political costs associated with import dependence.

8.1 Conflict between Efficiency and Equity Objectives

Provided certain conditions such as competition, absence of externalities,
etc. are satisfied, economic theory suggests that market forces can be relied upon to yield efficient outcomes. But there is no assurance that market equilibria will have properties consistent with preconceived distributive goals. In theoretical analysis a standard means of avoiding the potential conflict between efficiency and equity objectives is to imagine lump-sum transfers which redistribute income without changing relative prices. In practice, however, such a strict Musgravean separation between equity and efficiency is not generally possible. Hence distributive goals can only be achieved by departing from distortion-free market equilibria.

As we have noted, the basic underlying argument for maintenance of a below-world parity domestic price of energy is distributive. One might wish to argue that consumers fortunate enough to be resident in an economy with its own domestic endowment of crude oil should not be obliged to pay the monopolistically determined OPEC price; and, symmetrically, domestic producers should not be permitted to exploit the presence of OPEC as the setter of the parametric monopolistic world price to earn excessive profits. A clear expression of this position is found in the Energy Policy Draft:

It can be argued that pricing energy resources used within Australia to energy producers at less than world prices and allowing the benefits of these lower prices to flow through to energy consumers is justified as a means of allowing Australians to share in the exploitation of resources which belong to the nation. It can be further argued that such a pricing policy might be particularly appropriate where the profits accruing to producers would be high even at prices well below world parity or where opportunity cost pricing would bring exceptionally high returns to foreign investment in the production of the energy resources in question. (p.82)

Suppose that a judgment is indeed made that distributive aspects of energy pricing are sufficiently important to warrant policies which result in allocative inefficiency. Then there may be available means which avoid allocative inefficiency in the energy market and achieve the desired
distributive goals. For example, should it be desired to shield some groups from the adverse effects of oil price rises, this might perhaps be best done by tax concessions to groups which government wants to shield. Thus income tax concessions could be made, pensions could be raised, etc. \(^{33}\) Still, a major problem with such policies is that it is difficult to draw the line and to single out some groups as particularly worthy of assistance. For instance, groups may be singled out because their incomes are particularly low; others, who consume above-average quantities of petrol (e.g. residents in outer suburban areas or in country districts) are likely to find this 'unfair' and argue for special preferential treatment in their particular circumstances as well.

The constraints which distributional aims place on efficiency objectives may be explained in terms of what Max Corden (1974) has called the conservative social welfare function. This is a notion which seems quite generally helpful in understanding many countries' actual trade and pricing policies. Basically, the conservative social welfare regards it as 'unfair' to allow anyone's real income to be reduced significantly - especially if this is the result of deliberate policy decisions. Corden suggests that social peace - which might be regarded as a social good and a basis for political stability - requires that no significant group's income should fall while that of the community at large is rising. "And even if social peace does not depend on the maintenance of incomes ... the survival of a government may." \(^{34}\)

8.2 Economic Philosophy and the Role of the Market Mechanism

Distributional constraints provide one specific reason for refusal to accept unqualified market outcomes. More broadly, scepticism about market solutions may stem from the tenets of a non-market economic philosophy. However, rather than being completely general, lack of faith in market
outcomes may be confined to specific goods. Hence the merit-good type arguments considered in Section 7. Given such selectivity, an interesting question is what determines the status of a good as one for which a market equilibrium is acceptable or unacceptable?

In such a context, Arthur Wright (1978b) introduced the notion of a 'political' good as "one that is systematically and persistently allocated grounds other than economic efficiency". Wright proposes that in the course of the 1970's, energy in the US underwent a change in status to such a political good (testified to in particular by the creation of a Federal US Department of Energy in 1977). The evident catalyst for the change in status of energy from a good for which market outcomes were more or less socially acceptable to a political good was the 1973 Arab oil embargo and the consequent oil price rise.

In the setting of our discussion the position in the Treasury Submission may be viewed as seeking to avoid the categorization of energy as a political good, while the position in the Energy Policy Draft suggests the interpretation that energy is a political good. Perhaps the clearest example of this difference in perspective is provided by the respective views on the need for intervention in research and development.

Returning to this issue (which was covered in Section 4), consider the two reasons proposed in the Energy Policy Draft as underlying the need for government intervention:

Firstly, there is the requirement to ensure that resources devoted to energy R & D are employed efficiently and in accordance with the objectives and priorities of energy policy. Secondly, having determined a natural energy R & D strategy, it is an appropriate role for Government to ensure that the strategy is implemented in a co-ordinated and collaborative manner. (p.55)

There is a presumption that it is a natural role for governments to have an energy policy which seeks distinct non-market outcomes. One also finds the
associated presumption that if desirable outcomes are to be achieved, governments are obliged to monitor the activities of private individuals (to ensure that the government's 'strategy is implemented in a co-ordinated and collaborative manner').

Yet accepting the specification of energy as a political good is not costless. Administrative decision-making necessitates access to information, which is possibly unobtainable - or, if obtainable, only at substantial cost. Also, the time-lags involved in data acquisition may render the information dated, and so unsuitable for current decision-making. The market mechanism is, on the other hand, informationally efficient, and there is good reason to believe that appropriate 'co-ordination and collaboration' among private agents might be the natural consequence of individuals' decentralized optimizing responses to the incentives provided by the market. Hence one might have sympathy with the Treasury Submission's view that:

Questions that arise (with respect to government involvement in research and development) include whether bureaucratic/political prediction of the future energy needs of business and consumers will produce quicker or more reliable responses to changing circumstances than the reactions of individuals to the price mechanism. Are bureaucrats and politicians who do not stand to profit directly from a new fuel-saving technology more capable of predicting whether the new technology will be economically viable than those businessmen and consumers who do? If an individual businessman makes an erroneous decision about the future needs of his business, the resulting losses are borne primarily by the business. When incorrect economic decisions are made at the bureaucratic or political level and applied through assistance to industry, the cost is borne by the whole community. (p.32)

Although made here in particular with respect to research and development, the potency of this argument is quite general, and underlies a case for a bias that market outcomes be regarded as acceptable unless proven otherwise - rather than the converse.

A further consideration pertinent to the evaluation of market and non-market solutions relates to the motives of the administrators themselves.
Whereas a standard presumption in the theory of economic policy has been that those charged with implementing policy do so in the social interest, there is also theory and some supportive evidence which suggests that, being rational optimizing agents, administrators might choose to implement policies in a manner which maximizes their own welfare. This latter possibility then further compromises the potential efficacy of government intervention.

8.3 Political and Economic Costs of Import Disruption

Finally, one might propose that reliance on market outcomes is compromised by the political costs of import dependence; for the market does not internalize these costs, and so there is a basis for intervention.

In this paper we have confined the frame of reference to economic issues, and hence, in particular, in considering trade disruption, we have focused on economic costs of curtailment of import supplies. This should, however, not be construed as implying that political costs associated with import dependence are unimportant. On the contrary, gains from international trade do not justify Australian subservience to foreign interests.

Moreover, our focus on economic costs of trade disruption has not meant that attendant political considerations have been neglected; for there is a very fundamental link between economic and political costs of import dependence. Underlying foreigners' leverage in securing political subservience from oil-importing economies is the economic cost to importers of disruption of oil supplies. In that sense, the economic costs of disruption are a fundamental determinant of the political costs which might be associated with import dependence: the lower the economic cost of disruption of import supplies, the less effective is the oil-exporters' political leverage. This relation between the potential harm of an embargo and the likelihood of an embargo being effected was considered in Section 1 and, as we indicated there, such endogeneity of the likelihood of trade disruption probably provides
the most meaningful of the various arguments for reduced import dependence; for, in this case, the public good nature of the gain from reduced dependence suggests that the benefit from trade contraction will not be internalized in private domestic agents' discretionary decisions.
FOOTNOTES

1. For more applied perspectives on energy in Australia, see Hawkins (1978), Folle and Ulph (1979), Vincent et al. (1979a,b), Folle (1980). In particular, Folle and Ulph (1979) address some of the issues which we consider; their schematic setting is, however, somewhat different, with the principal focus being on the presentation of different demand-supply scenarios and on the subsequent implications for domestic Australian production, consumption and trade. They also evaluate possible costs of trade disruption in different settings. The state contingent projections and quantitative analyses undertaken by Folle and Ulph provide a useful backdrop to the present paper, as does the empirical work of the IMPACT project staff (Vincent et al.) and Hawkins, and the market oriented descriptive overview of Folle. Outside the Australian setting, see Pindyk (1979) for a model of world demand, and Wright (1978a) for a comparison of the approaches to energy policy in a number of different countries.

2. For a recent discussion of this question in the US setting, see Adelman (1979), Schultz (1979).

3. Consideration of the manner in which the international oil cartel determines price and monitors adherence to cartel rules is outside the frame of reference of this paper. For an analysis of these issues, see Ben-Shahar (1976).


5. For a summary of the Australian history of crude oil pricing and levy arrangements, see the Appendix to Statement No. 4, Budget Papers. Five
changes were made to the parity pricing formula for oil between August 1975 and June 1979.

6. Sue Solow (1974) for a review of the considerations underlying the determination of dynamic price paths for depletable resources. A more extensive survey of the literature on depletable resources is provided by Peterson and Fisher (1977). More recently, Kemp and Long (1980) have investigated a wide range of aspects of the theory of depletable resources.

7. Pindyk (1978) suggests that the U-shaped dynamic price path for oil might be explained by a model wherein depletion and further exploration to build up depleted reserves are decided simultaneously. For a description of the post-1973 international oil market, see Folie and Ulph (1978).


9. Bhagwati and Srinivasan (1976) analyse the case where the probability of trade disruption is determined endogenously by the volume of trade undertaken. Also, Cox and Wright (1975) have suggested a tariff policy as a means of minimizing domestic disruption due to potential oil embargoes. Cox and Wright point out that while a tariff reduces import dependence, at the same time it leads to faster domestic depletion of the domestic crude oil stock by raising the domestic supply price of oil. To counter this effect of the tariff on depletion, they propose a policy scheme whereby oil importers are offered rebates of the import duty provided that they are prepared to maintain excess domestic supply capacity as an emergency reserve to be utilized in the event of trade disruption. We
consider the topics of depletion and storage in Sections 2 and 5 respectively.

10. On the social optimality of competitive depletion, see, for example, Weinstein and Zeckhauser (1975), Cropper, Weinstein and Zeckhauser (1978). On the other hand, competitive extraction is not optimal if firms have anticipations of possible nationalization of their stocks (see Long, 1975), or when property rights to depletable stocks are not specific to firms depleting the stock (see Kemp, 1976). It has also been shown that competitive depletion is suboptimal when individuals employ the resource stock as a medium for saving (see Kemp and Long, 1979).


12. On extraction costs and depletion, see Solow and Nan (1976). Levhari and Leviatan (1977) consider the case where incomplete depletion is optimal and provide the appropriate modification to the competitive depletion rule. On the effect of government policies on domestic depletion (with particular reference to the US), see Cox and Wright (1976).

13. These questions are addressed and answered in Hillman and Long (1980a), which provides the basis for sections 2.4 and 2.5.

14. There is a substantial literature on the implications for depletion of market structure. For example, on socially optimal, competitive and monopolistic depletion (under certainty), see Weinstein and Zeckhauser (1975), Stiglitz (1976), Sweeney (1977), Lewis, Matthews and Burness (1979), and the dynamic extension in Kemp and Long (1980, essay No.6). Gilbert (1978) investigated the dominant firm market structure for a depletable resource in a von Stackelberg model, and for a limit-pricing model.
with a depletable resource, see Gilbert and Goldman (1978). Kemp and Long (1980, essay No.10) have shown that oligopolistic firms following Cournot-type strategies will adopt socially optimal depletion paths given a constant demand elasticity (and certainty, manifested as knowledge by each producer of the depletion path of others).

15. This forms the basis for Stiglitz's (1976) presumption that the monopolistic extraction program will be conservationist. More generally, Peterson and Fisher (1977) were led to conclude in their survey article that "one is usually correct in assuming that monopolists conserve resources".


17. See Hillman and Long (1980a). There have been a number of other studies of resource extraction in an open economy, but these have abstracted from the element of potential trade disruption: see, for example, Vouzden (1974), Long (1974), Kemp and Suzuki (1975), Arrestad (1978), Dasgupta, Eastwood and Heal (1978), Kemp and Long (1980, Part III).


19. See Herfindahl (1967), and for some qualifications, Kemp and Long (1980, essay No.3). A general description of the functioning of the price mechanism with respect to the introduction of substitutes is also provided in Solow (1974). Heal (1976) examines the relationship between price and extraction cost when there is a backstop technology, and Noel (1978b) investigates the case where a substitute has an uncertain cost.

20. We consider the topic of storage per se in Section 5.


25. For a discussion of storage as a response to threat of trade disruption, see Cox and Wright (1975), Tolley and Wilman (1977), Feder, Just and Schmitz (1977). Folie and Ulph (1979, pp.114-17) provide projections of costs of stockpiling crude oil in Australia.

26. For example, a study of US international trade concluded that in the 1960's that country's imports were relatively energy intensive (see Hillman and Ballard, 1978), and hence, the presumption was that, in the case of the US, direct international factor flows and energy embodied in the composition of traded goods moved in the same direction. In the Australian setting, see Partridge (1977) for some observations on energy as an intermediate input into a sector which exhibits a comparative advantage in international trade, and also Vincent et al (1979a,b), Folie (1980).

27. On adjustment costs in consumption due to trade disruption, see Tolley and Wilman (1977).

28. For a fuller discussion of these issues, see Hillman (1980).

29. See, for example, Head (1976).

30. We emphasize that the Energy Policy Draft has no official status, and can in no way be construed as representing government views on the formulation of energy policy. It would appear, indeed, that the
document was repudiated after internal government discussion. Moreover, even if the paper had been published, Green Papers are not intended to provide statements of government policy, but rather to review the relevant issues. What we have done is used the document as a straw-man whose anti-market sentiments stand in direct contrast to the pro-market sentiments expressed in the Treasury Submission. While in the search for anti-market sentiments one confronts no particular shortage of straw-men; the particular merit of employing the Energy Policy Draft in this regard is that it addresses the same broad general issue as the Treasury Submission, that is, what Australian energy policy ought to be.

31. See, for example, Arrow (1970).

32. For an example of integration of equity and efficiency concerns, see McGuire and Gern (1969). Paul Davidson (1979), in commenting on the oil price decontrol debate in the US setting, argues that the 'energy crisis' is a purely distributive phenomenon, founded in "an economic struggle between producers and consumers over relative income shares".

33. For example, in the US under the Carter Administration's energy plan, it was proposed that part of the proceeds from the windfall profits tax on oil companies be channelled to low income households.


35. See, for example, Peltzman (1976), and with specific reference to the Australian setting, see Anderson (1980), Suler (1979).
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