

TRANSPORT ENERGY AND EQUITY:
WINNERS AND LOSERS

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Abstract:

Although the literature on energy use by the transport sector is mounting, evaluation of the equity effects of rising petrol prices has been hampered by lack of analysis in three major areas:

- . the existing pattern of energy consumption by different groups*
- . differences between groups in access to adaptive strategies*
- . the transmission of petrol price increases into housing, employment, labour and car markets*

This paper examines these three areas with specific reference to Sydney and provides an overview of who wins and who loses from higher petrol prices. Brief comment is also made on appropriate strategies which the public sector might adopt to ameliorate the regressive effects of rising prices.

This paper represents the views of the authors and in no way purports to represent the views of either the New South Wales Premier's Department or the New South Wales Department of Environment and Planning.

INTRODUCTION

Up until June 1977, the real price of petrol declined steadily in Australia. As a proportion of average weekly earnings, for example, the maximum price of a litre of super grade in Sydney was less than half the 1955 level by January 1977. In real terms, the price at that date was less than the 1955 level despite the adoption of full import parity pricing a year earlier.

In combination with rising real incomes, this decline in the real price of petrol encouraged large increases in car ownership and petrol consumption. Over the period 1964 to 1977, the size of Australia's car fleet almost doubled and per capita petrol consumption grew by nearly 50 percent. Because real incomes were rising, households were able to increase their consumption of petrol, yet devote a relatively constant proportion of their income to its purchase.

However, with the introduction of full import parity pricing in August 1978, real per capita expenditure on petrol has risen dramatically. In N.S.W. such expenditure is currently about 40 percent higher than it was in 1971 and the proportion of income devoted to petrol by Sydney households has risen almost 60 percent since 1974/75.

These increases in expenditure have had a pervasive influence on a population used to consuming large amounts of petrol and have reduced the real income of virtually everybody. However, individuals have been affected to markedly different extents, depending on such factors as petrol consumption and income. As a result, the distribution of real income has been altered significantly.

This paper addressed the question of the relative losses different groups in urban areas will incur by rises in the real price of petrol and in particular examines the consequent equity implications. It also seeks to identify appropriate policies that the public sector might adopt to balance petrol conservation objectives against equity objectives.

Approach

In approaching this question, an understanding of existing patterns of energy consumption is a necessary prerequisite. In the shorter term, higher petrol prices will be superimposed on the existing urban system, which will largely determine the immediate distribution of changes in real income. In the longer term, higher prices will precipitate changes, such as locational shifts, which are constrained by the existing system.

In view of the importance of the historical pattern of consumption, it is surprising that this area largely appears to have been ignored in the literature on adaptive responses to increases in the price of petrol. The next section will therefore briefly examine existing patterns of energy consumption, using Sydney as a case study.

The equity implications of higher petrol prices are also a function both of the access individuals have to adaptive strategies and of wider changes in the urban system which result from the aggregate of individual responses. The distribution of real income is altered not only by direct changes in travel costs, but also by changes in related areas such as housing costs. The examination of existing energy consumption is therefore followed by a discussion of the equity implications of such system-wide changes.

Finally, the paper briefly canvasses policies which the public sector might adopt to ameliorate the effects of higher prices.

SYDNEY'S ENERGY CONSUMPTION PATTERNS

The amount of energy a household uses for travel in Sydney depends on a number of critical variables, including car ownership, location and income. Within the household, energy used for urban travel varies dramatically with the age, sex and occupational status of its members.

To examine these patterns, a profile of existing consumption was developed from data on 1971 weekday travel (excluding walk and travellers aged under five years) collected in the course of the Sydney Area Transportation Study (1974). Only direct energy consumption by transport is considered. Generally it is measured in units of primary energy, which includes losses incurred in producing secondary energy sources such as petrol. Where reference is made to consumption of secondary energy, it is measured in fuel-specific units, such as litres of petrol.

Within the household, persons of working age (15-60 years) consumed about five times as much energy for travel in 1971 as persons aged 5-15 years and about two and a half times as much as older people. On average, men consumed double the energy that women did, partly because of their greater number in the workforce and partly because they travelled further and more frequently by car.

Men in the workforce consumed on average between 70 and 120 percent more energy than women workers, depending on the occupational group. Per capita energy consumption did not vary substantially by occupation when men and women

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were aggregated, but those not in the workforce used less than a third of the energy of those who were.

Energy Consumption

Differences between households for selected variables are shown in Table 1, where it can be seen that energy consumption in 1971 increased both with greater travel and greater use of private transport. Further, energy consumption rose as income, car ownership and inaccessibility to employment by public transport rose.

Travel by public transport in fact was 2.6 times less energy - intensive than that by private transport. This advantage varied with the time of day, ranging from 3.5 in peak hours when public transport passenger loadings are high, to 1.35 during evenings. Overall, public transport carried 31.4 percent of total weekday person kilometres, but consumed only 17.2 percent of total energy for such travel.

The influence of accessibility, car ownership and income on energy consumption is also readily apparent from Table 1. For example, 28 percent of the kilometres travelled by households in locations with the poorest accessibility was by public transport, whereas those in the most accessible locations undertook 39 percent of their travel by this less energy-intensive mode. Similarly, households without a car used public transport for 77 percent of kilometres travelled compared to 31 percent by those with one car and only 19 percent by those with two or more cars.

In both these cases, absolute kilometres of travel by public transport also declined as inaccessibility and car ownership increased. In the case of income, the proportion of kilometres travelled by public transport fell from 40 to 24 percent as income rose over the range shown, although absolute travel actually increased for both modes.

Petrol Consumption

The relationship between location, car ownership and income can be seen from Table 2, which shows petrol consumption in units of primary energy. It is evident that the largest consumers of petrol were households with high car ownership and low accessibility to employment by public transport.

For example, the per capita petrol consumption of households with two or more cars living in the least accessible locations was 2.4 times that of one car households with the highest accessibility. The disparity increases to 3.1 when the highest income members of the former group are compared to the lowest income members of the latter, but in general income explains less of the variation in petrol consumption than either location or car ownership.

Expenditure on Petrol

In the case of expenditure on petrol, however, income assumes primary importance as a determinant of the burden of rises in the price of petrol. Table 3 shows that all of the low income car owning households spent a higher proportion of their income on petrol than the 2.6 percent Sydney average for all households. Even for low income households with only one car, this proportion ranged from 1.6 times the Sydney average for those with high accessibility to 2.6 times for those with low accessibility.

When low income households with two or more cars are considered, the proportion of income spent on petrol ranged from 7.3 percent to 11.5 percent, depending on accessibility. In comparison, the range for comparable high income households was only 1.8 percent to 3.1 percent, even though Table 2 demonstrates that these households consumed a greater absolute amount (i.e. litres) of petrol.

The reasons for the pattern of petrol consumption and expenditure documented in Tables 2 and 3 are complex. As noted earlier, the historical combination of falling real petrol prices and rising real incomes until the late seventies encouraged large increases in petrol consumption. They also assisted the growth of a decentralised pattern of urban development which was contingent on car-based travel.

For the outer suburbs, low residential densities and Sydney's centralised distribution of employment generate long trip distances and times, particularly by public transport. By either necessity or choice, outer suburban residents display a preference for car travel and high car ownership.

In Sydney's Western Region, for example the average public transport trip time in 1971 was 54 minutes and by car 30 minutes. The comparable figures for the rest of Sydney were respectively 43 minutes and 22 minutes. In addition, Western Region residents in 1976 could reach on average only 6 percent of Sydney's jobs by public transport within 40 minutes, whereas other Sydney residents could reach 15 percent on average.

At the 1976 Census, 83.4 percent of the Western Region's occupied private dwellings had at least one car and 28.2 percent had two or more. The ABS Household Expenditure Survey found that households in the Western Region (plus Baulkham Hills L.G.A.) spent more of their income on transport and communications in 1974/75 than the Sydney average. Moreover, those earning less than \$80 per week spent 27 percent more of their income on transport than comparable households in Sydney.

Effect of Higher Prices

Forecasting changes in the price of petrol is particularly difficult, especially given that factors such as political instability intrude upon assumptions of economic rationality. However, were there to be further significant increases in real oil prices in the near future, low income households in outer suburbs would be most disadvantaged if 1971 patterns of petrol consumption were maintained.

Table 4 provides an indication of the impact on current average household incomes of hypothetical increases in the real price of petrol. The Table was derived from the 1971 pattern of petrol consumption, but utilises March 1980 prices and incomes. It can be seen that low income households with one car and low accessibility would spend an estimated 10.2 percent of their income on petrol if the real price increased 25 percent and an estimated 13 percent of income if the real price were to rise by 60%. By comparison, similar households spent 6.7 percent of their income on petrol in 1971.

There have been, of course, significant changes in energy consumption levels in Sydney since 1971. The average fuel consumption rate of the light vehicle fleet, for example, rose from 12.9 to 14.5 litres per 100 kilometres between 1971 and 1976, (Glazebrook, 1980), whilst the total kilometres of travel by such vehicles increased 15.4 percent and the total amount of petrol they consumed rose 29.6 percent.

Other pertinent changes over the intercensal period include decentralisation of employment and declining patronage of public transport. The CBD's share of Sydney's employment declined from 25.4 percent to 21.7 percent and the proportion of work trips undertaken by public transport fell from 33.4 percent to 27.2 percent.

If these changes have continued since 1976, they can be expected to have increased the impact of further petrol price rises on average incomes which, in any case, have been declining in real terms since June 1979. The differences between groups may have changed since 1971 but there is no reason to believe that the relative differences in expenditure on petrol have changed significantly.

INDIVIDUAL AND SYSTEM RESPONSES

From the foregoing discussion it is evident that low income, car owning households in outer suburbs would be the most disadvantaged if 1971 patterns of petrol consumption were maintained in the face of significant real price increases. However, individuals are likely to respond by reducing consumption and thus it is necessary to examine adaptive responses in order to appreciate the final equity implications of higher petrol prices.

The more significant options available to individuals for reducing petrol consumption are:

- .. shifting a proportion of travel from car to public transport
- .. reducing car ownership
- .. changing to a smaller, more fuel-efficient car
- .. moving to a more accessible location.

Mode Shifts

The first two options would be most feasible for households in accessible locations which enjoy a relatively high level of public transport service, since as noted previously in relation to Sydney's Western Region, average travel times by public transport tend to be long in outer suburbs.

For example, Western Region residents shifting from car to public transport travel in 1971 would have incurred additional travelling time almost 20 percent higher than that experienced by other Sydney residents making a similar change. As Table 5 shows, Manning (1978) has estimated selected 1971 travel times for outer suburban residents which indicate that a shift in their location of employment to enable a change from car to train travel would have involved them in considerably longer travel times.

For residents of Sydney's outer South-West, such a change would have involved an additional travelling time of 41 minutes, or an increase of 152 percent. By comparison, the penalty for residents of the inner Marrickville/Leichhardt area would have been only 20 minutes, or an 83 percent increase. The difference between these areas if a similar shift from car to bus had been undertaken is not as significant, but only a relatively small proportion of outer area residents travelled by bus as main mode in 1971. In the Outer South-West, bus was the main mode for 6 percent of work trips, compared to 24 percent in Marrickville/Leichhardt. The former were short on average, in line with the lack of cross-regional services typical of outer areas.

It should also be noted that the reduction in petrol expenditure gained by outer suburban residents from a mode change would be offset by a countervailing decline in real income equal to the value of the additional travelling time. The extent to which this occurred would depend on the appropriate shadow price for travel time and on the extent of the increase in real petrol prices.

For example, a resident of the South-West travelling an average 9.4 kilometres to work in a car obtaining 10.73 kilometres/litre (30.3 mpg) would spend 29 cents on petrol for the trip based on the maximum Sydney retail price last July of 33.2 cents/litre. If the same resident valued his or her travel time at a quarter of the wage rate (Manning 1978) and earned \$5.00 per hour after tax, the value of the additional 41 minutes involved in the shift from car to train would be 85 cents. Thus the real price of petrol would have to triple before it equalled the reduction in real income incurred by this resident on changing mode.

It is possible that outer suburban residents might attempt to reduce their travelling time on shifting to public transport by shortening trip distances. Such a response would accord with the concept of a constant travel time budget, which implies that a fixed amount of time is devoted to work travel. In this event, they would have a reduced range of job opportunities and in consequence would be likely to experience reduced earnings and higher unemployment.

The above discussion on mode shift has concentrated on work trips. However, 1971 travel patterns in Sydney reveal similar relationships between car ownership, location and mode share for both work and non-work trips. Even so a full understanding of the savings in petrol expenditure and the additional travel time involved in a mode shift would need to take account of shopping, recreational and other non-work trips.

Closely related to the mode shift question are the issues of lowering car ownership levels and the consequences of who in the household retains access to the remaining vehicle(s). Much has been written on this topic (Stiles, 1979), but it should be noted that reduced car ownership would have a particularly adverse impact on housewives in outer suburbs who are dependent on a second household car for travel to community and shopping facilities. However, this disadvantage may be offset in aggregate by gains to housewives in one car families where the husband is able to shift his work travel from car to public transport.

Smaller Cars

Changing to a smaller (more fuel-efficient) car will reduce an individual's consumption of petrol, but will not necessarily provide a corresponding reduction in the burden of higher real petrol prices on his or her income. As is already apparent in the used-car market, rising petrol prices increase demand for smaller cars and thereby increase their price. This trend is also apparent in the new car market where it has manifested most obviously in widespread discounting of large cars.

Sheridan (1980) has prepared estimates for selected cars in the used car market which indicate the differences between petrol savings and capital costs. The used car market is an important case, as it is the major source of replacement vehicles for low income groups and involves considerably more transactions than the new car market.

Sheridan estimates the June 1980 market price of a 1974 automatic Holden Kingswood at \$2,600 and the price of an automatic Toyota Corona of the same year at \$3,850. On the assumption of 16,000 kilometres of travel per year, the additional capital cost of "trading-down" to the Corona would be \$1,250. The savings in petrol expenditure, however, would amount to only \$164 per year.

For a travel rate of 25,000 kilometres per year, which would be more typical of outer suburban households (Graves, 1978) the petrol savings of shifting from a Kingswood to a Corona amount to \$417 per annum, or about half the additional capital cost. On the other hand, households in accessible locations with an annual travel rate of 10,000 kilometres would incur additional expenditure on petrol of \$156 per annum if they were to change from a Corona to the larger Kingswood, but would make a capital gain of \$1,250.

Current differences in prices between small and large cars may be partly inflated as a result of expectations generated by the recent history of rising real petrol prices. Were petrol prices to rise to a stable plateau level, it may be that large differences occurring during the transitional phase eventually would level out. Nevertheless, a number of tentative conclusions can be drawn about the effects of higher petrol prices on car markets.

Firstly, current owners of small cars will make capital gains. If they live in accessible locations, they can actually increase their income in the short term by changing to a larger car. If they live in outer locations, however, their nett gain may be small as the capital gain would be minimised by higher petrol expenditure.

Secondly, current owners of large cars will incur a capital loss. The additional cost of petrol will disadvantage outer suburban residents to the greatest extent and accordingly they would have the strongest incentive to change to a smaller car. Their likelihood of doing so, however, will depend on the length of the period before they recover their capital outlay. Even so, such a strategy would only minimise the impact of higher petrol prices on their incomes, and would by no means eliminate it.

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Thirdly, current owners of large cars who purchase a small vehicle on the new car market will incur a capital loss on trade-in, as well as incurring the increment in the price of the new car attributable to the higher petrol price. Should the new car market in Australia recover from its current malaise, this increment is likely to be a great deal more apparent.

Even without the prices of new cars rising as the cost of petrol increases, the conservation potential of improvements in fuel-efficiency technology are likely to be slow to take effect. Realisation of this potential primarily depends on the rate of improvement in the fuel economy of new models, the rate at which they enter the car fleet, and the rate at which older, less fuel-efficient cars are removed.

However, new car registrations have fallen in Australia from around 10.5 percent of the fleet in 1974/75, when they peaked at 500,000 to a current level of around 9 percent of the fleet, or 450,000 per annum. Thus the fleet is now turning over relatively slowly. Even a rapid reduction to an average new model fuel consumption rate of 7 litres per kilometre (40 mpg), which is equivalent to half the rate of the Sydney fleet in 1976 in urban traffic, would take ten years to achieve a 30 percent reduction in average fleet fuel consumption.

In general, outer suburban residents will be most disadvantaged by the capitalisation of real petrol price increases into car prices. Lower income households, of course, will be least able to raise the necessary capital to shift to a smaller car via either the used or new car markets. Further, the widespread view that individuals will adapt to higher petrol prices by shifting to smaller cars requires at least some reassessment in view of the changes in car prices which would eventuate.

Location Shifts

Another way for households to respond to higher petrol prices is to move to a more accessible location. The consequence of such a strategy is that increased demand raises residential "rents" in locations close to employment and other facilities. This limits the ability of households to avoid the effects of higher petrol prices. Similarly, competition among firms for locations more accessible to a now less mobile workforce increases employment "rents" at such locations.

A rise in the price of petrol changes the direct cost of travel for households as well as both the cost of housing and the cost of employment. In the case of housing, for example, higher residential "rents" result in capital gains for owners and increased rentals for tenants. Similarly, those firms gaining higher employment "rents" can be more selective in their choice of labour.

Using 1971 data for Adelaide, Bannister (1979) has estimated that a change in work travel costs for residents is accompanied on average by a change in residential "rent" equal to 88 percent of the travel change and by a change in employment "rent" equal to 12 percent of the travel change. Thus a change in the real petrol price would have generated a total cost for the average Adelaide resident of which 50 percent was attributable to the direct change in work travel cost, 44 percent to the related change in residential "rent" and 6 percent to the change in employment "rent".

Changes in residential "rents" declined with distance from the CBD, the radial gradient being steeper in the case of Finance and Insurance industry workers than in the case of manufacturing workers. On the other hand, changes in employment "rents" increased with distance from the CBD.

The significant change in residential "rents" has important implications for different groups. In the event of higher petrol prices, owners of property in accessible locations could expect to make tax-free capital gains. These could be enjoyed either in cash by selling, or enjoyed as an increase in real income by remaining in the now more highly valued dwelling. Tenants in accessible locations, however, would face higher rents as landlords increased rental levels in line with property values.

Owners in outer suburbs would lose capital gains they otherwise might have expected to make. It is arguable, however, that house prices would fall significantly in real terms, as they tend to be determined more by construction and infrastructure costs than by locational attributes. Outer suburban tenants could expect rents not to increase in real terms, although it should be noted that the bulk of Sydney's rental accommodation is located in more central areas.

Bannister's study of Adelaide lends support to these hypotheses. He assumed residential "rents" would not change on the periphery and calculated that the average change in direct travel costs for outer suburban residents would account for 80 percent of the average change in total cost. The other 20 percent would be due to changes in employment "rent". In the case of the inner city he assumed employment "rents" would not change and calculated that the average change in residential "rent" for inner city residents constituted 80 percent of the total cost with the change in direct travel cost accounting for the other 20 percent.

In Sydney, industries which draw on a specialist region-wide workforce can be expected to respond to higher petrol prices by seeking locations of high public transport accessibility. Higher income workers in Professional, Service and Administrative occupations, for example, would therefore find it most feasible to use public transport.

In addition, they will obtain the greatest advantage from living in accessible residential areas such as the inner city. The higher initial housing cost would be more than off-set by subsequent capital gains and by the higher travel expenditure otherwise required of an outer suburban location. As a result lower income tenants would be forced out of the inner suburbs by rising rents, the renovation of rooming houses to single dwellings and the conversion of flats to strata title units, if there were no redevelopment.

Despite its high accessibility, the City of Sydney L.G.A. had a median annual rent of 17 percent below the metropolitan median at the 1976 Census. This suggests that the important role the inner city fulfills in housing low income tenants would be seriously threatened. Indeed, higher petrol prices would hasten the process of gentrification of Sydney's inner suburbs which has been occurring for over a decade.

Industries able to draw on a local workforce, on the other hand, would be expected to seek dispersed locations. This would partly be a function of their lesser ability to compete for locations of high public transport accessibility and partly a function of their need to maximise proximity to their workforce. Workers in these industries, as a result, would be more dependent on car travel, although the amount of such travel would decline compared to the level prior to the rise in the price of petrol.

PUBLIC SECTOR STRATEGIES

Two major conclusions with direct relevance to the formulation of appropriate public sector responses can be drawn from the analysis in the preceding two sections. Firstly, low income, car owning households in outer suburbs will suffer the greatest relative disadvantage from higher real petrol prices. Secondly, the prevalent view that voluntary changes to smaller cars will alone be sufficient to ameliorate the effects of price increases is open to serious question.

The complex relationship between land use, housing and transport requires that consideration also needs to be given to a range of public sector policy initiatives other than those dealing with car fuel consumption rates. Those which appear most promising in reconciling petrol conservation, equity and political feasibility constraints include:

- . centralising population
- . decentralising employment
- . improving public transport.

Each of these options assists energy objectives by improving public transport's share of travel on the one hand and/or, by reducing the amount of travel by private transport on the other. A great deal has been written on these options, and the discussion therefore will be confined to brief comment on their major implications.

Centralising Population

As noted previously, households can be expected to respond to higher petrol prices by attempting to shift to more accessible locations. A proper role of the public sector in this regard would be to encourage the development of higher density housing in the vicinity of railway stations and employment concentrations. Increased housing supply in such locations would assist in minimising both capital gains to owners and higher rents for tenants.

The range of appropriate public sector policies includes zoning, site ratio and building code initiatives designed to encourage redevelopment. In particular, it would be desirable to eliminate restrictive codes which increase development costs per unit (Archer, page 7) and thereby exclude low income housing. Related policies include encouragement of dual occupancy and so-called "granny-flats".

Diversion of population from outer suburbs to more central locations would also benefit residents of outer locations. For example, it has been suggested that diverting say 20 percent of the expected 1991 population in Blacktown and Penrith could reduce car travel for the remaining residents of the Western Region as a whole by about 7 percent, mostly because of reduced competition for local jobs.

In aiding the process of diversion, the public sector would minimise higher travel costs for low income groups by relocating the major portion of new welfare housing construction in established areas. Such housing constitutes a significant proportion of all dwellings in outer areas. At the 1976 Census, for example, 17 percent of dwellings in the Blacktown L.G.A. were rented by housing authority tenants.

Decentralising Employment

The earlier discussion on locational strategies indicated that higher petrol prices can be expected to reinforce the decentralisation of jobs which has been occurring in Sydney over the last decade. Policies directed at encouraging this process, such as payroll tax incentives, can be expected to reduce both car and public transport trip times for outer suburban residents.

For example, recent research indicates that increasing the expected 1991 employment in the Western Region by 20 percent would reduce car trip times there by 12.4 percent and public transport times by 5.7 percent if the employment were diverted from the rest of Sydney. The improvements would be greater if public sector policies encouraged low income employment to those outer locations which have the poorest employment/workforce ratios. On the other hand, they would not be as substantial if the employment were diverted from the city centre.

It should be noted, however, that employment decentralisation is likely to reduce public transport's share of travel and hence will not necessarily produce nett energy savings. For example, over the period 1971-76 LGAs experiencing a growth in white collar jobs had an energy cost/job of 63.8 MJ in 1976, compared to only 57.4 MJ/ job in those experiencing a nett loss. Similarly, the respective figures for blue collar employment were 70.3 MJ/job and 54.8 MJ/job.

This suggests that job decentralisation policies should be closely linked with public transport improvements in outer areas. If petrol prices rise very significantly for example, it would be more appropriate to locate employment in suburban nodes of high public transport accessibility, rather than to seek to reduce car trip times.

Improved Public Transport

Improving public transport services for outer suburban residents is an essential component of any policies directed toward ameliorating the effects of higher petrol prices. The major problem which needs to be addressed is that of long average trip times to low income employment by public transport. If these are not reduced, higher petrol prices will be experienced either as higher petrol expenditure or as reduced real income arising from longer trip times if mode shift to public transport occurs.

Significant improvements in public transport travel times are contingent on the location of suitable employment both in areas with poor workforce/employment ratios and in suburban nodes of high public transport accessibility. This implies that emphasis should be given to cross-regional bus services which serve local employment, rather than to major line-haul services feeding distant job opportunities.

Provision of suitable bus services is likely to entail changes in the operation of the private bus system. Appropriate options could include re-regulation, further subsidy or the direct provision of public sector bus services. Higher petrol prices can be expected to improve

the viability of private bus operations servicing work travel, but close coordination and planning of services in relation to employment concentrations will be necessary.

An equally pressing area is that of non-work travel, which cannot be so easily serviced by public transport because of the more dispersed pattern of trip ends. In this regard, increasing attention will have to be given to innovative options such as shared-taxi (taxibus) services (Reed, 1980).

CONCLUSION

This paper has examined both the first-order effects of rising petrol prices on the distribution of real income and the second-order flow-on through to housing, employment and car markets. It has suggested that adaptive strategies are not equally available to all individuals and therefore that there will be regressive real income effects.

The analysis has identified clear winners and losers, and has briefly examined a range of public sector strategies in the land use - transport area. Although they have not been pursued here, the full range of relevant public sector policies would address such factors as access to housing, finance, taxation of capital gains and the distribution of income within households.

Within the limited set of land use and transport strategies examined, there are few soft options for the public sector in redressing the regressive effects of significantly higher petrol prices. Effective strategies would involve considerable expenditure on incentives, subsidies and infrastructure.

There is a compelling argument on grounds of horizontal and vertical equity for returning a share of the import parity pricing tax to outer urban areas. Residents of such areas pay more of this tax per capita than residents of inner locations and it comprises a greater share of their income.

Equally, most inner area tenants have a claim on the proceeds of this tax. Their per capita consumption of petrol is low, yet the tax disproportionately reduces their incomes relative to inner area owners. Indeed, landlords generally can shift the incidence of the tax away from themselves onto tenants.

In the cases of both outer suburban owner-occupiers and inner area tenants, those on the lowest incomes will be most disadvantaged. However, given that recent Federal budgets have increased taxation and reduced expenditure on urban and welfare programs, the prospect of the import parity pricing tax being returned to these groups seems remote. These groups consequently will bear the burden of this tax either as reduced incomes or reduced travel. Alternatively, State governments will have to divert expenditure from other programs and reassess the basic land use transport strategies which they have pursued in the post-war years.

TABLE 2
MJ PER CAPITA OF PETROL CONSUMPTION
SYDNEY 1971
 (internal weekday travel)

HOUSEHOLD CARS	HOUSEHOLD INCOME	ACCESSIBILITY		
		Low	Average	High
ZERO CAR	Low	10.9	8.8	5.3
	Medium	18.5	12.6	8.8
	High	9.3	9.7	8.8
	TOTAL	16.0	11.8	7.3
ONE CAR	Low	50.9	44.7	32.9
	Medium	65.1	50.5	41.4
	High	65.4	52.0	44.1
	TOTAL	61.1	49.1	38.4
TWO PLUS CARS	Low	87.2	75.6	55.5
	Medium	88.9	68.9	55.0
	High	101.6	78.9	57.3
	TOTAL	91.7	73.6	54.8

INCOME: Low = <\$4,000 p.a. Medium = \$4-8,000 p.a.
 High =>\$8,000 p.a.

ACCESSIBILITY: Proportion of Sydney's jobs accessible by
 public transport within 70 minutes.

TABLE 1
 PER CAPITA TRAVEL (KMS) AND ENERGY CONSUMPTION (MJ)
 SYDNEY 1971

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TABLE 3

PERCENT OF HOUSEHOLD INCOME SPENT ON PETROL
SYDNEY 1971

(internal weekday travel)

HOUSEHOLD CARS	HOUSEHOLD INCOME	ACCESSIBILITY		
		Low	Average	High
ZERO CAR	Low	1.4	1.2	0.7
	Medium	1.0	0.8	0.5
	High	0.2	0.2	0.2
	TOTAL	0.8	0.6	0.3
ONE CAR	Low	6.7	5.9	4.3
	Medium	3.7	2.8	2.3
	High	2.0	1.6	1.4
	TOTAL	3.0	2.5	2.0
TWO + CARS	Low	11.5	9.0	7.3
	Medium	5.0	3.9	3.1
	High	3.1	2.4	1.8
	TOTAL	4.7	3.8	2.8

INCOME: Low = <\$4,000 p.a. Medium = \$4-8,000 p.a.
High =>\$8,000 + p.a.

ACCESSIBILITY: Proportion of Sydney's jobs reachable by
public transport within 70 minutes.

TABLE 4

PERCENT HOUSEHOLD INCOME SPENT ON PETROL
INFLUENCE OF REAL PETROL PRICE RISES

(1980 prices and incomes; 1971 Sydney
internal weekday travel)

	HOUSEHOLD CARS	HOUSEHOLD INCOME	ACCESSIBILITY	ASSUMED INCREASE IN PETROL PRICE	
				25% real rise above March 1980	60% real rise above March 1980
high					
0.7			Low	2.1	2.7
0.5		Low	Average	1.8	2.3
0.2			High	1.1	1.4
0.3	ZERO CARS	Medium	Low	1.5	2.0
			Average	1.2	1.6
			High	0.8	1.0
4.3			Low	0.3	0.4
2.3		High	Average	0.3	0.4
			High	0.3	0.4
1.4					
2.0			Low	10.2	13.0
		Low	Average	9.0	11.5
			High	6.5	8.3
7.3			Low	5.6	7.2
3.1	ONE CAR	Medium	Average	4.3	5.4
			High	3.5	4.5
1.8			Low	3.0	3.9
2.8		High	Average	2.4	3.1
			High	2.1	2.7
			Low	17.5	22.3
		Low	Average	13.7	17.5
			High	11.0	14.2
	TWO PLUS CARS	Medium	Low	7.6	9.7
			Average	5.9	7.6
			High	4.7	6.0
			Low	4.7	6.0
		High	Average	3.6	4.7
			High	2.7	3.5
	TOTAL			3.9	5.0

ACCESSIBILITY: Proportion of Sydney's jobs accessible by
public transport within 70 minutes.

TABLE 5
AVERAGE DISTANCE AND DURATION BY MAIN MODE
SYDNEY WORK TRIPS, 1971

RESIDENTIAL AREA	AV. DISTANCE (KMS)			AV. DURATION (MINS)		
	Car	Train	Bus	Car	Train	Bus
Outer South West	9.4	18.7	5.4	27	68	35
Parramatta/Auburn	7.1	13.4	4.4	24	62	35
St. George/ Canterbury	7.6	11.7	5.5	26	54	37
Marrickville/ Leichhardt	5.1	5.9	3.7	24	44	38
Inner North	6.3	5.6	4.5	25	40	38

FROM: Manning, I. The Journey to Work, 1978, pp153. 157.

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ON (MINS)
 n Bus

8 35
 2 35

4 37

4 38
 0 38

157.